

2016/17 Annual report to the Minister for Energy on the Australian Energy Market Operator's compliance

Wholesale Electricity Market Rules

Gas Services Information Rules

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1 Executive Summary

The Economic Regulation Authority (**ERA**) has prepared its 2016/17 report to the Minister for Energy on the Australian Energy Market Operator's (**AEMO**) compliance with the Wholesale Electricity Market Rules and the Gas Services Information Rules.

The report contains the Australian Energy Market Operator's latest audit reports together with details of investigations carried out by the ERA for the period 1 July 2016 to 30 June 2017.

The audits confirm that AEMO was largely compliant with its electricity market and gas services obligations. All the matters investigated by the ERA were matters of technical compliance with no material consequences or risks.

The matters of most concern to the ERA in considering AEMO's compliance were information technology failures that could affect dispatch, and the adequacy of control room staffing ahead of the summer season. Both issues are part of AEMO's System Management function under the Wholesale Electricity Market Rules and are legacy issues relating to the transfer of this function to AEMO from Western Power.

The information technology failures resulted in System Management dispatching electricity market generators on the basis of a superseded Balancing Merit Order. While there were no material consequences from these events, dispatching from a Balancing Merit Order that does not contain participants' latest offers could cause use of generation plant that is not the least cost plant at the particular time, trigger unnecessary out-of-merit payments, and result in higher costs to electricity customers. AEMO has implemented measures to reduce the risk of these information technology failures re-occurring.

AEMO is dealing with a "generational change" of System Management staff. The auditor reported that AEMO has made considerable progress with recruiting and training new control room operators to replace departing senior operators but raised the issue that none of the new controllers has experience during the hot season when there are often high-risk events. To mitigate this risk, AEMO plans to retain experienced control room operators until the end of the hot season and continue to deliver its training program to new control room operators. The ERA is satisfied that AEMO is adequately aware of and addressing this risk.

On a procedural matter with the compliance audits, the ERA notes that the audit personnel conducting the 2016/17 audit include personnel involved in several earlier audits. The ERA recommends that AEMO consider a process for rotating auditors in future.

The ERA will monitor AEMO's progress with these issues.

2 Introduction

The ERA is responsible for the compliance and enforcement functions in the Wholesale Electricity Market Rules and the Gas Services Information Rules.

As part of these functions, the ERA is required to annually prepare a report to the Minister for Energy on AEMO's compliance.

Clause 2.14.5B of the Wholesale Electricity Market (**WEM**) Rules requires the report to contain:

- (a) the auditor's reports regarding WEM Rule compliance audits of AEMO carried out during the relevant period;
- (b) any reports prepared and published by AEMO in response to the auditor's reports referred to in (a); and
- (c) the results of any investigations of AEMO's compliance with the WEM Rules and the Market Procedures carried out by the ERA.

Rule 174(5) of the Gas Services Information (**GSI**) Rules also requires the ERA to provide to the Minister:

- (a) the auditor's reports regarding GSI Rule compliance audits of AEMO carried out during the relevant period; and
- (b) any reports prepared and published by AEMO in response to the auditor's reports referred to in (a).

This report sets out the information required to be provided to the Minister under the WEM Rules and the GSI Rules, covering the audit period from 1 July 2016 to 30 June 2017. The report also includes investigations carried out by the ERA during the same period.

3 Appointed auditor

Under the WEM Rules and the GSI Rules the auditor is appointed by AEMO¹. For the 2016/17 audit period AEMO appointed the energy consulting firm, Robinson Bowmaker Paul.

The audit personnel conducting the 2016/17 audit include personnel that were involved in the 2015/16 audit. These personnel were also involved in earlier audits².

While there may be efficiencies in using the same audit personnel over consecutive periods, this gives rise to the risk of eroding the auditor's independence. Auditor rotation is common

¹ See clause 2.14.1 of the WEM Rules and rule 174(1) of the GSI Rules.

² For the 2015/16 audit period AEMO appointed PA Consulting Group as the auditor. The PA Consulting Group personnel engaged for the [2015/16 audit](#) include personnel that are now engaged by Robinson Bowmaker Paul. PA Consulting Group were also the appointed auditor for all WEM and GSI audit periods prior to the transfer of functions from the Independent Market Operator on 30 November 2015 and Western Power on 1 July 2016 to AEMO.

practice for other statutory audit requirements³. The ERA recommends that AEMO consider a process for auditor rotation in future.

4 2016/17 Audit Reports

4.1 Auditor's compliance and risk ratings

Table 1 below describes the ratings used by the auditor to assess AEMO's compliance.

Table 1: Compliance ratings used by auditor

Compliance rating	Description of rating
1	Instances of non-compliance with the WEM Rules or GSI Rules
2	Findings that are not an instance of non-compliance, but pose a compliance risk
3	Findings on minor issues that do not affect compliance risk

The following risk ratings, set in consultation with AEMO, were used by the auditor in assessing the findings:

- Critical: Potential for catastrophic impact on dispatch, settlement or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level;
- Significant: Potential for major impact on dispatch, settlement or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings;
- Medium: Potential for moderate impact on dispatch, settlement or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring;
- Low: Potential for minor impact on dispatch, settlement or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

4.2 WEM Audit Report

The WEM Rules⁴ require AEMO to ensure that the auditor carries out audits of:

³ For example, section 324DA of the Corporations Act contains provisions that prohibit an individual from playing a significant role in the audit of the same company for more than 5 out of 7 successive years.

⁴ See clause 2.14.3 of the WEM Rules.

- (a) the compliance of AEMO’s internal procedures and business processes with the WEM Rules;
- (b) AEMO’s compliance with the WEM Rules and Market Procedures; and
- (c) AEMO’s market software systems and processes for software management.

The results of the 2016/17 audit are documented in the auditor’s “Independent Assurance Report on AEMO’s compliance with the WEM Rules and Market Procedures”. The report was published on AEMO’s website on 28 September 2017⁵.

As required by clause 2.14.5B(a) of the WEM Rules, the audit report is attached in Appendix 1.

4.3 WEM Audit Report - Summary of findings

A summary of the audit findings by compliance and risk rating is provided in Table 2 below.

Table 2: Summary of 2016/17 audit findings

	Low Risk	Medium Risk	Significant Risk	Total
Compliance Rating 1 (non-compliance)	18	10	1	29
Compliance Rating 2 (compliance risk)	6	8	3	17
Compliance Rating 3 (minor housekeeping issue)	6	-	-	6
Total	30	18	4	52

The audit report stated the following main themes and findings:

- AEMO (in its capacity as System Management) has made considerable progress in raising the capability of its human resources and reducing risks after transition of the function on 1 July 2016. This includes recruiting and training around 20 new staff, revising the suite of control room instructions, and standardising processes and protocols for information technology support;
- There are increasing levels of maturity in managing compliance and a strong compliance culture for AEMO’s market operator functions, noting that findings from previous years have been consistently addressed, and over 75% of non-compliance issues were self-reported;
- System Management information technology issues continue to pose a risk. For example, on many occasions file transfer failures have resulted in System

⁵ Refer to [Independent Assurance Report on AEMO’s compliance with the WEM Rules and Market Procedures](#).

Management being unable to load the latest Balancing Merit Order to its systems. (refer to section 4.4 of this report);

- There is scope to improve business continuity planning and testing beyond testing processes for system redundancy. Other elements such as reliance on key people, office premises, physical equipment and communication channels have not been tested. The auditor reported that AEMO is in the process of an organisation-wide review of its business continuity processes;
- The lack of process documentation for System Management continues to be a compliance risk (refer to section 4.4 of this report);
- Manual data preparation processes are a compliance risk, with manual errors being the root cause for a number of non-compliances. AEMO has informed the ERA that it is reviewing manual processes where there is a high risk of error with the aim of reducing the level of risk.

Of the 52 audit findings, 16 have been actioned and reported as closed. The remaining open issues (36 in total) mainly concern System Management's power system operations and planning functions.

4.4 WEM Audit Report - Significant risks

The auditor identified four significant risks, all concerning System Management.

Of these, two matters concerned information technology. Only one of these constituted non-compliance with the WEM Rules (Compliance Rating 1). The auditor identified the matter as being a material non-compliance⁶. This matter concerned multiple occasions where System Management did not dispatch from the latest Balancing Merit Order (**BMO**) mainly due to information technology file transfer process failures. The audit report stated:

"...dispatching from something other than the latest BMO is a breach of Clauses 7.6.1C and 7.6.1D of the WEM Rules and [any] subsequent out of merit dispatch will result in a constraint payment to a participant who would have otherwise not received one."

The ERA understands that System Management's information technology systems are owned, supported and maintained by Western Power under a service level agreement. The ERA is also aware that the causes of these information technology issues vary.

AEMO has implemented automated error checking and alerts to address these issues. AEMO has also confirmed that it has implemented a rigorous incident investigation and resolution process to identify root causes and reduce the occurrence of these issues.

The ERA is currently investigating some information technology non-compliance matters self-reported by AEMO where the latest BMO has not been used for dispatch. These events usually occurred at times of low market and system activity. Preliminary analysis carried out at the time of this report does not show any material consequences for the power system or the market from these events. If these types of events were to occur at periods with higher volumes of activity, material constraint payments may be triggered.

⁶ Pages 7 and 27 of [Independent Assurance Report on AEMO's compliance with the WEM Rules and Market Procedures](#).

The second information technology risk (Compliance Rating 2) concerned System Management's control room tools⁷. The auditor reported that documentation for the Real Time Dispatch Engine (RTDE) and the System Operations Control Centre User Interface (SOCCUI) was difficult to find and not current. For example, if something were to go wrong with the RTDE that would require it be reinstalled, it would probably lead to market suspension. The auditor also reported shortcomings with the SOCCUI, requiring the use of other tools or manual work arounds to make up for these shortfalls⁸.

The auditor reported that AEMO has commenced work to develop a strategy for the System Management information technology systems currently owned, supported and maintained by Western Power. These systems include the RTDE and SOCCUI.

The remaining two significant risk matters (neither of which constituted non-compliance) were:

- Lack of internal procedures⁹: The auditor reported that many of System Management's business processes are undocumented. System Management is currently updating all of its procedures and has assigned responsibilities to the relevant manager for each process;
- Departure of experienced control room operators¹⁰: The auditor noted considerable progress in recruiting and training new control room operators to replace departing senior operators. However, none of the new controllers has experience during the hot season when there are often High Risk and Emergency Operating State events. AEMO has confirmed that appropriate risk mitigation measures will be in place for this period. This plan includes retaining experienced control room operators until the end of the hot season and continuing its training program for new control room operators.

4.5 WEM Audit Report - Other matters

There were 18 medium risk matters identified by the auditor. Of these, 10 were classified as non-compliance matters (Compliance Rating 1). These matters occurred in a number of areas including provision of market information, reserve capacity processes, outages and ancillary services. The auditor classified two of these matters as material. The matters were:

- System Management did not use the latest temperature data provided by participants to calculate outage values¹¹. AEMO has advised the ERA that this non-

⁷ Pages 14 and 73 of [Independent Assurance Report on AEMO's compliance with the WEM Rules and Market Procedures](#).

⁸ For example, the auditor noted that the SOCCUI displays overestimated ancillary reserve quantities and does not incorporate credible multiple unit contingencies when calculating spinning reserve requirements. The auditor stated that some of these shortfalls have been addressed by adding new screens to the XA21 energy management system. A further example noted by the auditor is that the SOCCUI tool has no way to constrain the Synergy portfolio, requiring a manual calculation when a portfolio unit suffers a Forced Outage.

⁹ Pages 15 and 45 of [Independent Assurance Report on AEMO's compliance with the WEM Rules and Market Procedures](#).

¹⁰ Pages 16 and 78 of [Independent Assurance Report on AEMO's compliance with the WEM Rules and Market Procedures](#).

¹¹ Pages 27 and 57 of [Independent Assurance Report on AEMO's compliance with the WEM Rules and Market Procedures](#).

compliance is unlikely to have resulted in any material consequences. The latest data is now being used;

- On at least two occasions System Management has not provisioned Spinning Reserve sufficient to meet the Spinning Reserve standard under the WEM Rules¹². For these two occasions, while the amount of reserve did not meet the standard, AEMO confirmed that there was no threat to the security of the power system. The audit report notes that activation of spinning reserve is a manual process and the long-term solution requires new or changed information technology systems. In the interim AEMO has advised that it has raised internal awareness of this compliance obligation.

4.6 GSI Audit Report

The GSI Rules¹³ require AEMO to ensure that the audit covers the following matters:

- (a) the compliance of AEMO's internal procedures and business processes with the GSI Rules;
- (b) AEMO's compliance with the GSI Rules and GSI Procedures; and
- (c) AEMO's software systems for the Gas Bulletin Board and the calculation of GSI fees and processes for software management.

The results of the audit are documented in the auditor's "Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures". The report was published on AEMO's website on 28 September 2017¹⁴.

As required by rule 174(5) of the GSI Rules, the audit report is attached in Appendix 2.

The audit report stated the following main themes and findings:

- Continuing improvement in compliance management practices with a low volume of non-compliance;
- There is scope to improve business continuity planning and testing. Other elements such as reliance on key people, office premises, physical equipment and communication channels have not been tested.

A summary of the audit findings by compliance and risk rating is provided in Table 3 below.

¹² Pages 27 and 56 of [Independent Assurance Report on AEMO's compliance with the WEM Rules and Market Procedures](#).

¹³ See rule 174(2) of the GSI Rules.

¹⁴ Refer to [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

Table 3: Summary of 2016/17 audit findings

	Low Risk	Medium Risk	Significant Risk	Total
Compliance Rating 1 (non-compliance)	3	-	-	3
Compliance Rating 2 (compliance risk)	6	1	-	7
Compliance Rating 3 (minor housekeeping issue)	3	-	-	3
Total	12	1	-	13

Of the 13 audit findings, five have been actioned and reported as closed. The remaining open issues (eight in total) concern the need to review AEMO's general information technology controls.

Only three of the audit findings constituted non-compliance and all were low risk. Two of these were non-compliance with information publishing requirements¹⁵ and the other matter was the incorrect calculation of GSI fee adjustments¹⁶ (AEMO advised participants to ignore the incorrect adjustment invoices).

Seven findings were assessed as compliance risks and were not matters of non-compliance (Compliance Rating 2). Six of these were classified as low risk and covered deficiencies in process documentation¹⁷ and minor information technology matters for backup media encryption and data centre standards¹⁸.

The remaining compliance risk was classified with a medium risk rating and mirrored the WEM Rule audit finding that there is scope to improve business continuity planning beyond system redundancy testing¹⁹. As referred to in section 4.3 above, AEMO has initiated an organisation wide review of its business continuity plans.

There were three minor issues (Compliance Rating 3) covering updates to process documentation and training²⁰.

4.7 AEMO's response to the audits

Clause 2.14.4(b) of the WEM Rules and rule 174(3) of the GSI Rules provides that AEMO, if it does not accept the audit reports and recommendations, must prepare a separate report.

¹⁵ Pages 29 and 35 of the [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

¹⁶ Page 35 of the [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

¹⁷ Pages 32 and 36 of the [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

¹⁸ Page 46 of the [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

¹⁹ Pages 45 of the [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

²⁰ Pages 33 and 46 of the [Independent Assurance Report on AEMO's compliance with the Gas Services Information Rules and GSI Procedures](#).

The report must set out the matters that AEMO accepts and those that it does not accept, including AEMO's reasons. The ERA is required to include any separate report prepared by AEMO in this report.

AEMO has informed the ERA that it accepted all the audit findings. In the circumstances, AEMO did not prepare a separate report.

5 Investigations by the ERA during 2016/17

5.1 WEM Investigations

The ERA is required to include the results of any investigations it has carried out on AEMO's compliance with the WEM Rules and the Market Procedures in this report.

Between 1 July 2016 and 30 June 2017, the ERA completed five investigations of alleged breaches of the WEM Rules and/or Market Procedures by AEMO. All of these matters were self-disclosed by AEMO. The ERA considered all of these matters to be minor.

These matters are summarised in Table 4 below.

Table 4: 2016/17 Summary of AEMO investigations carried out

Reference ²¹	WEM Rule and/or Market Procedure	Description	Investigation Outcome
INV-1 and INV-15* (AEMO ID: 0001)	WEM Rule 3.23.2	The published LoadWatch Report may have contained missing Operational Load information.	No breach found
INV-2* (AEMO ID: 0004)	WEM Rule 3.17.2	Delay in publishing the Short Term PASA results.	Breach determined
INV-4* (AEMO ID: 0026)	WEM Rule 9.19.1(b)	Delay in publishing Non-STEM Settlement Statements by the due date.	Breach determined
INV-29 (AEMO ID: 0038)	WEM Rule 7A.3.7	Delay in internal transfer of Balancing Market SOI, EOI and RDQ data files.	Breach determined
INV-78 and INV-24* (AEMO ID: 0024)	Section 3.5.2 of the Market Procedure: Prudential Requirements	Process to return Credit Support to participant not followed.	Breach determined

²¹ The four asterisked matters were reported in the ERA's last [report](#) to the Minister prepared for the interim period to 28 February 2017. The ERA has sought to align the investigation reporting period used in this current report with AEMO's audit period of 1 July 2016 to 30 June 2017. This has required the inclusion of the four asterisked matters in Table 4.

5.2 GSI Investigations

While the GSI Rules do not require this report to include the results of any investigations carried out by the ERA on AEMO's compliance with the GSI Rules and GSI Procedures, this section has been included in this report for completeness.

To date the ERA has not investigated any alleged breaches of the GSI Rules or GSI Procedures by AEMO.

6 Conclusions

AEMO continues to demonstrate a strong compliance culture for its market operator functions. The auditor reported rigorous processes for self-detection of non-compliance and no material recurring non-compliance matters.

The auditor identified four continuing significant risks for AEMO's System Management functions in the areas of control room staffing, information technology maintenance and procedure documentation.

The ERA recognises that the audit period commenced at the time that AEMO gained responsibility for the System Management functions. In this time AEMO has made progress in reducing System Management's control room capability risks.

AEMO has confirmed that it is committed to addressing the audit findings for the outstanding significant risk matters. The ERA will monitor AEMO's progress with these issues.

The ERA also recommends that AEMO consider a process for auditor rotation in future.

Appendix 1 – Independent Assurance Report on AEMO’s compliance with the WEM Rules and Market Procedures



ROBINSON BOWMAKER PAUL



AUSTRALIAN ENERGY MARKET OPERATOR

INDEPENDENT ASSURANCE REPORT ON AEMO'S COMPLIANCE WITH
THE WEM RULES AND MARKET PROCEDURES

11 SEPTEMBER 2017

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Document version: FINAL PUBLIC

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EXECUTIVE SUMMARY

This independent assurance report sets out the results of the market audit by Robinson Bowmaker Paul (RBP) assessing AEMO’s compliance with the Wholesale Electricity Market Rules (WEM Rules) and Market Procedures.

AUDITED ENTITY

For avoidance of doubt:

- The term **AEMO CBD** is used to refer to AEMO’s market operator function based in central Perth (comprising Market Operations, System Capacity, Finance, Legal & Compliance and IT).
- The term **AEMO (System Management) (SM)** is used to refer to AEMO’s system operator function based in East Perth (comprising Power System Market Operations, Power System Planning and Control Room Operations).

AUDIT PERIOD

The Audit Period is 1 July 2016 to 30 June 2017, both dates inclusive.

REGULATORY CONTEXT AND SCOPE

Regulatory context

The regulatory context for the audit is summarised in the table below.

Table 1: Regulatory context for the Electricity Compliance Audit

Clause reference	Comment
2.14.1	Requirement for AEMO to appoint market auditor
2.14.2	Requirement for AEMO to ensure market audits are undertaken no less than annually
2.14.3	Defines the scope of the audit to include, at minimum: <ul style="list-style-type: none">• The compliance of AEMO’s Internal Procedures and business processes with the WEM Rules

Clause reference	Comment
	<ul style="list-style-type: none"> • AEMO’s compliance with the WEM Rules and Market Procedures • The compliance of AEMO’s market software systems and processes for software management with clause 2.36.1 of the WEM Rules.
2.36.1	Defines obligations with respect to AEMO’s software management systems and controls; this provides the compliance criteria for the review of processes for software management

Scope

Given the regulatory context above, the purpose of the Electricity Compliance Audit is to assess:

- How AEMO implements its obligations under the WEM Rules
- How AEMO manages non-compliance risk with respect to the obligations above
- Instances of non-compliance by AEMO during the Audit Period
- AEMO’s market software systems and its processes for software management, and specifically, AEMO’s compliance with clause 2.36.1 of the WEM Rules. It includes an assessment of whether:
 - AEMO maintains appropriate records
 - The software used by AEMO to implement its obligations under WEM Rules is compliant with the underlying mathematical formulations and the rules themselves.
 - AEMO has been compliant with its market systems certification obligations
 - AEMO can reproduce past results.

The Electricity Compliance Audit includes AEMO’s role as both market and system operator and includes the following work streams within scope:

- Compliance Assessment of AEMO’s operational compliance and application of controls to mitigate compliance risk
- Procedures Assessment of Market Procedures and Internal Procedures that have changed during the Audit Period
- Software Compliance Assessment
- Review of General IT Controls.

AUDIT CRITERIA

Criteria for determining operational and procedural compliance

The criterion we have used for determining the compliance of AEMO's Market Procedures is the WEM Rules dated 30 June 2017.

The criteria we have used for determining AEMO's operational compliance and the compliance of AEMO's Internal Procedures are the WEM Rules and the Market Procedures.

Criteria for determining control application

When assessing whether AEMO has applied effective controls during the Audit Period we have used relevant Internal Procedure and Confluence Work Instruction documentation as our audit criteria.

Table 2: Procedures reviewed to assess control application

AEMO functional area	Procedures against which control application has been assessed
Market Operations	Daily Operations Procedure, Prudential Requirements Procedure, Settlements Procedure and Confluence work instructions relating to Annual Loss Factor Review and NSTEM and STEM verification, billing and invoicing procedures
System Capacity	Certification Procedure and Preparation of ESOO Procedure
Finance	Determination of AEMO Budget Procedures and Fees Procedure
System Management Market Operations	Daily Market Operations Procedure, Daily Market Operations Contingency and Backup Procedure, Weekly Ad-hoc Market Operations Procedure, Dispatch Advisory Guidelines, Dispatch Advisory Software User Guide
System Management - System Operations	SOCC_UI Operation Manual, SWIS Technical Envelope
System Management - Planning	MetrixIDR Technical Guide
IT	Access Control and Authentication Standard, AEMO AD Domain Administrator Access Procedure, Application Security Standard, Backup Standard, Cyber Security Policy, Encryption Standard, Information Handling Guidelines, IT Security Incident Response Procedure, Logging and Log Management Standard, Malware Protection Standard, Mobile Computing and Remote Access Security Standard, Network Security Standard, Patch Management Standard, Secure Deletion and Disposal Standard, Workstation Security Standard, IT Change Management Policy, Incident Management Policy, Problem Management Policy, Software Configuration Management Plan, Western Power IT Branch Change Management Policy and

AEMO functional area	Procedures against which control application has been assessed
	Process, Western Power IT Problem Management Process, Western Power Release Management Guidelines, Western Power Incident Management Process

Where AEMO does not have documented controls or procedures relating to a business process under review we have used best practice criteria for a prudent market and system operator. This includes:

- The use of automated/semi-automated tools to reduce risk of errors
- Use of automated alerts or calendar reminders
- Approval and authorisation processes
- Issue escalation processes
- Validation and review processes
- Exception reporting

APPROACH

Assurance

This audit has been conducted in accordance with Australian Auditing and Assurance Standards Board's 'Framework for Assurance Engagements', ASAE 3000 'Assurance Engagements Other than Audits and Reviews of Financial Information'.

- We provide reasonable assurance under this standard with respect to our review of:
 - The compliance of AEMO's Internal Procedures with the WEM Rules
 - The compliance of AEMO's market software with the WEM Rules and Market Procedures
- We provide limited assurance under this standard with respect to our review of:
 - AEMO's compliance with the WEM Rules and Market Procedures
 - AEMO's software management processes and controls

Compliance and risk ratings

Table 3: Compliance and risk rating definitions

Compliance rating	Risk Rating
1: Instances of non-compliance with the WEM Rules	Critical: Potential for catastrophic impact on market or system operations or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level.
2: Findings that are not an instance of non-compliance, but pose compliance risk	Significant: Potential for major impact on market or system operations or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings.
3: Findings related to minor housekeeping issues that do not affect compliance risk	Medium: Potential for moderate impact on market or system operations or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring.
	Low: Potential for minor impact on market or system operations or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

Materiality (qualification of audit opinion)

In determining whether to qualify our opinion on whether AEMO has complied “in all material respects”, we have taken the following factors into account:

- Purpose and objectives of the market audit
- AEMO’s overall objectives
- AEMO’s risk matrix definitions of impact
- Financial impacts on Market Participants
- The number of Market Participants or other stakeholders affected
- The impact of an issue on market objectives such as transparency, equity and efficiency
- Whether an issue is systemic
- Whether an issue is recurring (from previous audits).

Audit activities

We have undertaken a combination of:

- Reviewing self-reported incidents of AEMO non-compliance with the WEM Rules and Market Procedures
- Business process walkthroughs and interviews with staff

- Reviewing AEMO’s Market Procedures, Internal Procedures¹ and IT Procedures to ensure WEM Rules changes and other changes (e.g. processes, systems, etc.) have been reflected in the procedures
- Compliance testing to audit AEMO’s operational compliance with the WEM Rules and Market Procedures and to determine the effectiveness of operating controls².

The first two activities were conducted as part of two field-visits (one undertaken in March 2017 and the other in June 2017). Remaining activities have been undertaken remotely.

Compliance testing and business process walkthroughs were focussed on subset of functional areas based on residual compliance risk, materiality, and rule changes occurring in the Audit Period. These areas include:

Table 4: Audit focus areas

AEMO functional area	Focus area
Market Operations	Verification, billing and invoicing procedures for initial NSTEM settlement, daily market operations procedures relating to operating the STEM and Balancing Markets, end to end credit limit reviews and publication and review of Loss Factors
System Capacity	Capacity certification approval procedures and Electricity Statement of Opportunities (ESOO) report preparation
Finance	Calculation and publication of WEM budget and market fees (considering recent changes in fee categories)
System Management Market Operations	Reviewing, assessing and incorporating standing data changes, manual preparation of settlement input data and other market data (in particular, market data preparation and publication obligations that were previously split between AEMO and System Management), System Management and Synergy meetings under clause 7.6A of the WEM Rules
System Management - System Operations	Dispatch, including control room operations, operational load forecasting, manual generation constraints and Dispatch Advisories
System Management - Planning	ST and MT PASA, Synergy Dispatch plan

¹ In some instances, We have reviewed draft versions of Internal Procedures that had not been formally approved as at the time of the audit.

² In doing so, we have sourced information from all AEMO (WA) teams.

AEMO functional area	Focus area
IT	Business continuity, service management, and user-facing information security policies and procedures, System Management software processes and procedures

AUDIT THEMES AND FINDINGS

Comment

Considerable progress in raising AEMO (System Management) capability and reducing risk

AEMO (System Management) (SM) has made considerable progress in reducing the very significant risks around the transition from Western Power to AEMO, particularly in relation to the departure of experienced control room staff and System Operations Planning Engineers. Since the last audit, System Management has recruited and trained around 20 new staff and successfully retained some experienced ex-Western Power staff; this has contributed greatly to the effectiveness of the training programme (also developed since the last audit and tailored to the Western Australian system operations).

System Management has also addressed another previous finding relating to outdated Control Room Instructions (CRIs) by revising their suite of CRIs to reflect current operational practices; this is a valuable support tool for the newly recruited control room operators.

In terms of service level agreements with Western Power, System Management continues to make good progress standardising process and protocols for control room and IT support.

There are still outstanding risk areas with respect to control room staffing; particularly the newly recruited control room operators may still not be sufficiently experienced to deal with system contingencies during bushfire season; especially in a new control room in light of AEMO’s upcoming move to new premises in central Perth. This risk is further exacerbated due to frequent IT system issues as discussed below.

Continuing improvement in compliance management practices at AEMO CBD³

We continue to note increasing levels of maturity in managing compliance and a strong compliance culture with respect to AEMO CBD.

³ Covering market operator functions: Market Operations, System Capacity, Finance and Legal & Compliance.

- Audit findings from previous years have been consistently addressed and closed with no material recurring themes noted. The vast majority of medium or higher risk audit findings from the current Audit Period have likewise been addressed and closed promptly.
- Over 75% of non-compliance incidents with the WEM Rules and Market Procedures were self-reported; this speaks to the effectiveness of AEMO's detective controls.
- Settlement processes employ strong controls which are effective in detecting data errors and anomalies (including meter data errors originating from Western Power). Furthermore, the Market Operations (CBD) team are proactive in improving controls (for settlement and other areas) as issues are detected.
- Our site visits have indicated that the Market Operations and System Capacity teams maintain and apply effective controls to manage compliance risk.

System Management IT issues continue to cause non-compliance and pose risk

Problems with System Management IT systems have caused breaches on multiple occasions in the Audit Period. Further, the currency of and support for critical control room tools need more focus.

We noted at least 15 occasions on which System Management IT issues resulted in AEMO not dispatching from the latest Balancing Merit Order. Root causes vary, but most incidents appear to have been caused by an issue in the design of the FTP transfer process, which has now been addressed via automated error checking and alerting. Other causes include:

- A missed maintenance task which led to unavailability of real-time input data
- The inadvertent disabling of a production file transfer account during routine maintenance
- A server turned off as part of the Western Power data centre move, which unexpectedly affected market functions, and turned out to be a single point of failure
- A task missed during a data centre failover that left FTP services pointing to the wrong server
- Issues with Western Power's ISP that meant data could not be transferred between the two different parts of AEMO.

Further, during our audit of the Real-time Dispatch Engine (RTDE), we noted that documentation and information about both RTDE and SOCCUI (interface) was difficult to find, and when found, not current. There is very little deployment documentation for RTDE, and the support team had never installed the tool on a new environment before. As a result, it took several weeks and numerous follow ups to work out a way to test the tool, and several more weeks to work through the issues in getting the tool to run outside the existing environments.. If, for example, the server running RTDE failed in a way that required it to be reinstalled, this would likely lead to market suspension.

In our control room visits, we noted multiple issues with the SOCCUI tool, affecting its use for controllers, none of which are captured in defect or change requests. Two examples of such issues include:

- Changes to facility Ancillary Service capability have not been reflected in SOCCUI, meaning that figures displayed overestimate available reserves and load following. Such a mismatch means that operator may not provision enough Ancillary Services, which could impact system security, and in a major contingency, could lead to load shedding
- Weather data in the tool (used to identify similar days for load forecasting purposes) dates back to 2015, and there is no 2016 or 2017 data. This severely hampers controllers' ability to identify similar days - 2015 load profiles are sufficiently different to 2017 that they are not useful.

In both cases controllers have used manual work arounds to address the issues; however, these work arounds are not adequate controls for compliance risk.

Due to the frequency, impact and variety of IT issues, the nature of the additional risks around software, and the fact that the market design changes previously planned in the WA Electricity Market Review are at least two years in the future, we have recommended that AEMO puts a very high priority on addressing the future of these systems.

AEMO has commenced work to develop a strategy for the System Management IT systems which are currently being hosted and supported by Western Power.

Scope to improve business continuity planning and testing

AEMO maintains redundant IT systems, so that the market can continue to operate in the event of losing one data centre. Both data centres are regularly exercised, by running production market systems from each location at regular intervals. While this is perhaps the most critical part of AEMO's business continuity preparation, other aspects of business continuity have not been explored. We have not seen evidence of any business continuity testing beyond system failover and backup restoration testing. This means that reliance on key people, office premises, physical equipment, and communications channels has not been tested. This applies to both AEMO CBD and System Management (East Perth) activities, and is particularly concerning for control room operations.

AEMO has initiated an organisation wide review and update of Business Continuity Plans as part of its move to a new organisational structure.

Lack of System Management process documentation continues to be a compliance risk area

As noted in previous years, many of System Management's business processes are undocumented. This includes all areas except Market Operations, affecting obligations including outage planning and approval, setting Ancillary Services requirements, commissioning tests, dispatch, and power system security. Network outage scheduling and approval processes (in the process of being transferred from Western Power staff to AEMO). This results in inconsistent practices; for example, different controllers have different approaches to assessing on the day opportunistic maintenance requests.

System Management is currently in the process of updating all of its Internal Procedures and has assigned responsibilities to the relevant manager for each process.

Manual data preparation poses compliance risk

Much of System Management's data preparation process is manual, though generally well-documented in the System Management daily and weekly operations Internal Procedures. Given the manual nature of the processes, it is inevitable that from time to time errors and oversights will occur. During the audit, we have noted a number of instances where manual errors have been root causes for non-compliance incidents and where data preparation activities could be improved to reduce compliance risk.

To address this risk, System Management proposes to:

- Review the suite of Market Operations spreadsheets and consider improvements where System Management can increase automation and/ or decrease manual input to the spreadsheet (as possible).
- Review how to improve calendar reminder notifications.

Summary

Table 5 below summarises the total number of audit findings (broken down by risk rating) reported during the 2015/16 and 2016/17 Audit Periods.

The majority of open issues pertain to power system operations and planning (System Management) findings (27 of the 36 open issues), many of which are recurring issues from previous audits.

Table 5: Audit finding summary by risk rating and open/closed status, 2015/16 and 2016/17.

	2015/16 Findings	2016/17 Findings		
Risk Rating	Total	Total	Closed	Open
Significant	4	4	0	4
Medium	11	17	4	14
Low	23	30	12	18
Total	38	52	16	36

Table 6: Summary of audit findings

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 1.01	Issue Type N/A Process System Management - Market & System Operations	Risk Rating Significant Compliance Rating 2	Level of support for control room software tools needs improvement	<p>Ensure adequate support and development capacity for control room tools. Monitor staffing levels to ensure that knowledge is increased, and to cover key person risk where possible.</p> <p>Improve mechanism to effectively capture defects and enhancement requests for SOCCUI, including a route for users to contribute on an ongoing basis.</p> <p>Consider a strategy for control room tools to address known problems with significant risk.</p> <p>Ensure all System Management IT systems are in version control.</p>
17 WEM 2.01	Issue Type RBP reported non-compliance Process Finance	Risk Rating Low Compliance Rating 1	Failure to publish historical WEM Financial Report	Update Internal Procedures to document this process.
17 WEM 2.02	Issue Type N/A Process System Capacity	Risk Rating Low Compliance Rating 2	Validation processes for ESOO data registers are undocumented	No recommendations as AEMO has addressed this finding
17 WEM 2.03	Issue Type RBP reported non-compliance Process	Risk Rating Medium Compliance Rating 1	AEMO has not published an updated equipment list	Schedule twice annual reviews in organisational calendar

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
	System Management - Planning			
17 WEM 2.04	Issue Type RBP reported non-compliance Process System Management - Planning	Risk Rating Low Compliance Rating 1	AEMO does not take DSM availability into account when assessing outages	Review costs/risks/benefits of incorporating DSM availability into outage assessment. If inclusion is decided against, consider proposing a rule change to remediate.
17 WEM 2.05	Issue Type N/A Process System Management	Risk Rating Significant Compliance Rating 2	Lack of Internal Procedures (or business process documentation) poses compliance risk	Develop and maintain procedure documentation for all business processes. We recommend using collaboration tools as well as MS word or pdf documents. For example, System Management could take a similar approach to the CBD office, using Confluence for collaborating on work instructions and recording work done. Add Temperature deration update process to market operations procedure document Update market operations procedure document for new AEMO email accounts, and removal of references to retired tools such as the Generator trip log.
17 WEM 2.06	Issue Type N/A Process System Management - Planning & Market Operations	Risk Rating Low Compliance Rating 2	Manual process to include transmission outages and potential constraints for MT and ST PASA reports poses risks of omission and errors.	Following transfer of network outage management functions from WP to AEMO, review internal network outage process and identify ways to reduce manual error.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 2.07	Issue Type RBP reported non-compliance Process System Management - Planning	Risk Rating Low Compliance Rating 1	AEMO does not provide updated Dispatch Plans to Synergy on the Trading Day	Review internal definition of 'significant event', and update Dispatch Advisory guidelines to ensure notifications to Synergy are included. Investigate whether to remove Synergy fuel calculations from Dispatch Plan provided to Synergy by System Management.
17 WEM 2.08	Issue Type AEMO Self-reported non-compliance Process System Management - Market Operations	Risk Rating Significant Compliance Rating 1	Not using latest BMO due to IT systems issues	Investigate backup methods of importing market data into System Management systems. Ensure plan for future of systems is completed by the end of 2017, so that action can be taken to address this ongoing risk.
17 WEM 2.09	Issue Type RBP reported non-compliance Process System Management - Market Operations	Risk Rating Medium Compliance Rating 1	Late issuance of Dispatch Advisories	Long term: Investigate alternate mechanisms for providing information to Market Participants, for example regular automated publication of System Management projected dispatch schedules each time RTDE is rerun with new inputs every time RTDE is rerun using new information (e.g. new forecasts, new constraints, or a new BMO). Medium term: Review this issuance of Dispatch Advisories in conjunction with the establishment of the security desk. Short term: Investigate whether Market Operations analysts can have remote access to issue Dispatch Advisories from off-site
17 WEM 2.10	Issue Type N/A Process	Risk Rating Significant	Departure of experienced control room operators poses significant risk to	Ensure access to experienced control room staff during 2018 bushfire season.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
	System Management - System Operations	Compliance Rating 2	power system security and market dispatch obligations (particularly in light of patchy process documentation in this area)	Create and maintain procedure documentation for control room processes.
17 WEM 2.11	Issue Type N/A Process System Management - System Operations	Risk Rating Medium Compliance Rating 2	There is room to better align the dispatch process with market objectives around economic efficiency	Investigate feasibility of updating software to recalculate and issue dispatch instructions at 5-minute intervals.
17 WEM 2.12	Issue Type N/A Process System Management - System Operations	Risk Rating Medium Compliance Rating 2	Communication protocols between Western Power and AEMO will be required to ensure seamless application of network constraints in dispatch	Short term: Develop and agree communication protocol between Western Power Networks and AEMO System Management. Medium term: Introduce tools and processes (as part of new security desk) to allow AEMO staff to assess and monitor network security including dynamic powerflows.
17 WEM 2.13	Issue Type N/A Process System Management - System Operations	Risk Rating Medium Compliance Rating 2	System Management's dispatch decisions around Synergy plant are opaque; there is potential for breaches of Clauses 7.6.2 and 7.13.1(a)	Short term: As part of developing control room documentation, ensure that verbal dispatches of Synergy facilities are included in the Reporting and Logging protocol Medium term: Investigate potential for keeping electronic records of Synergy dispatch.
17 WEM 2.14	Issue Type N/A Process	Risk Rating Medium	There is opportunity to improve the audit trail of control room operations	Short term: Define standard for control room logging, and explicitly note items to be recorded

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
	System Management - System Operations	Compliance Rating 2		Medium term: Investigate ways to automate or assist the capture of information about real time events
17 WEM 2.15	Issue Type RBP reported non-compliance Process System Management - Planning & Market Operations	Risk Rating Medium Compliance Rating 1	RDQ forecasts prepared by System Management do not always reflect best estimate of forecast load	Investigate a mechanism to capture and publish the actual load forecast used in the control room. Include reasons for Metrix override in control room logging standard.
17 WEM 2.16	Issue Type RBP reported non-compliance Process System Management - Market Operations	Risk Rating Low Compliance Rating 1	System Management does not publish updates to the ST PASA when material changes occur	Following transfer of network outage planning function to AEMO, review usefulness of PASA information to participants, refine reports to provide match with what participants need and investigate automatic publication. In the meantime, continue with current ST PASA publication approach.
17 WEM 2.17	Issue Type RBP reported non-compliance Process System Management - Planning & Market Operations	Risk Rating Low Compliance Rating 1	System Management does not publish transmission constraint information in PASA	Following the transfer of the network planning function to AEMO, review usefulness of PASA information to Market Participants, refine reports to provide better match with what participants need, and investigate automatic publication.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 2.18	Issue Type N/A Process System Management - Market Operations	Risk Rating Low Compliance Rating 3	SCADA data cleansing processes remove consumption data	Update Cleansing of Generation Facility MWh output data PSOP to reflect all data cleansing steps Review and refine SCADA cleansing processes to improve accuracy
17 WEM 2.19	Issue Type RBP reported non-compliance Process System Management - Planning	Risk Rating Low Compliance Rating 1	Ancillary Service Report not published on AEMO website by 1 July 2017	Schedule publication in organisational calendar. Allow more time for internal review in submission timetable.
17 WEM 2.20	Issue Type RBP reported non-compliance Process System Management - Planning	Risk Rating Low Compliance Rating 1	Dispatch Plan and associated Information provided to Synergy does not include specified ancillary service information, and the format and time resolution is not described in a procedure.	Standardise Dispatch Plan creation process and describe in a procedure Alter dispatch plan preparation process to remove reliance on sheet containing confidential information.
17 WEM 2.21	Issue Type N/A Process System Management - System Operations	Risk Rating Medium Compliance Rating 2	Verbal dispatch instructions are not automatically recorded in IT systems	Consider moving responsibility from Market Operations to control room staff to enter verbal dispatch instructions into systems.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 2.22	Issue Type N/A Process System Management - System Operations	Risk Rating Medium Compliance Rating 2	Control room business continuity plans do not include continuous oversight of power system, and IT system disaster recovery plans are not sufficient	Investigate mechanism to provide remote access (e.g. from home or another office location) to control room tools, to allow continuous system oversight in the event of evacuating the primary site. Develop and test disaster recovery plans for System Management IT systems.
17 WEM 2.23	Issue Type AEMO Self-reported non-compliance Process Various	Risk Rating Low Compliance Rating 2	PSOPs out of date	AEMO should update the PSOP to reflect the various organisational changes, including publication obligations
17 WEM 2.24	Issue Type N/A Process Various	Risk Rating Low Compliance Rating 3	Missing obligations in Market Procedures	AEMO should update the relevant Market Procedures to include the omissions next time there is a Procedure Change Proposal progressed for the relevant Market Procedure
17 WEM 2.25	Issue Type N/A Process Various	Risk Rating Low Compliance Rating 3	Missing obligations in AEMO's non-System Management Internal Procedures	AEMO should update the relevant Internal Procedures to pick up gaps and transitional rule changes
17 WEM 2.26	Issue Type RBP reported non-compliance	Risk Rating Medium Compliance Rating 1	Allocation of Certified Reserve Capacity to facilities that did not meet WEM Rules criteria ⁴	While it was an executive decision to breach the WEM Rules in this particular circumstance, AEMO should document any future deviations from the WEM Rules to support the rationale of its decision.

⁴ Reported as out of period finding in last year's Electricity Compliance Audit.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
	Process System Capacity			
17 WEM 2.27	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	Incorrect calculation of IRCR due to software bug.	No recommendations as AEMO has addressed this finding through a system fix
17 WEM 2.28	Issue Type AEMO Self-reported non-compliance Process System Capacity	Risk Rating Medium Compliance Rating 1	Incorrect calculation of Relevant Level and assigned CRC level due to manual error (and consequential technical breach in calculating Monthly Reserve Capacity Price)	No recommendations as AEMO has addressed this finding.
17 WEM 2.29	Issue Type AEMO Self-reported non-compliance Process System Capacity	Risk Rating Low Compliance Rating 1	Delay in publication of Market Procedure for Expected DSM Dispatch Quantity and DSM Activation Price	No recommendations – AEMO has published the Market Procedure as at 9 June 2017.
17 WEM 2.30	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Medium Compliance Rating 1	Incorrect Reserve Capacity Refund calculation due to WEMS defect	No recommendations as AEMO has fixed the software defect and is addressing the settlement errors through adjustments.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 2.31	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	Delay to STEM Window closing time due to manifest error in the WEM Rules	No recommendations – AEMO has taken appropriate actions to mitigate the risk of breach recurrence and the extent of delay caused by AEMO exercising its right to extend timelines under clause 6.4.6 of the WEM Rules.
17 WEM 2.32	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Medium Compliance Rating 1	Incorrect settlement calculations due to erroneous Spinning Reserve import	No recommendations as AEMO has updated procedures to prevent recurrence of similar breaches.
17 WEM 2.33	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	Failure to acknowledge notice of disagreement due to oversight.	No recommendations as AEMO has adequate controls to mitigate recurrence of similar breaches. This was an instance of human error.
17 WEM 2.34	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	Failure to notify participant of incorrect Capacity Credit Allocation leading to erroneous revocation of Capacity Credit Allocation	No recommendations as AEMO has updated the failover checklists and internal process documentation to include a check of the MOSMI logs to identify errors. This should prevent recurrence of this breach.
17 WEM 2.35	Issue Type AEMO Self-reported non-compliance Process Various	Risk Rating Low Compliance Rating 1	Failure to publish summary of closed Rule Change Proposals and Procedures Changed proposals	No recommendation as AEMO has resolved the issue.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 2.36	Issue Type AEMO Self-reported non-compliance Process Various	Risk Rating Low Compliance Rating 1	Failure to notify MAC of Procedure Change Proposal publication	Include checklists that cover change process deadlines, notification and publication requirements.
17 WEM 2.37	Issue Type N/A Process Market Operations	Risk Rating Low Compliance Rating 3	Rule inconsistency in relation to settlement tolerances raises a risk of incorrect tolerances being used	No recommendations.
17 WEM 2.38	Issue Type RBP reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	Technical non-compliance with requirement to notify receipt by telephone	No recommendations.
17 WEM 2.39	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 2	Documentation for backup architecture not available	Ensure that current backup refresh project delivers documentation for the architecture of the backup environment.
17 WEM 2.40	Issue Type N/A Process IT	Risk Rating Medium Compliance Rating 2	Business continuity exercises are limited to system failovers	Plan and conduct regular desk-based and live business continuity exercises covering selected credible contingency scenarios.
17 WEM 2.41	Issue Type N/A Process IT	Risk Rating Low	WA backup media not encrypted as required by AEMO Encryption Standard	Consider backup media encryption as part of backup refresh project.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
		Compliance Rating 2		
17 WEM 2.42	Issue Type N/A Process System Management - Market Operations	Risk Rating Medium Compliance Rating 2	Market operations data preparation processes are heavily manual.	<p>Assess opportunities for automating to reduce manual effort and reduce errors. In particular:</p> <ul style="list-style-type: none"> • Automate: <ul style="list-style-type: none"> ◆ preparation of the ancillary service activation quantities and ◆ calculation of outage quantities for intermittent generators. • Lock key spreadsheet tools and add to source control. • Implement timestamping on manually amended database tables. <p>Long term: Introduce MOSMI alerts for System Management market operations activities Medium term: Centralise management of activity reminders and deadline notifications, for example in a shared calendar.</p>
17 WEM 2.43	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 3	New IT applications staff have had limited exposure to service management concepts	Ensure support staff have appropriate service management training.
17 WEM 2.44	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 3	Configuration management system could be improved	<p>Ensure support staff have appropriate service management training</p> <p>Consider refreshing CMDB as part of the wider AEMO service management programme</p>
17 WEM 2.45	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 2	One data centre is not Tier III aligned	Consider moving to a more distant Tier III aligned data centre site as part of next data centre lifecycle refresh project.

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
17 WEM 2.46	Issue Type RBP reported non-compliance Process System Management - Market Operations	Risk Rating Medium Compliance Rating 1	Non-issuance of Dispatch Advisories	Review Dispatch Advisory Guidelines, including threshold significance of unit constraint on a facility. We recognise that if the constraint is only for a short time (e.g. less than the gate closure period), the market effects may be minimal, and in these cases AEMO might choose to accept non-compliance rather than incur the overhead of creating and maintaining a Dispatch Advisory.
17 WEM 2.47	Issue Type RBP reported non-compliance Process System Management - System Operations	Risk Rating Medium Compliance Rating 1	Insufficient Spinning Reserve activated	Ensure ancillary service dispatch is considered in planning for evolution of System Management IT systems. Monitor ancillary service provision to identify any trend towards greater volatility of requirement or activation.
17 WEM 2.48	Issue Type AEMO Self-reported non-compliance Process System Management - Market Operations	Risk Rating Low Compliance Rating 1	Late preparation of data	See 17WEM2.42
17 WEM 2.49	Issue Type AEMO Self-reported non-compliance Process System	Risk Rating Low Compliance Rating 1	Not following the PSOP in approving Day Ahead Opportunistic maintenance	No recommendations

Ref	Process	Risk & Compliance Rating	Finding	Recommendation
	Management - Planning			
17 WEM 2.50	Issue Type AEMO Self-reported non-compliance Process System Management - Planning	Risk Rating Low Compliance Rating 1	Not providing aggregate resource plan data to Synergy	No additional recommendations
17 WEM 2.51	Issue Type RBP reported non-compliance Process System Management - Market Operations	Risk Rating Medium Compliance Rating 1	Not using latest temperature dependence ratio provided under Standing Data to calculate facility outage quantities	Clarify to Market Participants (including updating market facing documentation) the relationship between Appendix 1(b)iii and 1(b)iv of the WEM Rules. Request that all Market Participants update their Appendix 1(b)iii values to be at 15 degrees Celsius OR change outage calculations to assume 41 degrees and ask Market Participants to submit on that basis Request that Market Participants responsible for the 9 facilities who have not supplied a temperature deration curve supply one. Review process for incorporating derate curves, including explicit instructions in Internal Procedure documentation.

OPINION

Qualifications

We have noted three instances of material non-compliance with the WEM Rules; our definition of materiality is set out on page 7:

- System Management has used incorrect temperature deration coefficients to calculate outage values, which is not compliant with clause 3.21.6(a) of the WEM Rules.
- On at least two occasions System management has not provisioned Spinning Reserve sufficient to meet the Spinning Reserve requirement as required by clause 3.12.1 of the WEM Rules.
- Due to IT issues, System Management has dispatched other than from the latest Balancing Merit Order (BMO) on several occasions, which is not compliant with clauses 7.6.1C and 7.6.1D of the WEM Rules.

Conclusion

Opinion on the compliance of AEMO's Market and Internal Procedures with the WEM Rules

Subject to the inherent limitations set out in Section 1.5.4, based on the audit procedures we have performed and the evidence we have examined, AEMO's Market Procedures and Internal Procedures are compliant with the WEM Rules.

Opinion on AEMO's operational compliance with the WEM Rules and Market Procedures

Subject to the inherent limitations set out in Section 1.5.4 and with the exception of the instances set out above, based on the audit procedures we have performed and the evidence we have examined, nothing has come to our attention that causes us to believe AEMO has not been compliant with the WEM Rules and Market Procedures during the Audit Period, in all material respects.

Opinion on the compliance of AEMO's Market Software Systems with the WEM Rules

Subject to the inherent limitations set out in Section 1.5.4, based on the audit procedures we have performed and the evidence we have examined, AEMO's Market Software Systems are compliant with the WEM Rules in all material respects.

Opinion with respect to the compliance of AEMO's software management processes with the WEM Rules

Subject to the inherent limitations set out in Section 1.5.4, based on the audit procedures we have performed and the evidence we have examined, nothing has come to our attention that causes us to believe that AEMO's processes for software management have not been compliant with the WEM Rules and Market Procedures during the Audit Period in all material respects.

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1 INTRODUCTION

This chapter sets out the regulatory context for the Electricity Compliance Audit and our approach to performing the audit.

1.1 AUDITED ENTITY

The audited entity for this report is AEMO.

For avoidance of doubt:

- The term *AEMO CBD* is used to refer to AEMO's market operator team based in central Perth (comprising Market Operations, System Capacity, Finance, Legal & Compliance and IT).
- The term *AEMO (System Management) (SM)* is used to refer to AEMO's system operator team based in East Perth (comprising Power System Market Operations, Power System Planning and Control Room Operations).

1.2 AUDIT PERIOD

The Audit Period is 1 July 2016 to 30 June 2017, both dates inclusive.

1.3 REGULATORY CONTEXT AND SCOPE

1.3.1 Regulatory context

The regulatory context for the audit is summarised in the table below. For avoidance of doubt, the heads of power for the Electricity Compliance Audit are derived from clauses 2.14.1, 2.14.2 & 2.14.3 of the WEM Rules and covers AEMO's role as both market operator and system operator.

Table 7: Regulatory context for the market audit

Clause reference	Comment
2.14.1	Requirement for AEMO to appoint market auditor.
2.14.2	Requirement for AEMO to ensure market audits are undertaken no less than annually.

Clause reference	Comment
2.14.3	Defines the scope of the audit to include, at minimum: <ul style="list-style-type: none"> • The compliance of AEMO's Internal Procedures and business processes with the WEM Rules. • AEMO's compliance with the WEM Rules and Market Procedures. • The compliance of AEMO's market software systems and processes for software management with clause 2.36.1 of the WEM Rules.
2.36.1	Defines obligations with respect to AEMO's software management systems and controls; this provides the compliance criteria for the review of processes for software management.

1.3.2 Scope

Given the regulatory context above, the purpose of the Electricity Compliance Audit is to assess:

- How AEMO implements its obligations under the WEM Rules.
- How AEMO manages non-compliance risk with respect to the obligations above.
- Instances of non-compliance by AEMO during the Audit Period.
- AEMO's market software systems and its processes for software management, and specifically, AEMO's compliance with clause 2.36.1 of the WEM Rules. It includes an assessment of whether:
 - AEMO maintains appropriate records.
 - The software used by AEMO to implement its obligations under WEM Rules is compliant with the underlying mathematical formulations and the rules themselves.
 - AEMO has been compliant with its market systems certification obligations.
 - AEMO can reproduce past results.

The Electricity Compliance Audit includes AEMO's role as both market and system operator and includes the following work streams within scope:

- **Compliance Assessment** of:
 - Areas where we have noted breaches or non-compliance risk during past audits.
 - Areas that have changed or been introduced in the past Audit Period (e.g. in terms of rule changes, system changes, operational practice changes).
 - AEMO's self-reported instances of non-compliance with the WEM Rules.
 - Areas of potential risk identified by Market Participants during the Stakeholder Session on 23 March 2017.

- **Procedures Assessment** of Market Procedures and Internal Procedures that have changed during the Audit Period.
- **Software Compliance Assessment.** Our audit team has tested and certified updates to WEMS and settlements systems on an ad-hoc basis throughout the year (prior to implementation). Hence the Software Compliance Assessment does not include certification testing but does include:
 - A review of AEMO’s change logs for WEMS, settlements, SPARTA, RTDE and SOCCUI
 - A review of rule changes and release notes to determine whether all rule changes have been reflected in software
 - Testing compliance of MR 2.36.1(b) in respect of Balancing Merit Orders for 8 July 2016 to check whether AEMO can recreate system outputs
 - Certification of the Real-time Dispatch Engine (RTDE) tool against its functional specifications and the WEM Rules. This year, the scope of the Software Compliance Assessment has been expanded to include testing and certification of RTDE, which is not yet complete, and results will be reported separately.
- **Review of General IT Controls.** This year we have broadened the scope of our software management process review to encompass general IT controls not reviewed (or reviewed only in part) in previous years. This review covers:
 - Change and release management for all AEMO WA systems
 - Incident and problem management
 - Backup arrangements, retention and restoration
 - Authentication, authorisation and access management
 - Database management
 - User-facing information security controls.

1.4 AUDIT CRITERIA

1.4.1 Criteria for determining operational and procedural compliance

The criterion we have used for determining the compliance of AEMO’s Market Procedures (referred to as the *Market Procedures*) is the Wholesale Electricity Market Rules dated 28 June 2017 (referred to as the *WEM Rules*).

The criteria we have used for determining AEMO’s operational compliance and the compliance of AEMO’s Internal Procedures are the WEM Rules and the Market Procedures.

1.4.2 Criteria for determining control application

When assessing whether AEMO has applied effective controls during the Audit Period we have used relevant Internal Procedure and Confluence Work Instruction documentation as our audit criteria. These are summarised below.

Table 8: Procedures reviewed to assess control application

AEMO functional area	Procedures against which control application has been assessed
Market Operations	Daily Operations Procedure, Prudential Requirements Procedure, Settlements Procedure and Confluence work instructions relating to Annual Loss Factor Review and NSTEM and STEM verification, billing and invoicing procedures
System Capacity	Certification Procedure and Preparation of ESOO Procedure
Finance	Determination of AEMO Budget Procedures and Fees Procedure
System Management Market Operations	Daily Market Operations Procedure, Daily Market Operations Contingency and Backup Procedure, Weekly Ad-hoc Market Operations Procedure, Dispatch Advisory Guidelines, Dispatch Advisory Software User Guide
System Management System Operations	SOCC_UI Operation Manual, SWIS Technical Envelope
System Management Planning	MetrixIDR Technical Guide
IT	Access Control and Authentication Standard, AEMO AD Domain Administrator Access Procedure, Application Security Standard, Backup Standard, Cyber Security Policy, Encryption Standard, Information Handling Guidelines, IT Security Incident Response Procedure, Logging and Log Management Standard, Malware Protection Standard, Mobile Computing and Remote Access Security Standard, Network Security Standard, Patch Management Standard, Secure Deletion and Disposal Standard, Workstation Security Standard, IT Change Management Policy, Incident Management Policy, Problem Management Policy, Software Configuration Management Plan, Western Power IT Branch Change Management Policy and Process, Western Power IT Problem Management Process, Western Power Release Management Guidelines, Western Power Incident Management Process

Where AEMO does not have documented controls or procedures relating to a business process under review we have used best practice criteria for a prudent market and system operator. This includes:

- The use of automated/semi-automated tools to reduce risk of errors.

- Use of automated alerts or calendar reminders.
- Approval and authorisation processes.
- Issue escalation processes.
- Validation and review processes.
- Exception reporting.
- Practices at other system and market operators with which we are familiar.

1.5 APPROACH

1.5.1 Assurance

Our audit has been conducted in accordance with Australian Auditing and Assurance Standards Board's '*Framework for Assurance Engagements*', ASAE 3000 '*Assurance Engagements Other than Audits and Reviews of Financial Information*'.

- We provide reasonable assurance under this standard with respect to our review of:
 - The compliance of AEMO's Internal Procedures with the WEM Rules
 - The compliance of AEMO's market software with the WEM Rules and Market Procedures
- We provide limited assurance under this standard with respect to our review of:
 - AEMO's compliance with the WEM Rules and Market Procedures
 - AEMO's software management processes and controls

1.5.2 Risk ratings and materiality

Compliance and risk ratings

Audit findings are categorised as follows:

Table 9: Compliance and risk ratings

Compliance rating	Risk Rating
1: Instances of non-compliance with the WEM Rules	Critical: Potential for catastrophic impact on market or system operations or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level.
2: Findings that are not an instance of non-compliance, but pose compliance risk	Significant: Potential for major impact on market or system operations or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings.
3: Findings related to minor housekeeping issues that do not affect compliance risk	Medium: Potential for moderate impact on market or system operations or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring.
	Low: Potential for minor impact on market or system operations or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

Risk rating descriptors for audit findings were set in consultation with AEMO and are based on AEMO’s corporate risk matrix. Please refer to Section 15.1 for more information on compliance and risk ratings.

Materiality (qualification of audit opinion)

In determining whether to qualify our opinion on whether AEMO has complied “in all material respects”, we have taken the following factors into account:

- Purpose and objectives of the market audit
- AEMO’s overall objectives
- AEMO’s risk matrix definitions of impact
- Financial impacts on Market Participants
- The number of Market Participants or other stakeholders affected
- The impact of an issue on market objectives such as transparency, equity and efficiency
- Whether or not an issue is systemic
- Whether or not an issue is recurring (from previous audits).

1.5.3 Audit activities

We have undertaken a combination of:

- Reviewing self-reported incidents of AEMO non-compliance with the WEM Rules and Market Procedures
- Business process walkthroughs and interviews with staff to audit the application of operating controls and to determine the level of compliance risk associated with selected business processes
- Reviewing AEMO's Market Procedures, Internal Procedures⁵ and IT Procedures to ensure WEM Rules changes and other changes (e.g. processes, systems, etc.) have been reflected in the procedures
- Compliance testing to audit AEMO's operational compliance with the WEM Rules and Market Procedures and to determine the effectiveness of operating controls. In doing so, we have sourced information from all AEMO (WA) teams, with a particular emphasis on the Market Operations team.

The first two activities were conducted as part of two field-visits (one undertaken in March 2017 and the other in June 2017). Remaining activities have been undertaken remotely.

Compliance testing and business process walkthroughs were focussed on subset of functional areas based on residual compliance risk, materiality, and rule changes occurring in the Audit Period. These areas include:

- Market Operations:
 - Verification, billing and invoicing procedures for initial NSTEM settlement
 - Daily market operations procedures relating to operating the STEM and Balancing Markets
 - Capacity certification approval procedures
 - End to end credit limit reviews
 - Electricity Statement of Opportunities (ESOO) report preparation
 - Publication and review of Loss Factors
 - Calculation and publication of WEM budget and market fees (considering recent changes in fee categories).
- System Management Market Operations
 - Reviewing, assessing and incorporating standing data changes

⁵ We have reviewed draft versions of Internal Procedures that had not been formally approved as at the time of the review.

- Manual preparation of settlement input data and other market data (and in particular, market data preparation and publication obligations that were previously split between AEMO and System Management)
- System Management and Synergy meetings under clause 7.6A of the WEM Rules.
- System Management System Operations
 - Dispatch, including control room operations, operational load forecasting, manual generation constraints and Dispatch Advisories.
- System Operations Planning
 - ST and MT PASA
 - Synergy Dispatch plan.
- Review of general IT controls:
 - Business continuity
 - Service management
 - User-facing information security policies and procedures
 - System Management software processes and procedures.

1.5.4 Inherent limitations

As in previous years, we note that there are limitations to any external audit. Audits are not an absolute guarantee of the truth or reliability of agency information or the effectiveness of internal controls. They may not identify all matters of significance. This is because external audit techniques involve:

- Professional judgement as to “good industry and market operational practice”
- The use of sample testing
- An assessment of the effectiveness of internal control structures and
- An assessment of risk.

A market audit does not guarantee every procedure and action carried out in the operation of the electricity market in the audit report, nor does it examine all evidence and every transaction. However, our audit procedures should identify errors or omissions significant enough to adversely affect market outcomes.

Our opinion with respect to AEMO’s compliance with the WEM Rules and Market Procedures is therefore subject to the following caveats:

- Our audit procedures did not include assessing irregularities such as fraudulent or illegal activities. As such, our audit should not be relied upon to disclose such irregularities. However, in the event that we were to detect any fraudulent or illegal activity, we would report this to AEMO. No such findings have been made during this audit.
- Our audit is not designed to detect all weaknesses in control procedures as it is not performed continuously throughout the Audit Period and is performed on a sample basis.

1.6 STRUCTURE OF THIS REPORT

The remainder of this report is structured as follows:

- Chapters 2 to 13 present our audit findings relating to the Compliance Assessment and Procedures Assessment work streams on an WEM Rule chapter by chapter basis.
- Chapter 14 presents findings relating to the Software Compliance and general IT Controls work streams.

1.7 ACKNOWLEDGMENTS

RBP would like to thank managers and staff from AEMO and Western Power who willingly provided information and shared in discussions with us while we carried out this audit.

2 WEM RULES CHAPTER 1 - INTRODUCTION

WEM Rules Chapter 1 sets out the Introduction to the WEM Rules and covers areas such as the objectives of the market, conventions and transitional arrangements.

2.1 RULE AMENDMENTS

There have been transitional changes to Chapter 1 of the WEM Rules to reflect reallocation of obligations across AEMO, the Independent Market Operator (IMO) and the Economic Regulation Authority (ERA).

2.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 1 of the WEM Rules in all material respects.

2.3 COMPLIANCE WITH CHAPTER 1

We have not conducted any audit procedures to assess AEMO's compliance with Chapter 1 of the WEM Rules.

There have been no self-reported instances of non-compliance with Chapter 1 of the WEM Rules.

3 WEM RULES CHAPTER 2 - ADMINISTRATION

Chapter 2 of the WEM Rules sets out obligations relating to Functions and Governance; Market Documents; Monitoring, Enforcement and Audit; Reviewable Decisions and Disputes; Market Consultation; Budgets and Fees; Maximum and Minimum Prices and Loss Factors; Participation and Registration; Communications and Systems Requirements; Prudential Requirements and Emergency Powers.

3.1 RULE AMENDMENTS

Amendments to Chapter 2 reflect both transitional changes and changes to Demand Side Program (DSP) registration:

- Transitional changes such as:
 - Changes to clauses that previously referenced System Management have been amended to reflect AEMO as the obligated entity (given the transfer of System Management functions to AEMO)
 - Changes to reflect the amended processes for market rule and procedure changes including reallocation of tasks between the ERA, IMO, AEMO and the Rule Change Panel
 - Changes to reflect reallocation of market monitoring tasks between the ERA and AEMO.
 - Changes to market fee structure to take into account the above transitional changes.
- Changes to registration of Associated Loads to a DSP.

3.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 2 of the WEM Rules in all material respects.

3.2.1 Market Procedures (including the PSOP)

AEMO's Market Procedures are compliant with Chapter 2 of the WEM Rules. This includes a new PSOP section under 2.28.3A covering information to be provided by networks (IMS Interface Market Procedure - Network Operators and AEMO).

We have noted two issues that are not instances of non-compliance:

- All PSOPs need to be updated to reflect the transfer of functions from the IMO and Western Power, to AEMO, ERA and the Rule Change Panel. This is not a breach as clause 1.19.3 provides for transitional roles of the IMO, ERA and AEMO. This applies to all rule chapters, not just chapter 2.
- We have noted a small number of obligations that are not documented in Market Procedures.

3.2.2 Internal Procedures

As noted in previous years, many of SM’s business processes are undocumented. This includes all areas except Market Operations, affecting obligations including outage planning and approval, setting ancillary services requirements, commissioning tests, dispatch, and power system security. Network outage scheduling and approval processes (undertaken by Western Power staff under formal delegation) are likewise undocumented. This results in inconsistent processes - for example different controllers have different approaches to assessing on the day opportunistic maintenance requests. Some existing procedures need to be updated. This applies to all rule chapters, not just chapter 2.

AEMO’s non-SM procedures have not been updated to reflect a small number of AEMO obligations (relating to fees, participant compliance monitoring and rule and procedure changes).

Except for the issues noted above, AEMO’s Internal Procedures are compliant with the WEM Rules.

We have additionally noted a small number of obligations that are undocumented.

3.2.3 Compliance of AEMO’s procedures with the WEM Rules

Audit findings related to the compliance of AEMO’s procedures are summarised below:

Table 10: Findings associated with AEMO’s internal procedures

Ref	Finding	Risk & Compliance Rating	Recommendation
17WEM2.05	Many of SM’s business processes are undocumented. This includes all areas except Market Operations, affecting obligations including outage planning and approval, setting ancillary services requirements, commissioning tests, dispatch, and power system security.	Significant Level 2	Develop and maintain procedure documentation for all business processes. We recommend using collaboration tools as well as MS word or pdf documents. For example, SM could take a similar approach to the CBD office, using Confluence for collaborating on work instructions and recording work done.

Ref	Finding	Risk & Compliance Rating	Recommendation
	Network outage scheduling and approval processes (undertaken by Western Power staff under formal delegation) are likewise undocumented. This results in inconsistent processes - for example different controllers have different approaches to assessing on the day opportunistic maintenance requests. Further, some existing procedures need to be updated.		Add Temperature deration update process to market operations procedure document Update market operations procedure documents for new AEMO email accounts, and removal of references to retired tools such as the Generator trip log.
17WEM2.23	All PSOPs need to be updated to reflect the transfer of functions from the IMO and Western Power, to AEMO, ERA and the Rule Change Panel.	Low Level 2	Update PSOP to reflect the various organisational changes, including publication obligations
17WEM2.24	A small number of obligations are not documented in Market Procedures	Low Level 3	AEMO should update the relevant Market Procedures to include the omissions next time there is a Procedure Change Proposal progressed for the relevant Market Procedure
17WEM2.25	In a small number of instances, AEMO's Internal Procedures have not been updated to reflect the transfer of functions from IMO to ERA and SM to AEMO. There are also a small number of undocumented obligations.	Low Level 3	AEMO should update the relevant Internal Procedures to pick up gaps and transitional rule changes

3.3 OPERATIONAL COMPLIANCE WITH CHAPTER 2

3.3.1 Audit activities

- We have conducted (retrospective) business process walkthroughs to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls in the following areas:
 - Determination and publication of AEMO budget (clause 2.22A of the WEM Rules)

- Determination and publication of market fees (clause 2.24 of the WEM Rules).
- We have conducted compliance testing on a sample of end-to-end Credit Limit reviews to ensure credit limits have been calculated and notified in accordance with the WEM Rules and Prudential Requirements Market Procedure.
- We reviewed AEMO's compliance with the requirement to publish system operations delegations on the Market Website under clause 2.2.4 of the WEM Rules.
- We reviewed AEMO's execution and publication of tolerance reviews under clauses 2.13.6D and 2.13.6E of the WEM Rules.
- We conducted process walkthrough and compliance testing on AEMO System Management's processes for reviewing, assessing and incorporating standing data changes.

3.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 2 of the WEM Rules are summarised in the table below.

Table 11: Operational compliance findings associated with Chapter 2 of the WEM Rules

Ref	Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.01	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation WEM 2.22A.5</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Failure to publish historical financial report. The WEM Rules require AEMO to publish by 30 October a historical financial report comparing actuals to budgeted amounts. AEMO failed to publish the WEM Financial Report for the 2015/16 financial year on 30 October 2016 due to an oversight.</p> <p>AEMO has now published the 2015/16 historical financial report and has implemented calendar reminders or other alerts to ensure the breach does not recur</p>	<p>AEMO's Internal Procedures should be updated to document this obligation as it is currently undocumented.</p>
17 WEM 2.36	<p>Issue Type AEMO Self-reported non-compliance (New issue)</p> <p>Obligation Procedure Administration, Section 2.5.1</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Failure to notify MAC of Procedure Change Proposal publication. Section 2.5.1 of the Procedure Administration Market Procedure requires AEMO to notify the Market Advisory Committee (MAC) within one business day of publishing a Procedure Change Proposal. AEMO published Procedure Change Proposal AEPC_2017_04 (relating to Market Procedure: Certification of Reserve Capacity) on 27 June 2017 but did not notify MAC on 28 June 2017; MAC was notified on 30 June 2017. The Market Procedure and Rule change process was previously administered by the Market Development team which was disestablished in 2016. Procedure and rule change activities are now decentralized, and as indicated above, undocumented. Similar</p>	<p>We recommend AEMO:</p> <p>Include checklists that cover change process deadlines, notification and publication requirements.</p>

			instances of non-compliance are therefore possible. However, we note that such breaches would have minimal/negligible market impact.	
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4 WEM RULES CHAPTER 3 – POWER SYSTEM SECURITY AND RELIABILITY

Chapter 3 of the WEM Rules sets out obligations relating to Power System Security and Reliability; Ancillary Services; Medium and Short-Term Planning; Commissioning Tests; Decommitment and Reserve Capacity Obligations; and Settlement Data relating to power system operation.

4.1 RULE AMENDMENTS

Amendments to Chapter 3 of the WEM Rules include:

- Transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.
- Minor cosmetic changes to clarify rule intent.
- Changes to reflect interim arrangements for constrained grid access.

4.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 3 of the WEM Rules in all material respects. Please refer to Table 10 for audit findings relating to AEMO's procedures.

4.3 OPERATIONAL COMPLIANCE WITH CHAPTER 3

4.3.1 Audit activities

- We have conducted business process observation and walkthroughs to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls in the following areas:
 - Preparation of MT-PASA (clause 3.16 of the WEM Rules).
 - Preparation of ST PASA (clause 3.17 of the WEM Rules).

- Outage acceptance and approval (clauses 3.18 and 3.19 of the WEM Rules).
- Manual preparation of settlement input data and other market data.
- We have conducted compliance testing on:
 - Content and timing of MT-PASA.
 - Content and timing of ST PASA.
 - Manual preparation of settlement input data and other market data.

4.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 3 of the WEM Rules are summarised in the table below.

Table 12: Operational compliance findings associated with Chapter 3 of the WEM Rules

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.03	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation 3.18.2(b)</p>	<p>Risk Rating Medium</p> <p>Compliance Rating 1</p>	<p>AEMO has not published an updated equipment list. Clause 3.18.2(b) of the WEM Rules requires System Management to publish any updates to the equipment list. Between 27 Aug 2014 and July 2017, new generators and network components were commissioned but the list was not updated and republished until 21 July 2017.</p> <p>Further, Outages PSOP section 3.1.5 requires System Management to review the list every 6 months. We have not seen any evidence that this timing requirement was met in the Audit Period.</p>	<p>Schedule twice annual reviews in organisational calendar</p>
17 WEM 2.04	<p>Issue Type RBP reported non-compliance (Recurring issue)</p> <p>Obligation 3.18.11(a)</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>AEMO does not take Demand Side Management (DSM) availability into account when assessing outages. Clauses 3.18.11 and 3.19.6 of the WEM Rules require System Management to take into account a reasonable estimate of available DSM when approving outages. When approving outages, System Management does not take available DSM into account, assuming zero availability. In our view, this is not a reasonable forecast of total available demand side management'. This treatment arises from the difficulty of using DSM in practice - DSM may only be dispatched as a last resort, requires a four-hour notice period, and would typically only be dispatched in summer. Most facilities schedule long-duration outages in the off-peak/shoulder months.</p>	<p>Review costs/risks/benefits of incorporating DSM availability into outage assessment. If inclusion is decided against, consider proposing a rule change to remediate.</p>

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>Because the market has significant overcapacity, the omission of DSM as part of the outage approval process is unlikely to result in different outage decisions, and we have seen no evidence that any outage decision would have been different if DSM were accounted for. Therefore, this breach is likely to have negligible impact on market outcomes. Nevertheless, with recent rule changes to make DSM treatment more comparable to generation, it is more usable, and there is potential for outage decisions to be affected in future.</p>	
<p>17 WEM 2.06</p>	<p>Issue Type (Recurring issue) Obligation 3.17.9(f)</p>	<p>Risk Rating Low Compliance Rating 2</p>	<p>Manual process to include transmission outages and potential constraints for MT and ST PASA reports poses risks of omission and errors. Clause 3.17.9(f) of the WEM Rules requires System Management to include information about transmission outages and potential constraints in the ST PASA report. System Management retrieves outages from the Network Operator Interface, and manually checks them against the Equipment List (as network outages are entered using a free text field, and Western Power Networks personnel sometimes use different labels to identify transmission equipment). Identification of generators affected by transmission outages is ad-hoc, and may not reflect potential consequential outages.</p> <p>System Management is dependent on the integrity of information provided by participants. Furthermore, the manual processing of transmission outages has some risk of omissions and errors.</p> <p>We note that System Management is currently in the process of taking over the outage management system for network operations, and this may provide an opportunity to reduce potential for manual error, by, for example removing free text fields and standardising equipment labelling nomenclature.</p>	<p>Following transfer of network outage management functions from Western Power to AEMO, review internal network outage process and identify ways to reduce manual error.</p>

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.16	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation 3.17.1</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>System Management does not publish updates to the ST PASA when material changes occur. Clause 3.17.1(b) of the WEM Rules requires System Management to update and publish the ST PASA if changes occur that would materially affect market outcomes during the first week of the ST PASA. No updates have been published in the Audit Period. A version of the ST PASA spreadsheet tool is also used by System Operations Planning Engineers in outage assessment, using automatically refreshed data, but these updates are not published to the market.</p> <p>Most of the information in the ST PASA is available to Market Participants, but transmission outages, and 1st and 2nd standard deviation load forecasts are not available except in the PASA.</p>	<p>Following transfer of network outage planning function to AEMO, review usefulness of PASA information to participants, refine reports to provide match with what participants need and investigate automatic publication.</p> <p>In the meantime, continue with current ST PASA publication approach.</p>
17 WEM 2.17	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation 3.16.9(f), 3.17.9(f)</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>System Management does not publish transmission constraint information in PASA. Clauses 3.16.9(f) and 3.17.9(f) of the WEM Rules require System Management to publish forecast transmission capacity between potentially constrained regions under normal conditions (and for MT PASA, some contingencies). The PASA reports have placeholder fields for this information, but they are not populated, and have never been. In some situations, it would be reasonable to expect this information to be provided, such as when transmission to the Goldfields or North Country is constrained or those regions will potentially be islanded. Given that these fields have never been populated, it is difficult to say that there has been any great impact.</p>	<p>Medium term: Review usefulness of PASA information to participants, refine reports to provide better match with what participants need, investigate automatic publication.</p>
17 WEM 2.19	<p>Issue Type RBP reported non-compliance (New issue)</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Ancillary Service Report not published on AEMO website by 1 July.</p> <p>Clause 3.11.13 of the WEM Rules requires AEMO to publish the annual ancillary service report by 1 July 2017. AEMO did not publish the report until 3 July 2017, and it was approved by ERA on 7 July 2017.</p>	<p>Schedule publication in organisational calendar</p> <p>Allow more time for internal review in submission timetable.</p>

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
	Obligation 3.11.13		<p>We also note that clause 3.11.11 of the WEM Rules requires AEMO to submit the annual ancillary service report to ERA by 1 June 2017. While AEMO initially submitted the report on 31 May 2017, it resubmitted an updated version on 2 June 2017. Changes were to commentary only, and did not affect the core figures reported or planned for.</p>	
17 WEM 2.42	Issue Type (Recurring issue) Obligation Ch 3	Risk Rating Medium Compliance Rating 2	<p>Market operations data preparation processes are heavily manual. Much of System Management's data preparation process is manual, though generally well-documented in the System Management daily and weekly operations Internal Procedures. Given the manual nature of the processes, it is inevitable that from time to time errors and oversights will occur. We noted instances where System Management data preparation activities could be improved. Specifically:</p> <ul style="list-style-type: none"> • One of the check formulae in the ST PASA preparation sheet has replaced with a hardcoded value of '0', which means it would not pick up an issue. • When adjusting outage amounts for RCOQ, the analyst must manually change the values for intermittent generators, because RCOQ is 0 for these facilities. • Updates to temperature derating data are manually calculated and entered into the database. There is no history kept on this table, so identifying unintended changes is difficult • Network Operator Interface queries are based on Calendar Days, not Trading Days • Calendar reminders and notifications for activity deadlines are not centralised. Individual analysts must create and maintain their own reminders, resulting in omissions, duplications and inconsistencies. • Non-compliance notifications are manually edited in the database. 	<ul style="list-style-type: none"> • Assess opportunities for automating to reduce manual effort and reduce errors. In particular, consider automating: <ul style="list-style-type: none"> ◆ preparation of the ancillary service activation quantities and ◆ calculation of outage quantities for intermittent generators. • Lock key spreadsheet tools and add to source control • Implement timestamping on manually amended database tables • Long term: Introduce MOSMI alerts for System Management market operations activities • Medium term: Centralise management of activity reminders and deadline notifications, for example in a shared calendar.t

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.47	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation 3.12.1</p>	<p>Risk Rating Medium</p> <p>Compliance Rating 1</p>	<p>Insufficient Spinning Reserve activated. Clause 3.12.1 of the WEM Rules requires System Management to schedule and dispatch facilities to meet the Ancillary Service Requirements in each Trading Interval. Clause 3.10.2 of the WEM Rules defines the standard for Spinning Reserve to be the greater of 70% of total output of the unit with the largest current injection, or the maximum load ramp expected over a period of 15 minutes. The amount of Spinning Reserve available includes the quantities utilised to meet the load following requirement. The standard can be relaxed by 12% where the shortfall is expected to last less than 30 minutes.</p> <p>On 12 June 2017, two Trading Intervals had Spinning Reserve activation less than the relaxed requirement:</p> <ul style="list-style-type: none"> Trading Interval 14-2, where the requirement was 170.352 (could be relaxed to 149.9) and the average available Spinning Reserve was 147.4. Trading Interval 15-2, where the requirement was 213.0 (could be relaxed to 187.5) and the average available Spinning Reserve was 169.8. <p>Another two intervals were higher than the relaxed requirement, but lower than the full requirement. If the contingency were to occur in that period, system stability would be at risk.</p> <p>All these periods occurred in mid to late afternoon, where distributed solar PV injection is high, load is increasing as the evening ramp begins, and baseload thermal generation is ramping up again after having been backed off through the middle of the day. These dynamics make it difficult to manage load following and Spinning Reserve availability, and are likely to continue worsen in the short to medium term.</p> <p>We note that provisioning additional Spinning Reserve comes at a cost, and that the activation of Spinning Reserve is a manual task. As such, the potential</p>	<ul style="list-style-type: none"> Ensure ancillary service dispatch is considered in planning for evolution of System Management IT systems. Monitor ancillary service provision to identify any trend towards greater volatility of requirement or activation.

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>for such non-compliance will remain until AEMO can introduce new or changed systems to automatically adjust Spinning Reserve quantities.</p> <p>There is a similar general issue with Load Rejection Reserve (LRR), but we have not observed any particular instance of non-compliance in relation to LRR.</p>	
17 WEM 2.49	<p>Issue Type AEMO Self-reported non-compliance (New issue)</p> <p>Obligation 3.19.14</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Not following the PSOP in approving Day Ahead Opportunistic maintenance. Section 10.2.4 of the PSOP: Facility Outages requires System Management to not approve a request for Opportunistic Maintenance application made between 3:30pm on the day prior to the Scheduling Day and 6am on the Scheduling Day, after 12pm on the Scheduling Day.</p> <p>On 25 May 2017, System Management approved Day Ahead Opportunistic Maintenance request at 5.29pm. There was no impact on the market or on power system security. As we have noted in past audits, the rules and processes around opportunistic maintenance are overly prescriptive around timing of requests and approvals.</p>	No recommendations
17 WEM 2.51	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation 2.34.14(b), 3.21.6(a)</p>	<p>Risk Rating Medium</p> <p>Compliance Rating 1</p>	<p>Not using latest temperature dependence ratio provided under Standing Data to calculate facility outage quantities. Clause 3.21.6(a) of the WEM Rules requires System Management to convert outage data to a sent-out basis at 41 degrees Celsius. To do so, System Management uses temperature derating curves supplied by Market Participants under Appendix 1(b)iv of the WEM Rules, as part of their standing data. For 12 of 49 facilities, System Management was not using the facility derating coefficient provided in the most recent temperature derate curve provided by the facility. This means that the outage values calculated by System Management have been incorrect for these facilities, possibly for some time.</p>	<ul style="list-style-type: none"> Clarify to Market Participants (including updating the PSOP) the relationship between Appendix 1(b)iii and 1(b)iv of the WEM Rules. Request that all Market Participants update their Appendix 1(b)iii values to be at 15 degrees Celsius OR change outage calculations to assume 41 degrees and ask participants to submit on that basis. Request that Market Participants responsible for the 9 facilities who

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>This is also non-compliant with clause 2.34.14(b) of the WEM Rules, which requires AEMO to commence using this kind of revised Standing Data as soon as practicable.</p> <p>System Management also uses the maximum facility capacity provided for each facility under Appendix 1(b)iii of the WEM Rules in outage calculations, and assumes that it is a 15 degree value. For some facilities, this capacity matches the 15 degree figure in the temperature derate curve supplied under Appendix 1(b)iv, but for 23 facilities it does not. It is not clear that Market Participants understand the relationship between the Appendix 1(b)iii capacity and the 1(b)iv data, and how it is used, and the use of the Appendix 1(b)iii figure as a 15 degree figure is not explicitly noted in the rules or Market Procedure: Facility Registration, De-Registration and Transfer.</p> <p>We note another 9 facilities who have no temperature derate curve lodged with AEMO, though all have temperature deration coefficients.</p> <p>AEMO updated all temperature deration coefficients to match the latest curve data provided by Market Participants as part of the release of WEMS3.21 on 3 August 2017.</p>	<p>have not supplied a temperature deration curve supply one.</p> <ul style="list-style-type: none"> Review process for incorporating derate curves, including explicit instructions in Internal Procedure documentation.

5 WEM RULES CHAPTER 4 – RESERVE CAPACITY RULES

Chapter 4 of the WEM Rules sets out the Reserve Capacity Rules, including: Expressions of Interest; LT PASA; Certification of Capacity; Auctions and Bilateral Trades; Capacity Credits; Special Price Arrangements; Shortages of Reserve Capacity; Testing, Monitoring and Compliance; Funding; Capacity Refunds; Early Certification; and Settlement Data.

5.1 RULE AMENDMENTS

Amendments to Chapter 4 of the WEM Rules include:

- Transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.
- Correction of manifest errors relating to the assignment of Capacity Credits (under clause 4.20.5B of the WEM Rules) and the publication of provisional and final versions of the IRCR peak intervals and Existing Facility Load for Scheduled Generation under Appendix 9 of the WEM Rules.
- Changes to reflect interim arrangements for constrained grid access.

5.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 4 of the WEM Rules in all material respects. Please refer to Table 10 for audit findings relating to AEMO's procedures.

5.3 OPERATIONAL COMPLIANCE WITH CHAPTER 4

5.3.1 Audit activities

We have:

- Reviewed self-reported instances of non-compliance with Chapter 4 of the WEM Rules.

- Conducted sample testing of certification process outputs (for the 2015 Reserve Capacity Cycle conducted in August 2016) to determine compliance with clause 4.11.1 of the WEM Rules.
- Conducted a (retrospective) business process walkthroughs to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls in the following areas:
 - Certification activities for the 2015 Reserve Capacity Cycle (conducted in August 2016)
 - Preparation and publication of the Electricity Statement of Opportunities Report.

5.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 4 of the WEM Rules are summarised in the table below.

Table 13: Operational compliance findings associated with Chapter 4 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.02	Issue Type (New issue) Obligation N/A	Risk Rating Low Compliance Rating 2	ESOO Data Register validation controls are undocumented. AEMO staff undertake a range of validation processes to ensure the data registers used in the ESOO processes are correct. This includes historical comparisons, checking for manifest errors as well as verification by senior analysts. During site visits we noted these validation procedures were not documented in the ESOO procedures. AEMO has since documented validation procedures in the ESOO Internal Procedure.	No recommendations – AEMO has addressed this finding.
17 WEM 2.26	Issue Type Out of period finding reported in last audit Obligation 4.11.1(bA) 4.11.1(bB)	Risk Rating Medium Compliance Rating 1	Allocation of Certified Reserve Capacity (CRC) to facilities that did not meet WEM Rules criteria. Clause 4.11.1 of the WEM Rules sets out the principles to which AEMO must adhere when setting Certified Reserve Capacity, including: <ul style="list-style-type: none"> • Clause 4.11.1(bA) – that CRC must not exceed the unconstrained level of network access held by the facility, as shown in the evidence provided in the facility’s application for CRC. • Clause 4.11.1(bB) – that where two facilities share a Declared Sent Out Capacity (DSOC), the total CRC assigned to both must not exceed the shared DSOC. Some aspects of the capacity assessment process provide for AEMO to set the CRC not exceeding ‘AEMO’s reasonable expectation’ of the amount of capacity	As these were conscious breaches, AEMO should reiterate to staff and management the requirement to follow the documented certification procedure which is compliant with the WEM Rules.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>likely to be available, or not exceeding 'the capacity that AEMO believes' a facility can usefully contribute. Clause 4.11.1(bA) states only that CRC must not exceed the level of unconstrained network capacity already held and evidenced by the Market Participant, and does not provide for discretion. Clause 4.11.1(bB) does not provide for discretion either.</p> <p>In August 2016, AEMO set CRC higher than the level of unconstrained network access held (and evidenced) in relation to one facility, and for two facilities, set the total CRC higher than the shared DSOC.</p> <p>In the first case, the facility was yet to start construction, had not completed the network access process, and provided evidence of its ongoing negotiations to get a network access arrangement, including a draft proposal at an advanced stage of negotiation. AEMO certified the facility on the basis that its final access arrangement would be the same as the draft arrangement provided.</p> <p>In the second case, the facilities were already in service, already held capacity credits, and were applying for an increase in the amount of CRC for its facility. The access arrangement included DSOC sufficient for the combined level of CRC currently held, but not enough to cover the additional amount requested. Both facilities had demonstrated their ability to run at the higher output level, and the participant provided evidence of an application to increase its level of unconstrained network access. AEMO certified the facilities on the basis that this application would be approved.</p> <p>In the first case, there was no direct market impact, as the facility subsequently failed to provide the necessary evidence to move from 'proposed' to 'committed' status, and was therefore unable to trade capacity credits. In the second case, the additional CRC is likely to be worth around \$1.2M in additional capacity payments to that Market Participant, although forthcoming changes to the</p>	

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			Reserve Capacity rules may change this figure. This amount would otherwise have been retained by other Market Participants, and the amount involved makes this a material finding. If the Market Participant is not able to operate at the required level, the additional payments can be recovered.	
17 WEM 2.27	<p>Issue Type Out of period finding reported in last audit</p> <p>Obligation 4.28.11 Appendix 5, Step 6</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Incorrect calculation of IRCR due to software bug. Clause 4.28.11 of the WEM Rules requires AEMO to determine and publish updated Individual Reserve Capacity Requirements according to Appendix 5 of the WEM Rules.</p> <p>In July 2016, AEMO incorrectly calculated the IRCR related to one Intermittent load (IL) facility.</p> <p>Due to a software bug, AEMO's systems did not correctly account for the transfer of intermittent load facilities between participants where the IL facility had both intermittent and temperature dependent load (TDL) components. The transfer of both components based on the same time period, rather than having TDL component transferred 3 months later. In this case, the rules appear to be at fault, not contemplating this scenario, leading to an unintended outcome of requiring the transferring participant to remain liable for the TDL component of an IL for some time after the transfer has been effected.</p> <p>This is the first time such a transfer has occurred, and the impact totalled several hundred thousand dollars. The issue was fixed for the next IRCR calculation.</p>	No recommendations as AEMO has addressed this finding through a system fix.
17 WEM 2.28	<p>Issue Type AEMO Self-reported non-compliance (New issue)</p>	<p>Risk Rating Medium</p> <p>Compliance Rating 1</p>	<p>Incorrect calculation of Relevant Level and assigned CRC level due to manual error (and consequential technical breach in calculating Monthly Reserve Capacity Price). Clause 4.11.2(b) of the WEM Rules requires AEMO to use the Relevant Level calculation to determine CRC if that approach has been nominated by a Market Participant under clause 4.10.1(i) of the WEM Rules. On 6</p>	No recommendations as AEMO has addressed this finding.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	<p>Obligation 4.11.2; 4.14.9 - Calculation of Relevant Level 4.1.12, 4.1.15A - Publication of Capacity Credit assignment results 4.29.1(b) – Calculation of Monthly Reserve Capacity Price</p>		<p>September 2016 AEMO published CRC and quantity of Capacity Credits assigned to facilities for the 2015/16 Reserve Capacity Cycle; this included non-scheduled generators whose CRC had been calculated using the Relevant Level Methodology. On 9 September 2016, an AEMO staff member identified a potential error in the relevant level calculation which had occurred as a result of incorrect data manipulations. We have noted in our previous certifications of this tool that it is highly error prone and unwieldy. We further note that AEMO did have mitigation measures in place to prevent such errors (including detailed work instructions and validation and verification by two staff members). In this instance, the error was repeated by both staff members and affected eight non-scheduled generators. This error is a potential breach of clauses 4.11.2(b) and 4.14.9(b) of the WEM Rules.</p> <p>Once the error was identified, AEMO corrected the calculations which RBP staff verified as being accurate and compliant with the WEM Rules. The correct capacity credit assignments were republished; the republication is a potential breach of clauses 4.1.12 and 4.1.15A of the WEM Rules but one that AEMO has consciously taken as allowing the incorrect CRC calculations to remain would have been inconsistent with market objectives.</p> <p>If the error had not been corrected then the financial impact on the eight affected generators would have been to the order of \$1M per year for five years. However, as AEMO corrected the error, there was no financial impact. The Relevant Level Calculation Tool is in the process of being systematised as part of the RCM system changes; this will reduce significantly the potential for similar errors in the future. For this reason, we have deemed this to be a medium risk (not a significant one).</p>	

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			A consequential technical breach of clause 4.29.1(b) of the WEM Rules also occurred as a result of the breach above. Particularly, clause 4.29.1(b) requires the Monthly Reserve Capacity Price to be calculated using the originally published values (which were incorrect in this case). AEMO calculated the Monthly Reserve Capacity Price using the corrected Relevant Level values and therefore technically breached the WEM Rules; however, AEMO's actions were compliant with the intent of the WEM Rules.	
17 WEM 2.29	Issue Type AEMO Self-reported non-compliance (New issue) Obligation 4.5.14B	Risk Rating Low Compliance Rating 1	Delay in publication of Market Procedure for Expected DSM Dispatch Quantity and DSM Activation Price. Clause 4.5.14B of the WEM Rules requires AEMO to publish an Market Procedure setting out the methodology for the DSM Activation Price and Expected DSM Dispatch Quantity by 31 December 2016. Although a draft was completed, the consultation process means that the procedure was not approved and published by the required deadline. This is a minor issue with limited market impact as the WEM Rules provide default values for the DSM Activation Price and Expected DSM Dispatch Quantity until the Market Procedure is published. AEMO published the finalized procedure on 9 June 2017.	No recommendations – AEMO has published the Market Procedure as at 9 June 2017.
17 WEM 2.30	Issue Type AEMO Self-reported non-compliance (New issue) Obligation 4.26.1A(vii)	Risk Rating Medium Compliance Rating 1	Incorrect Reserve Capacity Refund calculation due to WEMS defect. AEMO calculated the Reserve Capacity Deficit Refund incorrectly for a number of Demand Side Programme (DSPs) between October 2016 and February 2017 due to a defect in WEMS that meant that the MinLoad quantity (which is used to calculate the Reserve Capacity Deficit Refund for DSPs and is the sum of minimum load quantities corresponding to the DSPs' Associated Loads) were not updating correctly. As a result of this defect one Market Participant was overcharged for Reserve Capacity Deficit Refund amounts while three Market	No recommendations – AEMO has fixed the software defect and is addressing the settlement errors through adjustments.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			Participants were undercharged. AEMO has since rectified this defect and will reverse the effect of these errors in upcoming settlement adjustments.	

6 WEM RULES CHAPTER 5 – NETWORK CONTROL SERVICES

Chapter 5 of the WEM Rules sets out obligations relating to Network Control Services, including the process, and settlement data requirements.

There are currently no contracts for network control services. Therefore, AEMO has no active obligations under Chapter 5 of the WEM Rules.

Our audit therefore excludes any review of AEMO's compliance with Chapter 5 of the WEM Rules.

7 WEM RULES CHAPTER 6 – THE ENERGY MARKET

Chapter 6 of the WEM Rules sets out obligations relating to the Energy Scheduling Timetable and Process; the Short-Term Energy Market; Non-Balancing Dispatch Merit Orders; Balancing Prices and Quantities; Market Advisories and Energy Price Limits; and Settlement Data.

7.1 RULE AMENDMENTS

Amendments to Chapter 6 of the WEM Rules include only transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.

7.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 6 of the WEM Rules in all material respects. Please refer to Table 10 for audit findings relating to AEMO's procedures.

7.3 OPERATIONAL COMPLIANCE WITH CHAPTER 6

7.3.1 Audit activities

- We conducted a (real-time) business process walkthrough to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls when conducting the daily market operations shift covering AEMO's obligations under Chapter 6 of the WEM Rules (bilateral submissions, STEM operation and resource plans).
- Reviewed system logs to compliance test whether AEMO opened and closed market windows and published market information in accordance with the requirements set out in Chapter 6 of the WEM Rules.

7.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 6 are summarised in the table below.

Table 14: Operational compliance findings associated with Chapter 6 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.31	Issue Type AEMO Self-reported non-compliance (New issue) Obligation 6.4.6	Risk Rating Low Compliance Rating 1	Delay to STEM Window closing time due to manifest error in the WEM Rules. Clause 6.3B.1 of the WEM Rules enables Market Participants to make STEM submissions between 9 am and 9:50 am. On 6 January 2017, a Market Participant was unable to make a compliant STEM submission due to an error in AEMO's facility limits calculation, which in turn was due to an error in the Ancillary Services calculation made by System Management under clause 7.2.3A of the WEM Rules (see Finding 17WEM2.48). AEMO made the decision to extend the closing of the STEM submission window (under clause 6.4.6 of the WEM Rules) to rectify the issue and to enable the affected participant to make their submission. However, clause 6.4.6 only contemplates the extension of STEM windows due to software failures or delays in preparing load forecasts (clause 7.2.1) or the outage schedule (clause 7.3.4). AEMO has escalated a proposed rule change to the Public Utilities Office to correct the manifest rule error and has delegated authority to the on-duty operator to delay the STEM window (to reduce the extent of the delay attributed to issue escalation). In this case there was no market impact due to the delay.	No recommendations as AEMO has taken appropriate actions to mitigate the risk of breach recurrence and the extent of delay caused by AEMO exercising its right to extend timelines under clause 6.4.6 of the WEM Rules.
17 WEM 2.37	Issue Type (Recurring issue) Obligation	Risk Rating Low Compliance	Rule inconsistency in relation to settlement tolerances raises a risk of incorrect tolerances being used. AEMO can determine Facility Tolerance ranges for all facilities, but the rules only specify that settlement shall use those for Scheduled Generators, with others calculated according to a specific formula.	No recommendations as AEMO has added issue to its rule change backlog

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	6.17.9 Settlement Tolerances	Rating 3	<p>System Management has determined a tolerance range for two of the wind farms (at the Market Participants' request), but there is no provision in the rules to use this in determining the settlement tolerance. As it happens, the determined range is the same as would be calculated in its absence, so there is no effect. However, if in future a different tolerance range is determined for any non-scheduled generator, the correct treatment would be unclear.</p> <p>We understand that AEMO has added this issue to AEMO's rule change backlog.</p>	

8 WEM RULES CHAPTER 7 - DISPATCH

Chapter 7 of the WEM Rules sets out obligations relating to the dispatch process, including: non-balancing dispatch; dispatch compliance; advisories, balancing suspension and reporting; and settlement and monitoring data relating to dispatch.

8.1 RULE AMENDMENTS

Amendments to Chapter 7 of the WEM include only transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.

8.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 7 of the WEM Rules in all material respects. Please refer to Table 6 for audit findings relating to AEMO's procedures.

8.3 OPERATIONAL COMPLIANCE WITH CHAPTER 7

8.3.1 Audit activities

We have conducted business process observation and walkthroughs to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls in the following areas:

- Preparation and provision of information to Synergy, including the Synergy Dispatch Plan.
- Dispatch (control room operations).

We have conducted compliance testing on:

- Content of Synergy Dispatch Plans.
- Content and timing of Dispatch Advisories.
- Agendae and minutes of System Management/Synergy meetings.
- Spinning reserve provision, to compare availability with requirement.
- Operational load forecasts and manual overrides.

- Application and reporting of manual generation constraints.

8.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 7 of the WEM Rules are summarised in the table below.

Table 15: Operational compliance findings associated with Chapter 7 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 1.01	Issue Type (New issue) Obligation Ch 7	Risk Rating Significant Compliance Rating 2	<p>Currency of and support for critical control room tools needs more focus. Documentation and information about RTDE and SOCCUI has been difficult to find, and when found, not current. It took the support team two months to identify a way to allow us to test RTDE. Deployment documentation is minimal. If something were to go wrong with RTDE, it would likely lead to market suspension, and take some time to resolve.</p> <p>During our control room visits, we noted a number of issues with the SOCCUI tool. For example:</p> <ul style="list-style-type: none"> • Changes to facility Ancillary Service capability have not been reflected in SOCCUI, meaning that figures displayed overestimate available reserves and load following. Such a mismatch means that operator may not provision enough Ancillary Services, which could impact system security, and in a major contingency, could lead to load shedding. • The tool has no way to incorporate credible multiple-unit contingencies (e.g. when a single transmission line outage would island a region) when calculating Spinning Reserve requirements. 	<ul style="list-style-type: none"> • Ensure adequate support and development capacity for control room tools. Monitor staffing levels to ensure that knowledge is increased, and to cover key person risk where possible. • Improve mechanism to effectively capture defects and enhancement requests for SOCCUI, including a route for users to contribute on an ongoing basis. • Consider a strategy for control room tools to address known problems with significant risk • Ensure all System Management IT systems are in version control.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<ul style="list-style-type: none"> • New screens have been added to XA21 to make up for some of these shortfalls, creating another tool that must be maintained. • The tool provides no way to constrain the Portfolio, which means that when a portfolio facility has a forced outage, updated dispatch instructions must be calculated manually by the controller. • Weather data in the tool (used to identify similar days for load forecasting purposes) dates back to 2015, and there is no 2016 or 2017 data. This severely hampers controllers' ability to identify similar days - 2015 load profiles are sufficiently different to 2017 that they are not useful. <p>A new version of SOCCUI was deployed in early April, but did not address any of these issues. We understand that this is partially due to historic change requests being lost when Western Power changed service management platforms. None of the issues above are on that list, or indeed any list. Although there are processes in place to identify bugs and enhancements to these tools, they do not appear to be working.</p> <p>IT support levels are specified in a service level agreement with Western Power, which has been agreed on a 'steady state' basis. AEMO has existing work underway to plan for the future support of control room IT tools, given that the current market structure will be in place until at least mid-2019. The first stage of this work, currently underway, is to consider the options for re-siting, remediation, and partial or full replacement. Mitigating this risk will not be a quick process.</p>	

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>We further note that AEMO is working to improve its documentation as part of action items to address the Systems Stability Audit for Western Power systems.</p>	
<p>17 WEM 2.07</p>	<p>Issue Type RBP reported non-compliance (New issue) Obligation 7.6A.2(f)</p>	<p>Risk Rating Low Compliance Rating 1</p>	<p>AEMO does not provide updated Dispatch Plans to Synergy on the Trading Day. Clause 7.6A.2(f) of the WEM Rules requires System Management to notify Synergy of any change in conditions, occurring after 4pm on the Scheduling Day but before the start of the Trading Interval, requiring a significant change in the Dispatch Plan (such as a generator trip or large change in load forecast). In practice, System Management sends three dispatch plans per day - at 3:30pm, 6:30pm, and 7:30am on the Scheduling Day. System Management do not notify Synergy of updates to the Dispatch Plan on the Trading Day, as stated in section 5.7 of the Dispatch PSOP. In practice, this has minimal impact, as the main use of the Dispatch Plan is to estimate Synergy's fuel requirements for the coming Trading Day. In fact, the spreadsheet calculates estimated fuel use, and the forecast fuel requirement is sometimes explicitly stated in System Management's covering email when sending the plan to Synergy. While this is a function of the presence of the Portfolio in the market design, the calculation of fuel requirements would seem to be something that should be calculated by Synergy, rather than provided by the system operator, who does not do this for any other participant.</p> <p>As we have noted in previous years, alternate, automatic mechanisms for providing information to Market Participants (for example regular automated publication of System Management projected dispatch schedules) would remove the requirement for manual effort, and</p>	<ul style="list-style-type: none"> • Review internal definition of 'significant event', and update Dispatch Advisory guidelines to ensure requirements for notifications to Synergy are covered. • Remove Synergy fuel calculations from Dispatch Plan provided to Synergy by System Management.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>provide better information to participants. We recognise that this approach will take some time to develop, will require rule changes, and may be best considered the next time significant market changes are on the cards.</p> <p>At present, AEMO's approach is to notify participants of significant events on the power system through Dispatch Advisories.</p>	
17 WEM 2.08	<p>Issue Type AEMO Self-reported non-compliance (Recurring issue)</p> <p>Obligation 7.6.1C, 7.6.1D</p>	<p>Risk Rating Significant</p> <p>Compliance Rating 1</p>	<p>Not using latest BMO due to IT systems issues. Clauses 7.61C and 7.6.1D of the WEM Rules set out the Dispatch Criteria and the rules around out of merit dispatch. On multiple occasions, IT systems issues resulted in System Management being unable to load the latest BMOs to its systems. During these times, System Management continued to dispatch in accordance with the most recently loaded BMO. The impact of the breach depends on the timing of the outage. When occurring in the early hours of the morning (when generation and load is flat) the system impact would be minor, but at other times (and particularly where the outage extended over several hours) out of merit dispatch is more likely to result. In any case, dispatching from something other than the latest BMO is a breach of Clauses 7.6.1C and 7.6.1D of the WEM Rules and subsequent out of merit dispatch will result in a constraint payment to a participant who would have otherwise not received one.</p> <p>Root causes vary, but most incidents appear to have been caused by an issue in the design of the FTP transfer process, which has now been addressed via an automated workaround. Other causes include:</p>	<ul style="list-style-type: none"> • Investigate backup methods of importing market data into System Management systems. • Ensure plan for future of systems is completed by the end of 2017, so that action can be taken to address this ongoing risk.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<ul style="list-style-type: none"> • A missed maintenance task which caused a PI server synchronisation issue, and subsequent unavailability of data. A new version of PI software has removed the need for the maintenance task. • The inadvertent disabling of a production file transfer account during routine active directory maintenance • A server turned off as part of the Western Power data centre move, which unexpectedly affected market functions, and turned out to be a single point of failure. Redundancy has now been introduced. • A task missed during a data centre failover that left FTP services pointing to the wrong server • Issues with Western Power's ISP. This will be a potential problem as long as AEMO uses the internet to access Western Power systems. <p>Given the recurrence of this issue and the potential financial impact on multiple participants, we have deemed this to be a significant audit finding.</p> <p>As discussed in 17WEM1.01, AEMO has a project underway to consider the future of System Management IT systems. In our view, the risk of managing the current systems with a 'steady state' approach cannot continue until new market changes are introduced, as current market structures will be in place until at least mid-2019.</p>	
17 WEM 2.09	Issue Type RBP reported non-compliance (Recurring issue)	Risk Rating Medium Compliance Rating 1	Late issuance of Dispatch Advisories. Clause 7.11.3 of the WEM Rules requires System Management to send out Dispatch Advisories (in accordance with clause 7.11.5) as soon as practicable after System Management becomes aware of the relevant event. In the sample we have tested, we have noted 9 instances in which System Management	<ul style="list-style-type: none"> • Long term: Investigate alternate mechanisms for providing information to Market Participants, for example regular automated publication of System Management projected dispatch schedules each time RTDE is rerun with

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	<p>Obligation 7.11.3</p>		<p>sent out Dispatch Advisories over an hour late. These are DAs 16615, 16629, 16791, 16868, 16902, 16911, 16960, 16981, 16984.</p> <p>All these Dispatch Advisories related to High Risk Operating State events. As such, it is important for System Management to release such advisories promptly.</p> <p>Eight of these Dispatch Advisories were issued late because the events occurred outside of business hours, requiring Market Operations staff to drive in to the office to prepare and transmit the advisory, as the controllers are not responsible for issuing Dispatch Advisories, and Market Operations do not have remote access to the Dispatch Advisories tool. 2 of these were not issued until the following morning, a gap of more than 9 hours.</p> <p>One Dispatch Advisory was issued late during the business day, because the situation was not communicated from the controller to Market Operations.</p> <p>As in past years, we note that the rules around Dispatch Advisories date from before the in-day balancing market, and are not really fit for purpose in a close-to-real-time market.</p>	<p>new inputs every time RTDE is rerun using new information (e.g. new forecasts, new constraints, or a new BMO).</p> <ul style="list-style-type: none"> • Medium term: Review this issuance of Dispatch Advisories in conjunction with the establishment of the security desk • Short term: Investigate whether Market Operations analysts can have remote access to issue Dispatch Advisories from off-site
<p>17 WEM 2.10</p>	<p>Issue Type (Recurring issue) Obligation Ch 7</p>	<p>Risk Rating Significant Compliance Rating 2</p>	<p>Departure of experienced control room operators poses significant risk to power system security and market dispatch obligations (particularly in light of patchy process documentation in this area). Last year we noted that the departure of all senior control room staff posed a major risk to SWIS operations and AEMO compliance. AEMO has made major progress in recruiting and training new control room operators to replace the departing</p>	<ul style="list-style-type: none"> • Ensure access to experienced control room staff during 2018 bushfire season. • Create and maintain procedure documentation for control room processes.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>senior controllers, and in retaining the services of senior control room staff on contract to mitigate the risk of complete change in personnel.</p> <p>Nevertheless, significant risk remains in that none of the new controllers have experience during a hot season, when there are often multiple instances of High Risk and Emergency Operating State declarations. If the experienced controllers all depart in 2017, then the new recruits will have to manage the control room without veteran experience during the 2018 bushfire season.</p> <p>We further note that while AEMO has developed and delivered training material as part of onboarding the new cohort of controllers, there is still no documented process documentation relating to control room operations.</p>	
17 WEM 2.11	<p>Issue Type (Recurring issue) Obligation Ch 7</p>	<p>Risk Rating Medium Compliance Rating 2</p>	<p>There is room to better align the dispatch process with market objectives around economic efficiency. System Management controllers use Synergy plant to manage LFAS position instead of the marginal plant. Although this may be considered “Dispatch Support Services”, when there is large movement in load during the interval, rerunning RTDE (with an updated load forecast) would lead to a more economically efficient outcome. In this sense, rerunning RTDE more frequently during the Trading Interval (e.g. once every five minutes; at the moment RTDE is run three times during the interval) would yield a more efficient outcome, particularly if the dispatch period was shortened from the current half hour.</p> <p>Also, constraints are manually entered into RTDE and remain in place until the causing issue has been resolved. Sometimes constraints can remain on for hours. This means that if participants change their offers</p>	<p>Investigate feasibility of updating software to recalculate and issue dispatch instructions at 5-minute intervals.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>to avoid being constrained on or off, this change in bidding will not be reflected in market outcomes (as System Management does not conduct a security constrained economic dispatch each interval). This may lead to potential breaches of clauses 7.6.1C and 7.6.1D of the WEM Rules (e.g. if a more expensive plant remains constrained on or a cheaper plant remains constrained off).</p> <p>We also note that on four occasions during the Audit Period (10 Jan 2017, 10 Feb 2017, 12 March 2017, 19 May 2017) System Management has not issued an updated dispatch instruction following facility advice of being unable to comply. In our view, where the decision does not affect the dispatch criteria, and has no effect on power system security, there is no breach of clause 7.10.5(d) of the WEM Rules. Nevertheless, the equivalent quantity would instead be provided by the Synergy Portfolio even if it is not the marginal unit.</p> <p>We understand that the low level of staffing in the control room is a contributing factor to the above practices.</p>	
17 WEM 2.12	Issue Type (Recurring issue) Obligation Ch 7	Risk Rating Medium Compliance Rating 2	<p>Communication protocols between Western Power and AEMO will be required to ensure seamless application of network constraints in dispatch. As noted in previous audits, security assessments used by the controller to place security constraints in RTDE are undertaken by Western Power Network Operations staff (as the single controller cannot both dispatch and undertake the security assessment, particularly during high risk/emergency situations). Likewise, the network aspects of system monitoring required to monitor the system state as defined in clauses 3.3.1, 3.4.1 and 3.5.1 of the WEM Rules (e.g. overloading of transmission lines, voltage issues,</p>	<ul style="list-style-type: none"> • Short term: Develop and agree communication protocol between Western Power Networks and AEMO System Management. • Medium term: Introduce tools and processes (as part of new security desk) to allow AEMO staff to assess and monitor network security including dynamic powerflows

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>circuit issues) are undertaken by Network Operations staff (who then notify the controller).</p> <p>The introduction of a security desk will allow this function to be carried out by AEMO staff, but Western Power staff are likely to continue carrying out these functions for some time yet.</p> <p>As System Management is currently co-located with Western Power Network Operations staff these security related processes can be undertaken with ease. However, when System Management transfers to new premises in late 2017., it will be important to have communication protocols in place to ensure network security constraints and network security status is communicated to System Management staff in a timely and efficient manner.</p> <p>System Management's current network study tool (TSM) does not model some protection schemes, and reports contingency violations on certain circuits all the time. The controller must know that the contingencies at issue are covered by protection schemes not modelled. Also, TSM is only able to do steady state assessments of voltage and thermal constraints. System Management staff are not able to do dynamic studies, increasing the risk of unanticipated consequences of network outages.</p>	
17 WEM 2.13	Issue Type (Recurring issue) Obligation 7.6.2, 7.13.1	Risk Rating Medium Compliance Rating 2	System Management's dispatch decisions around the Synergy portfolio are opaque; there is potential for breaches of Clauses 7.6.2 and 7.13.1(a). Clause 7.6.2 of the WEM Rules requires System Management to dispatch the Synergy Portfolio either under a Dispatch Plan or a Dispatch Order (the former notifying a deviation from a Dispatch Plan). Clause 7.13.1 of the WEM Rules requires System	<ul style="list-style-type: none"> Short term: As part of developing control room documentation, ensure that verbal dispatches of Synergy facilities are included in the Reporting and Logging protocol

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>Management to prepare a record of Dispatch Orders issued for each Trading Interval in the Trading Day.</p> <p>System Management prepares a Dispatch Plan under clause 7.6A.2 of the WEM Rules on the Scheduling Day which it sends to Synergy (which includes low, mean and high bounds for all portfolio facilities). In practice, however, this Dispatch Plan's primary purpose is to assist Synergy with its gas nomination. During real-time operations, the controller may vary individual Synergy facilities as they deem necessary to maintain power system security requirements. In effect, this means that the Dispatch Plan prepared on the Scheduling Day is not, in practice, a reflection of System Management's real-time dispatch decisions. Additionally, System Management does not issue electronic Dispatch Orders to Synergy facilities; relying instead on Automatic Governor Control (AGC) or the telephone, meaning the Synergy dispatch audit trail is intractable. Due to the lack of audit trail it is difficult to definitively state whether or not System Management has breached clause 7.6.2 of the WEM Rules (or clause 7.13.1 as a result of not sending Dispatch Orders to AEMO when there has been a deviation from the Dispatch Plan), as System Management alleges that Synergy facilities are typically dispatched between the high and low bounds of the Dispatch Plan. However, this this is not always the case, as the high and low bounds of the Dispatch Plan are based on forecasts that will not always reflect real-time conditions up to 24 hours in the future.</p> <p>Although we are not alleging a breach, we reiterate our past findings that the approach adopted to dispatching Synergy is opaque and runs counter to market transparency objectives. We also note the lack of</p>	<ul style="list-style-type: none"> • Medium term: Investigate potential for keeping electronic records of Synergy dispatch.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>proper governance around processes (specifically around audit trails) is a recurring issue in multiple areas such as control room operations and planning. We are pleased to note that some controllers are now recording their instructions to Synergy units on the control room log. These entries are not recorded in a database, but they are available for inspection after the fact if required.</p>	
<p>17 WEM 2.14</p>	<p>Issue Type (Recurring issue) Obligation Ch 7</p>	<p>Risk Rating Medium Compliance Rating 2</p>	<p>There is opportunity to improve the audit trail of control room operations. The level of records for control room activities is not sufficient to reconstruct events after the fact. The written log provides little (and sometimes no) information on actions or rationale for actions taken by the controller. On some days the control room log for a particular shift can contain as little as one or two entries. While there are database records of some actions taken such as constraints applied, these are not sufficient.</p> <p>This year for example, we have again noted instances where the control room operator has overridden the Metrix forecast with an alternate load forecast without indicating the rationale for doing so.</p>	<ul style="list-style-type: none"> • Short term: Define standard for control room logging, and explicitly note items to be recorded • Medium term: Investigate ways to automate or assist the capture of information about real time events
<p>17 WEM 2.18</p>	<p>Issue Type (New issue) Obligation 7.13.1(cA)</p>	<p>Risk Rating Low Compliance Rating 3</p>	<p>SCADA data cleansing processes remove consumption data. When preparing facility SCADA data for use in settlement, System Management manually cleans the data to remove spurious readings. This includes adjusting any negative values to equal zero. This practice is not described in the Cleansing of Generation Facility MWh output data PSOP.</p> <p>However, some facilities do legitimately draw power, for example when starting a thermal unit. In these cases, the unit will not be charged for</p>	<ul style="list-style-type: none"> • Update Cleansing of Generation Facility MWh output data PSOP to reflect all data cleansing steps • Review and refine SCADA cleansing processes to improve accuracy

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>its usage, and the additional usage will be washed up and settled as part of the notional meter.</p> <p>Because only Synergy facilities are settled on SCADA data, the overall effect should be minimal, as the amounts involved still form part of Synergy's bill.</p> <p>The ultimate solution to this issue would be to require facilities currently settled on SCADA data have revenue meters installed, but this is not likely to occur unless and until the market moves to a facility bidding model.</p>	
17 WEM 2.20	<p>Issue Type RBP reported non-compliance (New issue)</p> <p>Obligation 7.6A.2(c)</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Dispatch Plan and associated Information provided to Synergy does not include specified ancillary service information, and the format and time resolution is not described in a procedure.</p> <p>Clause 7.6A.2 requires AEMO to provide to Synergy by 4pm:</p> <ul style="list-style-type: none"> • Forecast energy required from the balancing portfolio • <i>The Dispatch Plan for each portfolio facility</i> • <i>A forecast of the detailed Ancillary Services required from each Facility in the portfolio.</i> • <i>where the format and time resolution of this data is to be described in a procedure.</i> <p>We have not observed any procedure (either internal or Market Procedure) which describes the format and time resolution. We note that slight variations on format are used, some including aggregated resource plan quantities and LFAS enablement for non-portfolio facilities, and some not. The information is prepared by copying information from the SOCCUI tool, which does include confidential</p>	<ul style="list-style-type: none"> • Standardise Dispatch Plan creation process and describe in a procedure • Alter dispatch plan preparation process to remove reliance on sheet containing confidential information

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>information on non-portfolio facilities. We did not find any confidential information in the dispatch plans we reviewed, but it has been sent in the past, and the risk remains.</p> <p>Finally, the information provided to Synergy provides only aggregated Ancillary Services requirements - not broken out by facility as required by the rules. Adding this level of detail is unlikely to be of much value until facility bidding is introduced.</p>	
<p>17 WEM 2.21</p>	<p>Issue Type (New issue) Obligation Ch 7</p>	<p>Risk Rating Medium Compliance Rating 2</p>	<p>Verbal dispatch instructions are not automatically recorded in IT systems. In our review of control room logs, we identified one instance where a facility was verbally dispatched by the controller in advance of the automatic RTDE recalculation. This meant that a matching electronic record had to be added manually after the fact. The Market Operations analyst on duty did not notice the occurrence, meaning that the record of dispatch would have been lost, and also that participant non-compliance data would be incorrect.</p> <p>The long-term solution would be to make all dispatch electronic, but we accept that this may not be pragmatic until facility bidding is introduced.</p>	<p>Consider moving responsibility from Market Operations to control room staff to enter verbal dispatch instructions into systems.</p>
<p>17 WEM 2.22</p>	<p>Issue Type (New issue) Obligation Ch 7</p>	<p>Risk Rating Medium Compliance Rating 2</p>	<p>Control room business continuity plans do not include continuous oversight of power system, and IT system disaster recovery plans are not sufficient. Control room business continuity plans (currently in the process of being documented) involve controllers moving to a secondary site in case of primary site evacuation. Under current policies, this will mean physically relocating personnel to a second site and starting up IT systems. From the time that personnel leave the primary site until the user interfaces are up at</p>	<ul style="list-style-type: none"> • Investigate mechanism to provide remote access (e.g. from home or another office location) to control room tools, to allow continuous system oversight in the event of evacuating the primary site. • Develop and test disaster recovery plans for System Management IT systems.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>the secondary site, no one will be in control of the power system. If a serious power system event were to go occur in this period, there would be a high chance of losing load, damaging equipment, and otherwise breaching the market rules.</p> <p>We understand that AEMO's access to control room systems is controlled by Western Power, whose security policy does not allow anything other than direct, onsite access to these systems by anyone other than the Western Power SCADA/OT support team. In our view, this policy must be updated to allow the critical power system operations function to continue uninterrupted in case of loss of site, and the risk managed using modern IT security practices. This will become even more pressing once AEMO's control room functions move to new premises later in 2017.</p> <p>Also, disaster recovery plans for System Management IT systems are very limited. There are a handful of references in the System Management IT support wiki, but in our view, they are not sufficient to describe what to do in case of disaster. We are not confident that the systems could be restored in a timely manner in some scenarios, including loss of the primary site.</p> <p>These tools will be in use for at least another two years, and in our view the current 'steady state' support approach is not robust enough to provide certainty of service over that horizon.</p>	
17 WEM 2.46	Issue Type RBP and AEMO	Risk Rating Medium Compliance	Non-issuance of Dispatch Advisories. Clause 7.11.5(g) of the WEM Rules requires System Management to issue a Dispatch Advisory in the event of or in anticipation of issuing a dispatch instruction out of merit. This includes situations where a Market Participant advises they cannot	Review Dispatch Advisory Guidelines, including threshold significance of unit constraint. We recognise that if the constraint is only for a short time (e.g. less

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	<p>reported non-compliance (Recurring issue)</p> <p>Obligation 7.11.5</p>	<p>Rating 1</p>	<p>meet their dispatch. On three occasions generation units refused their dispatch, were constrained to zero in RTDE by System Management (meaning that the next unit or units in the BMO would be selected), but no Dispatch Advisory was issued:</p> <ul style="list-style-type: none"> • 24 July 2016 17:16:29 • 11 Aug 2016 17:18:13 • 4 Sep 2016 18:27:36 <p>Clause 7.11.5(d) of the WEM Rules requires System Management to issue a Dispatch Advisory if significant outages of generation equipment are occurring. On 9 March 2017, a large generator tripped, but no Dispatch Advisory was issued.</p> <p>In each of these cases, Market Participants were not informed of a circumstance that made them more likely to be dispatched, and missed the opportunity to adjust their commercial offers.</p>	<p>than the gate closure period), the market effects may be minimal, and in these cases AEMO might choose to accept non-compliance rather than incur the overhead of creating and maintaining a DA.</p>
<p>17 WEM 2.48</p>	<p>Issue Type AEMO Self-reported non-compliance (Recurring issue)</p> <p>Obligation 7.2.1, 7.2.3A, 7.6A.2, 7A.3.7, 7A.3.15</p>	<p>Risk Rating Low</p> <p>Compliance Rating 1</p>	<p>Late preparation of data. Various rules oblige System Management to prepare information for use in market processes, and/or to publish it to Market Participants. On several occasions, System Management has prepared or published data after the time specified in the WEM Rules. Specifically, on the following dates:</p> <ul style="list-style-type: none"> • 19 July 2016, when IT issues resulted in provisional Relevant Dispatch Quantity and Resource End of Interval Quantities being provided at 11.35am, rather than by 10am (clause 7A.3.7 of the WEM Rules) • 22 July 2016, when IT issues resulted in correct Relevant Dispatch Quantity Data being prepared at 10.36am, to update the incorrect 	<p>See 17WEM2.42</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>data prepared before the 10am requirement (clause 7A.3.7(b) of the WEM Rules).</p> <ul style="list-style-type: none"> • 6 January 2017, when a mistake in manual data processing resulted in correct Ancillary Service Forecast data being prepared at 10.10am, to update the incorrect data prepared before the 8:30am requirement (clause 7.2.3A of the WEM Rules). This data is used in STEM processes, and the market had to be delayed until the data could be corrected. • 8 January 2017, when IT issues meant that Relevant Dispatch Quantities were not updated for three intervals (clause 7A.3.15 of the WEM Rules). These figures are used in preparing the Forecast BMO, meaning that information provided to Market Participants was not current. • 21 February 2017, when System Management sent the system demand forecast to Synergy at 9.06am instead of by 8:30am (clause 7.6A.2(b) of the WEM Rules). Synergy had access to this information from other sources. • 21 February 2017, when System Management sent the Dispatch Plan and forecast data to Synergy at 4.20pm instead of by 4pm (clause 7.6A.2(c) of the WEM Rules) because IT issues affected access to required information. The information was still provided in time for Synergy's day ahead processes. • 31 March 2017, when System Management prepared the daily informational load forecast at 7,32am instead of by 7:30am (clause 7.2.1 of the WEM Rules). 	

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>In all cases, the effect on the market is small, but not nothing. Some of the IT issues have been addressed, but given the manual nature of many of the processes, non-compliances are likely to continue to occur.</p>	
<p>17 WEM 2.50</p>	<p>Issue Type AEMO Self-reported non-compliance (New issue) Obligation 7.6A.2(c).i.1</p>	<p>e</p>	<p>Not providing aggregate resource plan data to Synergy. Clause 7.6A.2(c).i.1 of the WEM Rules requires System Management to provide Synergy with a forecast of requirements for energy from the balancing portfolio by 4pm, including the effects of the aggregate quantity of participant resource plans (i.e. the forecast of non-Synergy generation for the following day). On 29 April 2017, due to IT issues, System Management provided a forecast that used the previous day's resource plans.</p> <p>The impact was minimal. Since the start of the balancing market in July 2012, resource plan data is a much less relevant component of expected Synergy generation, and System Management provides Synergy with an updated forecast at 6:30pm, once the first balancing forecast for the following day is available.</p>	

9 WEM RULES CHAPTER 7A – BALANCING MARKET

Chapter 7A of the WEM Rules sets out obligations relating to the balancing market.

9.1 RULE AMENDMENTS

Amendments to Chapter 7A of the WEM Rules include only transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.

9.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 7A of the WEM Rules in all material respects. Please refer to Table 6 for audit findings relating to AEMO's procedures.

9.3 OPERATIONAL COMPLIANCE WITH CHAPTER 7A

9.3.1 Audit activities

- We conducted a (real-time) business process walkthrough to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls when conducting the daily market operations shift covering AEMO's obligations under Chapter 7A (Balancing Market Operations) of the WEM Rules.
- We reviewed system logs to compliance test whether AEMO has published balancing prices in accordance with the requirements set out in Chapter 7A of the WEM Rules.
- We reviewed the use of manual Load Forecast overrides, and the monitoring of load forecast accuracy

9.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 7A of the WEM Rules are summarised in the table below.

Table 16: Operational compliance findings associated with Chapter 7A of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.15	<p>Issue Type AEMO Self-reported non-compliance (Recurring issue)</p> <p>Obligation 7A.3.15</p>	<p>Risk Rating Medium</p> <p>Compliance Rating 1</p>	<p>RDQ forecasts prepared by System Management do not always reflect best estimate of forecast load. Clause 7A.3.15 of the WEM Rules requires System Management to prepare a forecast of the Relevant Dispatch Quantity (RDQ) for each future Trading Interval, which is then used in preparing the Forecast BMO. Additionally, each time it has new information on which to determine the forecast RDQ, System Management must update the forecast (but does not need to do so more than once per Trading Interval).</p> <p>System Management uses the Metrix tool to determine the forecast RDQ, which is published to the market every half hour. However, from time to time (8.1% of Trading Intervals during the period from 1 July 2016 to 31 March 2017), the control room operator will over-write the Metrix forecast with an alternate forecast (if they deem the Metrix forecast to not be tracking well against the actual SCADA outputs). System Management asserts that this override is a real-time decision; the Metrix tool self-corrects within 15-20 minutes there is limited value in sending the alternate load forecast to the market (as an update under clause 7A.3.15 of the WEM Rules), as the Metrix forecast is still their best forecast for the next Trading Interval.</p>	<ul style="list-style-type: none"> Investigate a mechanism to capture and publish the actual load forecast used in the control room. Include reasons for Metrix override in control room logging standard.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>To this end, we reviewed System Management's use of alternate forecasts and noted 10 instances in which the Metrix forecast was overridden by an alternate forecast for more than four hours (the longest override was for 11 hours on 26 August 2016):</p> <ul style="list-style-type: none"> • In four cases, the change is noted on the control room log sheet, along with a reason. • In two cases, the change is noted with no reason given. • In four cases, there is no record of the change on the control room log sheet. <p>We have determined these 10 instances to be a breach of clause 7A.3.15 of the WEM Rules as the prolonged use of the alternate forecast is a clear indication of System Management not believing Metrix to be the best forecast of RDQ in upcoming intervals. As this is a recurring issue and System Management has no means to transmit alternate forecasts to the market, it is likely this breach will recur. We have not assessed the impact of these particular breaches, but at least some are likely to be material, as according to the control room logs for four of the intervals, the Metrix forecasts were substantially incorrect. This issue is a recurring and systemic issue around the provision of market data. In this case, the most recent and accurate forecast should be stored, as this is a crucial input into the BMO. If System Management is using alternate load forecasts for multiple consecutive intervals then it is the alternate load forecast that should be stored and used in downstream processes to create the BMO (as this is the best estimate at the time).</p> <p>We further note that there is opportunity to improve the audit trail around the use of alternate forecasts in the control room. Currently, the controller does not always note in the log that they have overridden Metrix, and does not always describe the reason for doing so. As noted above, for 6 of the instances reviewed, System Management was unable to provide justification for the Metrix load forecast override.</p>	

10 WEM RULES CHAPTER 7B – LOAD FOLLOWING SERVICE MARKET

Chapter 7B of the WEM Rules sets out obligations relating to the load following service market.

10.1 RULE AMENDMENTS

Amendments to Chapter 7B of the WEM Rules include only transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.

10.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 7B of the WEM Rules in all material respects. Please refer to Table 6 for audit findings relating to AEMO's procedures.

10.3 OPERATIONAL COMPLIANCE WITH CHAPTER 7B

10.3.1 Audit activities

- We conducted a (real-time) business process walkthrough to determine whether AEMO has complied with the WEM Rules and its Internal Procedures and whether AEMO has applied appropriate controls when conducting the daily market operations shift covering AEMO's obligations under Chapter 7B (LFAS Operations) of the WEM Rules.
- Reviewed system logs to compliance test whether AEMO has published LFAS prices in accordance with the requirements set out in Chapter 7B of the WEM Rules.

10.3.2 Audit findings

We did not observe any instances of non-compliance with Chapter 7B of the WEM Rules.

11 WEM RULES CHAPTER 8 – WHOLESALE MARKET

METERING

Chapter 8 of the WEM Rules sets out obligations relating to metering, including: Metering Data Agents; Meter Registry; Meter Data Submissions; Metering Protocol Requirements; and Support of Calculations.

11.1 RULE AMENDMENTS

There have been no amendments to Chapter 8 of the WEM Rules.

11.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 8 of the WEM Rules in all material respects.

11.3 OPERATIONAL COMPLIANCE WITH CHAPTER 8

AEMO has limited obligations under Chapter 8 of the WEM Rules.

We have conducted no audit activities pertaining to Chapter 8 of the WEM Rules.

We have noted no instances of non-compliance or compliance risk associated with AEMO's obligations under Chapter 8 of the WEM Rules.

12 WEM RULES CHAPTER 9 - SETTLEMENT

Chapter 9 of the WEM Rules sets out obligations relating to Settlement Data; Settlement Calculations; Settlement Statements; Invoicing and Payment; and Default and Settlement in Default Situations.

12.1 RULE AMENDMENTS

Amendments to Chapter 9 of the WEM Rules include only transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA.

12.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 9 of the WEM Rules in all material respects. Please refer to Table 6 for audit findings relating to AEMO's procedures.

12.3 OPERATIONAL COMPLIANCE WITH CHAPTER 9

12.3.1 Audit activities

We have:

- Reviewed instances of self-reported non-compliance incidents with AEMO staff.
- Undertaken (real-time) business process walkthroughs of NSTEM billing and invoicing activities (including prepayment application).
- Undertaken (retrospective) business process walkthroughs of:
 - Meter data validation activities.
 - NSTEM Initial Settlement and Adjustment Settlement verification activities.

12.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 9 of the WEM Rules are summarised in the table below.

Table 17: Operational compliance findings associated with Chapter 9 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.32	Issue Type AEMO Self-reported non-compliance (New issue) Obligation 9.9.2(f), (i) & (l)	Risk Rating Medium Compliance Rating 1	Incorrect settlement calculations due to erroneous Spinning Reserve import. AEMO settlement systems uses the SRCAPPK_IMOWA parameter to determine spinning Reserve Capacity for peak intervals which in turn determines ancillary service payments. For the November 2015 billing month, as a result of a manual error, AEMO used incorrect values for the SRCAPPK_IMOWA parameter for the first (May 2016) and second (August 2016) adjustments. This resulted in an overpayment to the affected Market Participant; the error was also notified to AEMO by the participant. AEMO rectified the error in the third adjustment in November 2016. AEMO has updated its procedures to prevent recurrence of similar breaches. Manual line item imports into settlements are now verified by senior analysts before settlement processing commences.	No recommendations as AEMO has updated procedures to prevent recurrence of similar breaches.
17 WEM 2.33	Issue Type AEMO Self-reported non-compliance (New issue) Obligation 9.20.2	Risk Rating Low Compliance Rating 1	Failure to acknowledge notice of disagreement due to oversight. AEMO failed to acknowledge receipt of a notice of disagreement within one business day as required under clause 9.20.2 of the WEM Rules as a result of human error. The participant had submitted a notice on 3 March 2017 relating to the December 2016 Initial Settlement. AEMO confirmed receipt on 14 March 2017 (instead of 4 March 2017). The breach was a result of the operator not following AEMO's documented process for handling disagreements. The impacts are minor as the window for resolving the disagreement had not passed.	No recommendations as AEMO has adequate controls to mitigate recurrence of similar breaches.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
				This was an instance of human error.
17 WEM 2.34	Issue Type AEMO Self-reported non-compliance (New issue) Obligation 9.4.10	Risk Rating Low Compliance Rating 1	Failure to notify participant of incorrect Capacity Credit Allocation leading to erroneous revocation of Capacity Credit Allocation. Clause 9.4 of the WEM Rules sets out the capacity credit allocation process (which follows the timeline set out in clause 9.16.2 of the WEM Rules and the Settlement Cycle Timeline document). If a Market Participant has had more Capacity Credits allocated to it than its IRCR, AEMO must identify such a participant (rule 9.4.9) and notify the participant (clause 9.4.10 of the WEM Rules) so that the participant can modify its nomination. AEMO's automated alert system (MOSMI)) alerts AEMO staff whether a notification under clause 9.4.10 is required. However, on 16 June 2017, due to an emergency failover this alert was not triggered. As a consequence, the participant did not modify their allocation, and AEMO's market systems (WEMS) revoked the allocation under clause 9.4.12 of the WEM Rules (setting the participant's allocation to zero). Settling based on this amount would result the participant paying capacity costs to the market which were covered by bilateral arrangements; this is inconsistent with the intent of the WEM Rules. Therefore, AEMO allowed the participant to modify its Capacity Credit allocation (outside the rules stipulated timeframe) so that they do not incur the additional (unnecessary) capacity costs. As a result, there was no market impact. AEMO has updated the failover checklists and internal process documentation to include a check of the MOSMI logs to identify errors.	No recommendations – AEMO has resolved this issue.
17 WEM 2.38	Issue Type RBP reported non-compliance (Recurring issue)	Risk Rating Low Compliance Rating 1	Technical non-compliance with requirement to notify receipt by telephone. Clause 9.4.7 of the WEM Rules requires AEMO to confirm receipt of a Capacity Credit Allocation Submission from a Market Participant (made under clause 9.4.6 of the WEM Rules) by telephone within 30 minutes of receiving the submission. AEMO has automated the receipt of Capacity Credit Allocation Submissions in WEMS, and is therefore in technical breach of clause 9.4.7 (as it does not confirm receipt via telephone).	No recommendations

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	Obligation 9.4.7 Capacity Credit Allocation process		<p>This is a non-material technical breach identified in 2014. AEMO is complying with the intent of the rule (by automating confirmation receipts), and confirmation by telephone is unnecessary.</p> <p>We note that this issue may be resolved through a minor rule change to remove the telephone requirement. A rule change (RC_2014_07) is currently in the process to align obligation with practice.</p>	

13 WEM RULES CHAPTER 10 – MARKET INFORMATION

Chapter 10 of the WEM Rules sets out obligations relating to Market Information, including: confidentiality; and publication on the Market Web Site.

13.1 RULE AMENDMENTS

Amendments to Chapter 10 of the WEM Rules include transitional changes to reflect the transfer of System Management functions to AEMO and IMO functions to the ERA and changes to reflect interim arrangements for constrained grid access.

13.2 AEMO PROCEDURES

AEMO's Market Procedures and Internal Procedures are compliant with Chapter 10 of the WEM Rules in all material respects. Please refer to Table 6 for audit findings relating to AEMO's procedures.

13.3 OPERATIONAL COMPLIANCE WITH CHAPTER 10

13.3.1 Audit activities

We have reviewed AEMO's website and AEMO's procedures to determine compliance and compliance risk associated with its Market Data publication obligations under clause 10.5.1 of the WEM Rules.

13.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Chapter 10 are summarised in the table below.

Table 18: Operational compliance findings associated with Chapter 10 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.36	Issue Type AEMO Self-reported non-compliance (New issue) Obligation Procedure Administration, Section 2.5.1	Risk Rating Low Compliance Rating Level 1	Failure to publish summary of closed Rule Change Proposals and Procedure Changed proposals. Clause 10.5.1(a)(ix) requires AEMO to publish a document summarising all Rule Change Proposals and Procedure Change Proposals that are no longer open to public comment and whether or not those proposals were accepted or rejected. This document had not been moved across to AEMO website from the now superseded AEMO WA specific website. AEMO has now rectified this issue and has included a standing link to the ERA's website.	No recommendation as AEMO has resolved the issue.

14 MARKET SYSTEMS AND IT CONTROLS

This chapter covers the compliance of AEMO's market software and software management processes with the WEM Rules, in accordance with clause 2.14.3(c) of the WEM Rules.

- Section 14.1 sets out our review of AEMO's market software systems
- Section 14.2 sets out our review of AEMO's general IT controls, including processes for software management.

14.1 COMPLIANCE OF AEMO SOFTWARE

The software testing and certification process assesses whether the mathematical formulations specified in the WEM Rules and Market Procedures have been correctly implemented by the software.

The software systems covered by this section of the review are:

- WEMS
- POMAX Settlements
- POMAX Metering

We are currently carrying out initial certification testing of the Real Time Dispatch Engine software used by AEMO System Management to generate a security constrained dispatch from the unconstrained BMO.

14.1.1 Approach

Software testing and certification under clause 2.36.1(d) of the WEM Rules is carried out on a release by release basis throughout the year. Hence, at the time of the annual market audit, we rely upon the testing conducted throughout the year and our review of AEMO's software release change log (and other documentation) to determine:

- Whether all changes to market software contemplated by clause 2.36.1(d) have been independently certified, and therefore
- Whether all market software contemplated by clause 2.36.1(d) is still compliant with the WEM Rules and Market Procedures.

14.1.2 2016-17 market software certification

Certification of core market systems

The initial versions of AEMO's WA market systems were certified at market start in 2006/7. Since that time, various system changes have been made and certified, as set out in Section 15.2.

For this audit, we reviewed the release notes for all changes made to AEMO's market systems during the Audit Period. Most changes maintained certification without additional testing, as they did not involve changes that would be expected to have material impact on prices or quantities. All releases having material impact on market prices or quantities were independently certified prior to release. The changes are set out in Table 19, along with the certification status of the software version. The list only includes releases implemented in the production environment, and does not include versions which were only implemented in a development or test environment.

Table 19: Changes to AEMO market systems in the Audit Period

System	Version number	Release date	Material effect on prices / quantities?	Certification status	Comment
WEMS	3.17-1149-11	Aug 2016	Yes	Certified	DSM Reserve Capacity bilateral trade changes for EMR
WEMS	3.18-1183-5	Sep 2016	No	Maintained	
WEMS	3.19-1192-10	Apr 2017	No	Maintained	
WEMS	3.19-1192-13	May 2017	No	Maintained	
Metering	11.0.28	May 2017	No	Maintained	
Settlements	3.4.16	Sep 2016	Yes	Certified	IRCR changes for Intermittent Loads with TD component

Where the above software is designated 'Certified', it has either been independently tested by RBP, or AEMO testing has been reviewed and accepted by RBP. RBP has then certified that the software complies with the requirements of the WEM Rules.

Certification of tools outside core market systems

In addition to certification of core market systems, RBP has certified changes to supporting tools as shown in Table 20.

Table 20: 2016-2017 supporting tool certification

System	Subject	Certification scope	Date certified
Protected Excel Workbook	Alternative Maximum STEM Price	Calculation of Alternative Maximum STEM Price under clause 6.20.3 of the WEM Rules	25 July 2016
Relevant Level tool	Relevant level for intermittent generation	Relevant Level calculations under Appendix 9, steps 1 to 3 and 5 to 18 of the WEM Rules	12 May 2017

14.1.3 Compliance of market software with the WEM Rules

We have no audit findings to report with respect to the compliance of the market software with the WEM Rules.

14.2 GENERAL IT CONTROLS (INCLUDING SOFTWARE MANAGEMENT)

General IT controls are also reviewed in the Gas audit. We carried out a single review covering both audits. Other than findings in Table 21, the findings here are the same as those under the Gas Compliance Audit, and use the same reference numbers.

14.2.1 Audit activities

We reviewed AEMO's policies and procedures for:

- Business continuity
- Service management (including AEMO/Western Power service management integration workflows, and Western Power service management procedures)
- User-facing information security policies and procedures

- System Management software processes and procedures

We carried out compliance testing on:

- User password requirements
- Release notes
- Service management records (including AEMO and Western Power Jira and ServiceNow incident, problem, change and release records)
- Monthly service reports under AEMO's Service Level Agreement (SLA) with Western Power
- Data centre specifications
- Application and system logs
- Backup schedule, and backup restoration tasks

14.2.2 Management of market software

AEMO's obligations in respect of software management processes are specified in clause 2.36.1 of the WEM Rules.

Where AEMO uses software systems to determine Balancing Prices, to determine Non-Balancing Facility Dispatch Instruction Payments, to determine LFAS Prices, in the Reserve Capacity Auction, STEM Auction or settlement processes, it must:

- a. maintain a record of which version of software was used in producing each set of results, and maintain records of the details of the differences between each version and the reasons for the changes between versions;
- b. maintain each version of the software in a state where results produced with that version can be reproduced for a period of at least 1 year from the release date of the last results produced with that version;
- c. ensure that appropriate testing of new software versions is conducted;
- d. ensure that any versions of the software used by AEMO have been certified as being in compliance with the Market Rules by an independent auditor; and
- e. require vendors of software audited in accordance with clause 2.36.1(d) to make available to Rule Participants explicit documentation of the functionality of the software adequate for the purpose of audit.

Clause 2.36.2 of the WEM Rules defines a 'version' as follows:

A "version" of the software referred to in clause 2.36.1 means any initial software used and any changes to the software that could have a material effect on the prices or quantities resulting from the use of the software

14.2.3 Audit Findings

Compliance of market software

We have reviewed the relevant AEMO IT system change control logs (including release notes, JIRA records, and database logs) and have confirmed that, other than the changes set out in section 14.1.2, the core market systems and the non-core market software referenced in Section 14.1.2 have not been materially changed since the referenced tests were performed.

As such, as at the time of the market audit, we found all market software (contemplated by clause 2.36.1(d) of the WEM Rules) and non-core market software referenced in Section 14.1.2 to be compliant with the WEM Rules and Market Procedures, in all material respects.

Compliance of software management processes with the WEM Rules

There have been no self-reported or other instances of non-compliance with clause 2.36.1 of the WEM Rules.

AEMO's software management processes for the market systems remain sufficient to comply with the market rules.

Table 21: Comment on AEMO’s compliance with clause 2.36.1 of the WEM Rules during the Audit Period

Clause	Comment on compliance
2.36.1(a)	AEMO has maintained a record of all versions of market software used together with their dates in service, details of the differences between each version and the reasons for the changes between versions. These take the form of release notes, JIRA records, ServiceNow records and database entries.
2.36.1(b)	AEMO has maintained the ability to roll back versions of the market software by restoring previous database versions and re-installing previous versions of the software. AEMO was able to reproduce past results exactly for a sample case.
2.36.1(c)	AEMO has conducted appropriate testing on all new releases of market software prior to their being placed in service.
2.36.1(d)	AEMO has ensured that all software versions are covered by an independent certification prior to implementation.
2.36.1(e)	AEMO provides documentation to Market Participants covering the functionality of the market software. AEMO also holds release artefacts including detailed release notes for each release, which are available to Market Participants.

General findings

Table 22: Operational compliance findings associated with general IT controls

Ref	Issue Type	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.39	(New issue)	Risk Rating Low Compliance Rating 2	The current backup regime and architecture is not documented. Regular backup testing does occur, with no more than six months elapsing between restoration tests, but coverage is unclear. AEMO has a project underway to refresh the backup infrastructure and regime in line with organisational standards.	Ensure that current backup refresh project delivers documentation for the architecture of the backup environment
17 WEM 2.40	(New issue)	Risk Rating Medium Compliance Rating 2	AEMO maintains redundant IT systems, so that the market can continue to operate in the event of losing one data centre. Both data centres are regularly exercised, by running production market systems from each location at regular intervals. While this is perhaps the most critical part of AEMO's business continuity preparation, other aspects of business continuity have not been explored. We have not seen evidence of any business continuity testing beyond system failover and backup restoration testing. This means that reliance on key people, office premises, physical equipment, and communications channels has not been tested. This applies to both CBD and EPCC activities, and is particularly concerning for control room operations.	Plan and conduct regular desk-based and live business continuity exercises covering selected credible contingency scenarios
17 WEM 2.41	(New issue)	Risk Rating Low Compliance Rating 2	AEMO's Encryption Standard requires backup media to be encrypted where technically possible. AEMO WA backup media is not encrypted.	Consider backup media encryption as part of backup refresh project.

Ref	Issue Type	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.43	(New issue)	Risk Rating Low Compliance Rating 3	IT applications support and development has been insourced to new application support team. Team members are all new recruits, and are largely from a development background and relatively new to service management concepts. This increases the risk of problems in support processes.	Ensure support staff have appropriate service management training
17 WEM 2.44	(New issue)	Risk Rating Low Compliance Rating 3	AEMO CBD does have a configuration management database of sorts, but definitions used are inconsistent. Different people have used different concepts of what a "product" is, what a "configuration item" is, and which assets should be recorded and how. This significantly reduces the usefulness of a CMDB or CMS.	Ensure support staff have appropriate service management training Consider refreshing CMDB as part of the wider AEMO service management programme
17 WEM 2.45	(New issue)	Risk Rating Low Compliance Rating 2	Best practice for a critical infrastructure organisation like AEMO would be to have full, UTI Tier III, site level redundancy for critical systems, with sufficient geographic separation to avoid having both sites affected by the same incident. AEMO's IT infrastructure is located in two WA data centres. The newer facility is certified as UTI Tier III. The older facility does have redundancy on many levels, the facility is not certified as Tier III, and does not meet the Tier III requirements. The two facilities are 10.25km apart, both close to the centre of Perth.	Consider moving to a more distant Tier III aligned data centre site as part of next data centre lifecycle refresh project

15 APPENDICES

15.1 COMPLIANCE AND RISK RATING INFORMATION

This appendix contains information on the compliance and risk ratings used to classify audit findings.

15.1.1 Compliance and Risk Ratings

Audit findings are categorised as follows:

Table 23: Compliance ratings

Compliance rating	Description
1	Instances of non-compliance with the WEM Rules
2	Findings that are not an instance of non-compliance, but pose compliance risk
3	Findings related to minor housekeeping issues that do not affect compliance risk

Risk Rating descriptors for audit findings were set in consultation with AEMO and are based on AEMO's corporate risk matrix (including definitions of impact and likelihood).

Table 24: Risk Ratings

Risk Rating	Description
Critical	Potential for catastrophic impact on market or system operations or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level.
Significant	Potential for major impact on market or system operations or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings.
Medium	Potential for moderate impact on market or system operations or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring.
Low	Potential for minor impact on market or system operations or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

AEMO's definitions of likelihood and consequence are provided in the sections below.

15.1.2 AEMO likelihood ratings

Likelihood	Annual Probability	Qualitative Description
Almost Certain	>90%	Will occur in most circumstances; statistical record of several occurrences
Likely	51% - 90%	Can be expected to occur in most circumstances; statistical record of some occurrence
Possible	11% - 50%	May occur, but not expected in most circumstances; statistical record of at least one occurrence
Unlikely	1% - 10%	Conceivable but unlikely to occur in any given year; no history of occurrence
Rare	<1%	Will only occur in exceptional circumstances; no history of occurrence

15.1.3 AEMO impact ratings

Type of impact	EXTREME	MAJOR	MODERATE	MINOR	IMMATERIAL
Reputation & Stakeholders	Significant long-term damage to stakeholder confidence and relationships; total loss of public confidence; intensive adverse media exposure	Significant short-term damage to stakeholder confidence and relationships; some loss of public confidence; adverse media exposure	Some damage to stakeholder confidence and relationships	Manageable reduction in stakeholder confidence	No lasting effects
AEMO Financial Impact	>\$25M	>\$5M-25M	>\$500K-\$5M	>\$100K-\$500K	<\$100K
Safety	Single fatality or permanent injury or widespread impact on public safety	Serious injury requiring hospitalisation >5 days or localised impact on public safety	Injury requiring <5 days hospitalisation or medical treatment	Medical treatment only	First aid
Infrastructure, Assets & Environment	Permanent long-term effect and or rectification not possible	Significant effect, difficult rectification	Measurable effect, easy rectification	Measurable effect, no rectification required	No measurable damage or effect
Market	Loss of supply to >50% of customer demand in any one jurisdiction or >25% across multiple jurisdictions Market suspension in one jurisdiction or market	Loss of supply to >25% of customer demand in any one jurisdiction or >10% across multiple jurisdictions Market suspension in one jurisdiction or market	Loss of supply to >10% of customer demand in any one jurisdiction or >5% across multiple jurisdictions Market operating in an administered state for > 5 days for gas market or >1 day for electricity market	Loss of supply to >5% of customer demand in any one jurisdiction or >2% across multiple jurisdictions Market operating in an administered state for <5 days for gas market or <1 day for electricity market	No restriction of supply No disruption to markets

Type of impact	EXTREME	MAJOR	MODERATE	MINOR	IMMATERIAL
Legal & Regulatory	Imprisonment or fine >\$100 personal liability to officer or director of company Disqualification as officer/director Regulator or parliamentary inquiry with loss of Market Participants and public confidence	>\$100K personal liability to officer or director Disqualification as officer/director Regulator or parliamentary inquiry with substantial loss of reputation, financial cost, loss of stakeholder confidence, political impact	Fine of less than \$100K and no personal liability Regulator or government inquiry with loss of reputation or adverse government impact	Nominal fine Regulator or government inquiry resolved by routine management procedures	No fine No government or regulator inquiry

15.2 HISTORICAL MARKET SOFTWARE CERTIFICATION PRIOR TO THE 2016-17 AUDIT PERIOD

15.2.1 Initial software testing

When AEMO notifies us of changes to market software or release of new software we adopt one or both of the following methods:

- Constructing independent models of the specific case. The model may perform a set of calculations (such as pre-processing of data or quantity allocations, as defined by the formulation), or it may include an optimisation procedure designed to replicate a portion of the software's formulation.
- Directly comparing the software results to our understanding of the formulation. This may involve answering questions such as:
 - Are the appropriate constraints binding?
 - Does the set of calculations change as we expect when input values are altered and the software is re-run?
 - Does the software make optimal trade-offs between alternative resources, given their costs and associated constraints?

In testing AEMO's market software, we use both approaches.

As much of the software tested is embedded in the market systems, RBP specifies the tests to be performed (including input data requirements and output data to be provided) and AEMO staff conducts the tests on the market systems. We then review the test results to determine whether the results are compliant with the requirements of the WEM Rules and Market Procedures.

15.2.2 Assessment of software compliance at time of market audit

Once software has been tested and shown to be compliant, it is not necessary to retest the software unless:

- Changes have been known to be made to the software which render the previous testing no longer valid; or
- It is believed that unapproved changes have been made to the software.

The first circumstance is readily picked up where there is a rigorous software change control process. The second exists where such a change control process is lacking.

As part of the 2006-7 and 2007-8 annual audits of the IMO's market software systems we carried out full regression tests to verify that the market software systems comply with the requirements of the WEM Rules and Market Procedures. Since the 2008-9 year, we have determined the compliance of the market software by:

- Examining AEMO's market software change procedures to ensure that they are robust
- Examining various records of changes made to the market software systems (including change process logs, release notes and system audit trails) to determine whether the changes required independent testing and certification
- Examining WEM Rules and Market Procedure changes and assessing whether corresponding changes to market software have been implemented (where relevant) and
- Carrying out such testing and certification on those software changes as required.

Under this regime, if there are no changes made to the software since the last time it was certified, we may deduce that the software continues to comply with the WEM Rules.

If changes are made to the software, we plan and conduct tests to exercise any new or changed calculations, and other calculations that are likely to have been affected.

This is in line with the approach we use when verifying software compliance in other jurisdictions.

This incremental approach provides a cost-effective means for providing assurance on compliance when changes to the market are incremental in nature, but it becomes less meaningful as time goes on and/or if major changes are introduced to the market.

15.2.3 Summary of historic tests

This section provides a summary of the relevant certification tests previously conducted on the core AEMO market software systems along with the results of those tests. The core market software systems are comprised of:

- WEMS – Wholesale Electricity Market Systems, a software system developed and maintained by AEMO, and incorporating proprietary components provided by ABB
- POMAX Settlements – a software system provided by the vendor Brady Energy
- POMAX Metering – a software system provided by the vendor Brady Energy

WEMS certification relies on the chain of certification testing back to the comprehensive testing conducted in 2007-8. We conducted comprehensive testing of new WEMS components for the introduction of balancing and load following markets in 2012.

Settlements certification is based on the chain of certification testing back to the comprehensive testing conducted in 2014 for the new settlements version 3.4.6.

For the 2008-2011 Audit Periods, the information presented is organised around the tests conducted and sets out:

- The features of Market Systems software which have been tested.
- The nature of the tests conducted.

For the 2011-2015 Audit Periods, we set out the specific market software component releases, and their certification status. Releases with certification status of 'maintained' did not require additional testing, as they did not involve changes that would be expected to have material impact on prices or quantities.

System	Subject	Test	Result	Year
Market Systems	STEM & Non-STEM	STEM ST1: Two Participants	PASS	2008
			PASS	2008
		STEM ST2: Multiple Optima Clearing Quantities	PASS	2008
			PASS	2008
		STEM ST3: Multiple Optima Clearing Prices	PASS	2008
		STEM ST4: Price set at Min-STEM price by default bid	PASS	2008
			PASS	2008
		STEM ST5: Price set at Alt-Max-STEM price by default bid	PASS	2008
			PASS	2008
		STEM ST6: Bilateral position outside of Price Curve	PASS	2008
	PASS	2008		
		STEM ST7: Three Participants		

System	Subject	Test	Result	Year
		NST 1 Dispatch Merit Order NST 2 Dispatch Instructions NST 3 Administered Balancing Prices NST 4 Reserve Capacity Obligation Quantities		
Market Systems	Non-STEM	Maximum Alternative Maximum Stem Price calculation	PASS	2008
Market Systems	Non-STEM	Incremental Reserve Capacity Ratio calculation	PASS	2008
Market Systems	Non-STEM	Prudential Requirements calculation	PASS	2008
Market Systems	STEM & Non-STEM	Change to the resource plan calculation	PASS	2009
Settlement	Other Settlement	Settlement of intermittent load generators	PASS	2009
Market Systems	Reserve Capacity	Supplementary Reserve Capacity calculation	PASS	2009
Market Systems	STEM	Inclusion of more than 50 participants in STEM auction and dispatch merit order calculations	PASS	2011

System	Version number	Changes to calculations affecting market outcomes?	Certification status
WEMS	2.6.6	No	Maintained
WEMS	2.6.7	Yes	Certified
WEMS	2.6.8	No	Maintained
WEMS	2.7.37	No	Maintained
WEMS	2.7.39	No	Maintained
WEMS	2.7.41	No	Maintained
WEMS	2.8.28	No	Maintained
WEMS	2.8.29	No	Maintained
WEMS	3.0.18	No	Maintained
WEMS	3.0.21	Yes	Certified
WEMS	3.1.36	No	Maintained
WEMS	3.1.41	No	Maintained
WEMS	3.1.43	Yes	Certified
WEMS	3.1.44	Yes	Certified
WEMS	3.1.45	No	Maintained
WEMS	3.2.8	No	Maintained
WEMS	3.3.12	No	Maintained
WEMS	3.4.11	Yes	Certified
WEMS	3.5.6	Yes	Certified
WEMS	3.6.12	Yes	Certified
WEMS	3.6.13	No	Maintained
WEMS	3.6.15	No	Maintained
WEMS	3.6.16	No	Maintained
WEMS	3.7.9	No	Maintained
WEMS	3.7.12	No	Maintained
WEMS	3.7.13	Yes	Certified

System	Version number	Changes to calculations affecting market outcomes?	Certification status
WEMS	3.8.5	No	Maintained
WEMS	3.8.6	No	Maintained
WEMS	3.9.2	Yes	Certified
WEMS	3.9.2 (AS-2456)	Yes	Certified
WEMS	3.10.99-15	Yes	Certified
WEMS	3.10.99-59	No	Maintained
WEMS	3.10-99-63	No	Maintained
WEMS	3.10-99-71	No	Maintained
WEMS	3.11.374-57	No	Maintained
WEMS	3.11.374-63	No	Maintained
WEMS	3.11.374-81	No	Maintained
WEMS	3.11.374-84	No	Maintained
WEMS	3.11.374-94	No	Maintained
WEMS	3.11.374-116	No	Maintained
WEMS	3.11.374-128	No	Maintained
WEMS	3.12-913-9	Yes	Certified
WEMS	3.12-913-35	No	Maintained
WEMS	3.13-981-1	No	Maintained
WEMS	3.13-981-6	No	Maintained
WEMS	3.14-1016-3	No	Maintained
WEMS	3.14-1016-4	No	Maintained
WEMS	3.16-1105-2	Yes	Certified
Metering	11 update 14	Yes	Certified
Metering	11.0.20	No	Maintained
Metering	11.0.25	No	Maintained
Metering	11.0.27	No	Maintained

System	Version number	Changes to calculations affecting market outcomes?	Certification status
Settlements	3.4.6	Yes	Certified
Settlements	3.4.7	No	Maintained
Settlements	3.4.8	Yes	Certified
Settlements	3.4.9	No	Maintained
Settlements	3.4.12	No	Maintained

Appendix 2 – Independent Assurance Report on AEMO’s compliance with the Gas Services Information Rules and GSI Procedures



ROBINSON BOWMAKER PAUL



AUSTRALIAN ENERGY MARKET OPERATOR

INDEPENDENT ASSURANCE REPORT ON AEMO'S COMPLIANCE WITH
THE GAS SERVICES INFORMATION RULES AND GSI PROCEDURES

11 SEPTEMBER 2017

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Document version: FINAL PUBLIC

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EXECUTIVE SUMMARY

This independent assurance report sets out the results of the market audit by Robinson Bowmaker Paul (RBP) assessing AEMO’s compliance with the Gas Services Information (GSI) Rules and GSI Procedures.

AUDITED ENTITY

The audited entity for this report is AEMO.

AUDIT PERIOD

The Audit Period is 1 July 2016 to 30 June 2017, both dates inclusive.

REGULATORY CONTEXT AND SCOPE

Regulatory context

The regulatory context for the audit is summarised in the table below.

Table 1: Regulatory context for the market audit

Rule reference	Comment
174 (1)	Requirement for AEMO to appoint market auditor at least annually
174(2)	Defines the scope of the Audit to include, at minimum: <ul style="list-style-type: none">the compliance of AEMO’s Internal Procedures and business processes with the GSI RulesAEMO’s compliance with the GSI Rules and Procedures AEMO’s software systems for the Gas Bulletin Board (GGB) and the calculation of GSI Fees and processes for software management

Scope

Given the regulatory context above, the purpose of the GSI Compliance Audit is to assess:

- How AEMO implements its obligations under the GSI Rules
- How AEMO manages non-compliance risk with respect to the obligations above

- Instances of non-compliance by AEMO during the Audit period.
- AEMO’s market software systems and its processes for software management. It includes an assessment of whether:
 - AEMO maintains appropriate records
 - The software used by AEMO to implement its obligations under the GSI Rules is compliant with the underlying mathematical formulations and the GSI Rules themselves.
 - AEMO has been compliant with its market systems certification obligations

The GSI Compliance Audit includes the following work streams:

- Compliance Assessment of AEMO’s operational compliance and application of controls to mitigate compliance risk
- Procedures Assessment of GSI Procedures and Internal Procedures that have changed during the Audit Period
- Software Compliance Assessment.
- Review of General IT Controls.

AUDIT CRITERIA

Criteria for determining operational and procedural compliance

The criterion we have used for determining the compliance of AEMO’s GSI Procedures (referred to as the *GSI Procedures*) is the Gas Services Information Rules dated 26 November 2016 (referred to as the *GSI Rules*).

The criteria we have used for determining AEMO’s operational compliance and the compliance of AEMO’s Internal Procedures are the GSI Rules and the GSI Procedures.

Criteria for determining control application

When assessing whether AEMO has applied effective controls during the Audit Period we have used relevant Internal Procedure and Confluence Work Instruction documentation as our audit criteria.

This includes the following:

Table 2: Procedures reviewed to assess control application

AEMO functional area	Procedures against which control application have has been assessed
Market Operations	Daily Operations Procedure

AEMO functional area	Procedures against which control application have has been assessed
	Rerunning GBB Reports GSI Budget Work Instructions
System Capacity	Preparation of GS00 Procedure
Finance	Determination of AEMO Budget Procedure and Fees Procedure
IT	Access Control and Authentication Standard, AEMO AD Domain Administrator Access Procedure, Application Security Standard, Backup Standard, Cyber Security Policy, Encryption Standard, Information Handling Guidelines, IT Security Incident Response Procedure, Logging and Log Management Standard, Malware Protection Standard, Mobile Computing and Remote Access Security Standard, Network Security Standard, Patch Management Standard, Secure Deletion and Disposal Standard, Workstation Security Standard, IT Change Management Policy, Incident Management Policy, Problem Management Policy, Software Configuration Management Plan

Where AEMO does not have documented controls or procedures relating to a business process under review we have used best practice criteria for a prudent market operator. This includes:

- The use of automated/semi-automated tools to reduce risk of errors
- Use of automated alerts or calendar reminders
- Approval and authorisation processes
- Issue escalation processes
- Validation and review processes
- Exception reporting

APPROACH

Assurance

Our audit has been conducted in accordance with Australian Auditing and Assurance Standards Board's '*Framework for Assurance Engagements*', ASAE 3000 '*Assurance Engagements Other than Audits and Reviews of Financial Information*'.

- We provide reasonable assurance under this standard with respect to our review of:
 - The compliance of the AEMO's Internal Procedures with the GSI Rules
 - The AEMO's software changes and the compliance of AEMO's market software with the GSI Rules and GSI Procedures

- We provide limited assurance under this standard with respect to our review of:
 - The AEMO’s compliance with the GSI Rules and GSI Procedures
 - The AEMO’s software management processes and controls

Risk ratings and materiality

Compliance and risk ratings

Table 3: Compliance and risk rating definitions

Compliance rating	Risk Rating
1: Instances of non-compliance with the GSI Rules	Critical: Potential for catastrophic impact on market or system operations or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level.
2: Findings that are not an instance of non-compliance, but pose compliance risk	Significant: Potential for major impact on market or system operations or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings.
3: Findings related to minor housekeeping issues that do not affect compliance risk	Medium: Potential for moderate impact on market or system operations or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring.
	Low: Potential for minor impact on market or system operations or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

Materiality (qualification of audit opinion)

In determining whether to qualify our opinion on whether AEMO has complied “in all material respects”, we have taken the following factors into account:

- Purpose and objectives of the market audit
- AEMO’s overall objectives
- AEMO’s risk matrix definitions of impact
- Financial impacts on Gas Market Participants
- The number of Gas Market Participants or other stakeholders affected
- The impact of an issue on market objectives such as transparency, equity and efficiency
- Whether an issue is systemic
- Whether an issue is recurring (from previous audits)

Audit activities

We have undertaken a combination of:

- Reviewing self-reported incidents of AEMO non-compliance with the GSI Rules and GSI Procedures
- Business process walkthroughs and interviews with staff
- Reviewing AEMO's GSI Procedures, Internal Procedures and IT Procedures to ensure GSI Rules changes and other changes (e.g. processes, systems, etc.) have been reflected in the procedures.
- Compliance testing to audit AEMO's operational compliance with the GSI Rules and GSI Procedures and to determine the effectiveness of operating controls¹.

The first two activities were conducted as part of two field-visits (one undertaken in March 2017 and the other in June 2017). Remaining activities have been undertaken remotely.

Compliance testing and business process walkthroughs were focussed on subset of functional areas based on residual compliance risk, materiality, and rule changes occurring in the Audit Period. These areas include:

Table 4: Audit focus areas

AEMO functional area	Focus area
Market Operations	Daily GBB Operations Calculation of GSI Fees (initial and adjustment)
System Capacity	Preparation and publication of the GSOO report
Finance	Calculation and publication of GSI budget and market fees (considering recent changes in fee categories)
IT	Business continuity, service management, and user-facing information security policies and procedures

¹ In doing so, we have sourced information from all AEMO (WA) teams, with a particular emphasis on the market operations team.

AUDIT FINDINGS

Comment

Continuing improvement in compliance management practices

We continue to note increasing levels of maturity in managing compliance and a strong compliance culture.

- Audit findings from previous years have been consistently addressed and closed with no material recurring themes noted. The majority of medium risk audit findings from the current Audit Period have been addressed and closed promptly.
- There have only been four instances of minor non-compliance (i.e. compliance rating 1 findings, all of which have a low risk rating) with the GSI Rules and GSI Procedures, half of which have been self-reported by AEMO; this speaks to both the effectiveness of AEMO's detective controls and strong compliance culture.
- Our site visits have indicated that AEMO teams maintain and apply effective controls to manage compliance risk.

Scope to improve business continuity planning and testing

AEMO maintains redundant IT systems, so that the market can continue to operate in the event of losing one data centre. Both data centres are regularly exercised, by running production market systems from each location at regular intervals. While this is perhaps the most critical part of AEMO's business continuity preparation, other aspects of business continuity have not been explored. We have not seen evidence of any business continuity testing beyond system failover and backup restoration testing. This means that reliance on key people, office premises, physical equipment, and communications channels has not been tested.

AEMO has initiated an organisation wide review and update of Business Continuity Plans as part of its move to a new organisational structure.

Summary

Table 5 below summarises the total number of audit findings (broken down by risk rating) reported during the 2015/16 and 2016/17 Audit Periods.

Note that in Table 5, of the 13 reported findings for 2016/17, six findings relate to the review of AEMO's general IT controls; likewise, of the eight open findings, five relate to the review of AEMO's

general IT controls. Please note that these findings are also reported in the 2016/17 Electricity Compliance Audit Report and apply to the GSI Compliance Audit as well.

Table 5: Audit finding summary by risk rating and open/closed status, 2015/16 and 2016/17.

	2015/16 Findings	2016/17 Findings		
Risk Rating	Total	Total	Closed	Open
Significant	0	0	0	0
Medium	0	1	0	1
Low	3	12	5	7
Total	3	13	5	8

Table 6: Summary of audit findings

Ref	Issue type & process	Risk & Compliance Rating	Finding	Recommendation
17 GSI 2.01	Issue Type RBP & AEMO reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	Two instances of early publication of GBB reports due to error during manual report rerun	No recommendations – AEMO is pursuing appropriate remediating actions
17 GSI 2.02	Issue Type RBP reported non-compliance Process Finance	Risk Rating Low Compliance Rating 1	Failure to publish GSI Financial Report	Update Internal Procedures to document this process
17 GSI 2.03	Issue Type AEMO Self-reported non-compliance Process Market Operations	Risk Rating Low Compliance Rating 1	GSI Fees adjustment calculated incorrectly (Q1 2017) due to error in procedure	No recommendations – AEMO has updated procedures to correct error
17 GSI 2.04	Issue Type N/A Process Finance	Risk Rating Low Compliance Rating 2	GSI invoicing process (finance) manual with some risk of error	<ul style="list-style-type: none"> • Document the process used to create invoices including validation/error checking controls • Investigate ways to enhance the efficiency of the invoice creation process and to reduce the amount of manual manipulation

Ref	Issue type & process	Risk & Compliance Rating	Finding	Recommendation
17 GSI 2.05	Issue Type N/A Process System Capacity	Risk Rating Low Compliance Rating 2	Validation processes for GSOO data registers are undocumented	No recommendations - AEMO has updated the relevant procedure
17 GSI 2.06	Issue Type N/A Process System Capacity	Risk Rating Low Compliance Rating 2	Documentation for GSOO Data Collection process can be improved	No recommendations - AEMO has updated the relevant procedure
17 GSI 2.07	Issue Type N/A Process Various	Risk Rating Low Compliance Rating 3	Missing obligations in AEMO's Internal Procedures	AEMO should update the relevant Internal Procedures to pick up gaps and transitional rule changes
17 WEM 2.39	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 2	Documentation for backup architecture not available	Ensure that current backup refresh project delivers documentation for the architecture of the backup environment
17 WEM 2.40	Issue Type N/A Process IT	Risk Rating Medium Compliance Rating 2	Business continuity exercises are limited to system failovers	Plan and conduct regular desk-based and live business continuity exercises covering selected credible contingency scenarios
17 WEM 2.41	Issue Type N/A	Risk Rating Low	WA backup media not encrypted as required by AEMO Encryption Standard	<ul style="list-style-type: none"> Consider backup media encryption as part of backup refresh project.

Ref	Issue type & process	Risk & Compliance Rating	Finding	Recommendation
	Process General	Compliance Rating 2		
17 WEM 2.43	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 3	New IT applications staff have had limited exposure to service management concepts	Ensure support staff have appropriate service management training
17 WEM 2.44	Issue Type N/A Process IT	Risk Rating Low Compliance Rating 3	Configuration management system could be improved	<ul style="list-style-type: none"> • Ensure support staff have appropriate service management training • Consider refreshing CMDB as part of the wider AEMO service management programme
17 WEM 2.45	Issue Type N/A Process IT	Risk Rating Medium Compliance Rating 2	One data centre is not Tier III aligned	Consider moving to a more distant Tier III aligned data centre site as part of next data centre lifecycle refresh project.

OPINION

Qualifications

We have no qualifications to note with respect to the opinions provided below.

Conclusion

Opinion on the compliance of AEMO's GSI and Internal Procedures with the GSI Rules

Subject to the inherent limitations set out in Section 1.5.4, based on the audit procedures we have performed and the evidence we have examined, AEMO's GSI Procedures and Internal Procedures are compliant with the GSI Rules.

Opinion on AEMO's operational compliance with the GSI Rules and GSI Procedures

Subject to the inherent limitations set out in Section 1.5.4, based on the audit procedures we have performed and the evidence we have examined, nothing has come to our attention that causes us to believe AEMO has not been compliant with the GSI Rules and GSI Procedures during the Audit Period, in all material respects

Opinion on the compliance of AEMO's Market Software Systems with the GSI Rules

Based on the audit procedures we have performed and the evidence we have examined, AEMO's Market Software Systems are compliant with the GSI Rules in all material respects.

Opinion with respect to the compliance of AEMO's software management processes with the GSI Rules

Subject to the inherent limitations set out in Section 1.5.4, based on the audit procedures we have performed and the evidence we have examined, nothing has come to our attention that causes us to believe that AEMO's processes for software management have not been compliant with the GSI Rules and GSI Procedures during the Audit Period in all material respects.

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1 INTRODUCTION

This chapter sets out the regulatory context for the GSI Compliance Audit and our approach to performing the audit.

1.1 AUDITED ENTITY

The audited entity for this report is AEMO.

1.2 AUDIT PERIOD

The Audit Period is 1 July 2016 to 30 June 2017, both dates inclusive.

1.3 REGULATORY CONTEXT AND SCOPE

1.3.1 Regulatory context

The regulatory context for the audit is summarised in the table below.

Table 7: Regulatory context for the market audit²

Rule reference	Comment
174 (1)	Requirement for AEMO to appoint market auditor at least annually
174(2)	Defines the scope of the Audit to include, at minimum: <ul style="list-style-type: none">• the compliance of AEMO's Internal Procedures and business processes with the GSI Rules• AEMO's compliance with the GSI Rules and Procedures• AEMO's software systems for the Gas Bulletin Board (GGB) and the calculation of GSI Fees and processes for software management

1.3.2 Scope

Given the regulatory context above, the purpose of the GSI Compliance Audit is to assess:

² Rules references are as at 31 May 2017 unless otherwise indicated

- How AEMO implements its obligations under the GSI Rules
- How AEMO manages non-compliance risk with respect to the obligations above
- Instances of non-compliance by AEMO during the Audit Period.
- AEMO's market software systems, its processes for software management, and its general IT controls. It includes an assessment of whether:
 - AEMO maintains appropriate records
 - The software used by AEMO to implement its obligations under GSI Rules is compliant with the underlying mathematical formulations and the GSI Rules themselves.
 - AEMO has been compliant with its market systems certification obligations

The GSI Compliance Audit includes the following work streams:

- Compliance Assessment of:
 - Areas where we have noted breaches or non-compliance risk during past audits.
 - Areas that have changed or been introduced in the past Audit Period (e.g. in terms of rule changes, system changes, operational practice changes)
 - AEMO's self-reported instances of non-compliance with the GSI Rules
 - Areas of potential risk identified by Gas Market Participants during the Stakeholder Session on 23 March 2017.
- Procedures Assessment of GSI Procedures and Internal Procedures that have changed during the Audit Period.
- Software Compliance Assessment. We reviewed the software used to meet obligations under the GSI Rules. In particular, we:
 - Reviewed AEMO's Market Systems (used to implement GSI obligations), and in particular the nature of changes to the Gas Bulletin Board (GGB) software and GSI Fees tool to assess compliance with Part 1 Rule 19(1) of the GSI Rules
 - Reviewed AEMO's software management processes.
- Review of General IT Controls. This year we have broadened the scope of our software management process review to encompass general IT controls not reviewed (or reviewed only in part) in previous years. This review covers:
 - Change and release management for all AEMO WA systems
 - Incident and problem management
 - Backup arrangements, retention and restoration

- Authentication, authorisation and access management
- Database management
- User-facing information security controls

1.4 AUDIT CRITERIA

1.4.1 Criteria for determining operational and procedural compliance

The criterion we have used for determining the compliance of AEMO’s GSI Procedures (referred to as the *GSI Procedures*) is the Gas Services Information Rules dated 26 November 2016 (referred to as the *GSI Rules*).

The criteria we have used for determining AEMO’s operational compliance and the compliance of AEMO’s Internal Procedures are the GSI Rules and the GSI Procedures.

1.4.2 Criteria for determining control application

When assessing whether AEMO has applied effective controls during the Audit Period we have used relevant Internal Procedure and Confluence Work Instruction documentation as our audit criteria.

This includes the following:

Table 8: Procedures reviewed to assess control application

AEMO functional area	Procedures against which control application have has been assessed
Market Operations	Daily Operations Procedure Rerunning GBB Reports GSI Budget
System Capacity	Preparation of GSOO Procedure
Finance	Determination of AEMO Budget Procedure and Fees Procedure
IT	Access Control and Authentication Standard, AEMO AD Domain Administrator Access Procedure, Application Security Standard, Backup Standard, Cyber Security Policy, Encryption Standard, Information Handling Guidelines, IT Security Incident Response Procedure, Logging and Log Management Standard, Malware Protection Standard, Mobile Computing and Remote Access Security Standard, Network Security Standard, Patch Management Standard, Secure Deletion and Disposal Standard, Workstation Security Standard, IT Change Management Policy, Incident Management Policy, Problem Management Policy, Software Configuration Management Plan

Where AEMO does not have documented controls or procedures relating to a business process under review we have used best practice criteria for a prudent market operator. This includes:

- The use of automated/semi-automated tools to reduce risk of errors
- Use of automated alerts or calendar reminders
- Approval and authorisation processes
- Issue escalation processes
- Validation and review processes
- Exception reporting
- Practices at other market operators with which we are familiar.

1.5 APPROACH

1.5.1 Assurance

Our audit has been conducted in accordance with Australian Auditing and Assurance Standards Board's '*Framework for Assurance Engagements*', ASAE 3000 '*Assurance Engagements Other than Audits and Reviews of Financial Information*'.

- We provide reasonable assurance under this standard with respect to our review of:
 - The compliance of the AEMO's Internal Procedures with the GSI Rules
 - The AEMO's software changes and the compliance of AEMO's market software systems with the GSI Rules and GSI Procedures
- We provide limited assurance under this standard with respect to our review of:
 - The AEMO's compliance with the GSI Rules and GSI Procedures
 - The AEMO's software management and general IT processes and controls.

1.5.2 Risk ratings and materiality

Compliance and risk ratings

Audit findings are categorised as follows:

Table 9: Compliance and risk rating definitions

Compliance rating	Risk Rating
1: Instances of non-compliance with the GSI Rules	Critical: Potential for catastrophic impact on market or system operations or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level.
2: Findings that are not an instance of non-compliance, but pose compliance risk	Significant: Potential for major impact on market or system operations or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings.
3: Findings related to minor housekeeping issues that do not affect compliance risk	Medium: Potential for moderate impact on market or system operations or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring.
	Low: Potential for minor impact on market or system operations or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

Further information on risk and compliance ratings is provided in Appendix A.

Materiality (qualification of audit opinion)

In determining whether to qualify our opinion on whether AEMO has complied “in all material respects”, we have taken the following factors into account:

- Purpose and objectives of the market audit
- AEMO’s overall objectives
- AEMO’s risk matrix definitions of impact
- Financial impacts on Gas Market Participants
- The number of Gas Market Participants or other stakeholders affected
- The impact of an issue on market objectives such as transparency, equity and efficiency
- Whether or not an issue is systemic
- Whether or not an issue is recurring (from previous audits)

1.5.3 Audit activities

We have undertaken a combination of:

- Reviewing self-reported incidents of AEMO non-compliance with the GSI Rules and GSI Procedures

- Business process walkthroughs and interviews with staff to audit the application of operating controls and to determine the level of compliance risk associated with selected business processes.
- Reviewing AEMO’s GSI Procedures, Internal Procedures and IT Procedures to ensure GSI Rules changes and other changes (e.g. processes, systems, etc.) have been reflected in the procedures.
- Compliance testing to audit AEMO’s operational compliance with the GSI Rules and GSI Procedures and to determine the effectiveness of operating controls. In doing so, we have sourced information from all AEMO (WA) teams, with a particular emphasis on the market operations team.

The first two activities were conducted as part of two field-visits (one undertaken in March 2017 and the other in June 2017). Remaining activities have been undertaken remotely.

Compliance testing and business process walkthroughs were focussed on subset of functional areas based on residual compliance risk, materiality, and rule changes occurring in the Audit Period. These areas include:

Table 10: Audit focus areas

AEMO functional area	Focus area
Market Operations	Daily GBB Operations Calculation of GSI Fees (initial and adjustment)
System Capacity	Preparation and publication of the GS00 report
Finance	Calculation and publication of GSI budget and market fees (considering recent changes in fee categories)
IT	Business continuity, service management, and user-facing information security policies and procedures

1.5.4 Inherent limitations

As in previous years, we note that there are limitations to any external audit. Audits are not an absolute guarantee of the truth or reliability of agency information or the effectiveness of internal controls. They may not identify all matters of significance. This is because external audit techniques involve:

- Professional judgement as to “good industry and market operational practice”
- The use of sample testing
- An assessment of the effectiveness of internal control structures and
- An assessment of risk.

A market audit does not guarantee every procedure and action carried out in the operation of the market in the audit report, nor does it examine all evidence and every transaction. However, our audit procedures should identify errors or omissions significant enough to adversely affect market outcomes.

Our opinion with respect to AEMO’s compliance with the GSI Rules and GSI Procedures is therefore subject to the following caveats:

- Our audit procedures did not include assessing irregularities such as fraudulent or illegal activities. As such, our audit should not be relied upon to disclose such irregularities. However, if we were to detect any fraudulent or illegal activity, we would report this to AEMO. No such findings have been made during this audit.
- Our audit is not designed to detect all weaknesses in control procedures as it is not performed continuously throughout the Audit Period and is performed on a sample basis.

1.6 STRUCTURE OF THIS REPORT

The remainder of this report is structured as follows:

- Chapters 2 to 11 present our audit findings relating to the Compliance Assessment and Procedures Assessment work streams on an GSI Rule Chapter by Chapter basis.
- Chapter 12 presents findings relating to the IT work streams

1.7 ACKNOWLEDGMENTS

RBP would like to thank AEMO managers and staff who willingly provided information and shared in discussions with us while we carried out this audit.

2 PART 1 – INTRODUCTORY & ADMINISTRATIVE MATTERS

Part 1 of the GSI Rules sets out the Introduction to the GSI Rules and covers areas such as the objectives of the market, conventions and transitional arrangements.

2.1 RULE AMENDMENTS

There have been transitional changes to Part 1 to reflect reallocation of obligations across AEMO, the Independent Market Operator (IMO) and the Economic Regulation Authority (ERA).

2.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 1 of the GSI Rules in all material respects.

2.3 OPERATIONAL COMPLIANCE WITH PART 1

We have not conducted any audit procedures to assess AEMO's compliance with Part 1 of the GSI Rules.

There have been no self-reported instances of non-compliance with Part 1.

3 PART 2 - REGISTRATION

Part 2 of the GSI Rules covers the registration of Gas Market Participants and facilities, including registration, deregistration, transfers, and exemptions.

3.1 RULE AMENDMENTS

There have been transitional changes to Part 2 to reflect reallocation of obligations across AEMO, the Independent Market Operator (IMO) and the Economic Regulation Authority (ERA).

3.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 2 of the GSI Rules in all material respects.

3.3 OPERATIONAL COMPLIANCE WITH PART 2

We have not conducted any audit procedures to assess AEMO's compliance with Part 2 of the GSI Rules.

There have been no self-reported instances of non-compliance with Part 2.

4 PART 3 – PROVISION OF INFORMATION FOR GBB

Part 3 of the GSI Rules deals with the GBB information requirements pertaining to Gas Market Participants and the various classes of Facilities.

4.1 RULE AMENDMENTS

There have been no amendments to Part 3.

4.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 3 of the GSI Rules in all material respects.

4.3 OPERATIONAL COMPLIANCE WITH PART 3

AEMO has limited obligations under Part 3; the obligations are all automated via the GBB which is certified. Therefore, we have not conducted any audit procedures to assess AEMO's compliance with Part 3 of the GSI Rules.

There have been no self-reported instances of non-compliance with Part 3.

5 PART 4 – THE GAS BULLETIN BOARD

Part 4 of the GSI Rules describes the information that is required to be published on the Gas Bulletin Board.

5.1 RULE AMENDMENTS

There have been no amendments to Part 4.

5.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 4 of the GSI Rules in all material respects.

5.3 OPERATIONAL COMPLIANCE WITH PART 4

5.3.1 Audit activities

- We conducted a (real-time) business process walkthrough to determine whether AEMO has complied with Part 4 of the GSI Rules and its Internal Procedure (relating to daily GBB Operations) and whether AEMO has applied appropriate controls when conducting the daily market operations shift.
- Reviewed system logs to compliance test whether AEMO has published daily and monthly GBB reports in accordance with Part 4.
- Reviewed AEMO's procedures for rerunning GBB reports when there are errors/omissions in data submission and reports must be recreated manually.

5.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Part 4 are summarised in the table below.

Table 11: Operational compliance findings associated with Part 4 of the GSI Rules

Ref	Issue Type & Obligation	Risk & Compliance Rating	Finding	Recommendation
17 GSI 2.01	<p>Issue Type AEMO & RBP reported non-compliance (New issue)</p> <p>Obligation Section 4.3.5 of GSI Procedure Operation of the Gas Bulletin Board (WA) and the Emergency Management Facility</p>	<p>Risk Rating Low</p> <p>Compliance Rating Level 1</p>	<p>Two instances of early publication of GBB reports due to error during manual report rerun. There have been two instances where GBB reports have been released early to the market due to human error in rerunning GBB reports to incorporate data that has been submitted late. AEMO’s procedures state explicitly the process that must be followed in such instances but due to human error this process was not followed.</p> <p>AEMO is pursuing a number of remediating actions including:</p> <ul style="list-style-type: none"> • Emailing and reminding teams of process to follow when rerunning GBB reports and the importance of following the work instructions • Requesting improved validation functionality in the release of GBB version 1.9 	<p>No recommendations – AEMO is pursuing appropriate remediating actions.</p>

6 PART 5 – EMERGENCY MANAGEMENT FACILITY

Part 5 of the GSI Rules describes the operation of the Emergency Management Facility (EMF), the information that is to be published on the EMF, and the access requirements and limitations.

6.1 RULE AMENDMENTS

There have been no amendments to Part 5 of the GSI Rules.

6.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 5 of the GSI Rules in all material respects.

6.3 OPERATIONAL COMPLIANCE WITH PART 5

We have not conducted any audit procedures to assess AEMO's compliance with Part 5 of the GSI Rules.

There have been no self-reported instances of non-compliance with Part 5.

7 PART 6 – THE GAS STATEMENT OF OPPORTUNITIES

Part 6 of the GSI Rules describes the high-level requirements for the publication and content of the Gas Statement of Opportunities (GSOO).

7.1 RULE AMENDMENTS

There have been no amendments to Part 6 of the GSI Rules.

7.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 6 of the GSI Rules in all material respects.

7.3 OPERATIONAL COMPLIANCE WITH PART 6

7.3.1 Audit activities

- We conducted a (retrospective) business process walkthrough to determine whether AEMO has complied with the GSI Rules and its Internal Procedures and whether AEMO has applied appropriate controls when preparing the 2016 GSOO report.
- We reviewed the 2016 GSOO report to ensure its contents were consistent with the requirements of Part 6 of the GSI Rules.

7.3.2 Audit findings

Areas of compliance risk associated with Part 6 are summarised in the table below.

There have been no self-reported instances of non-compliance with Part 6.

Table 12: Operational compliance findings associated with Part 6 of the GSI Rules

Ref	Issue Type & Obligation	Risk & Compliance Rating	Finding	Recommendation
17 GSI 2.05	<p>Issue Type RBP reported compliance issue</p> <p>Obligation N/A (New issue)</p>	<p>Risk Rating Low</p> <p>Compliance Rating 2</p>	<p>Validation processes for GSOO data registers are undocumented. AEMO staff undertake a range of validation processes to ensure the data registers used in the GSOO processes are correct. This includes historical comparisons, checking for manifest errors as well as verification by senior analysts. During site visits we noted these validation procedures are not documented in the GSOO procedures. AEMO has since documented validation procedures in the GSOO Internal Procedure.</p>	<p>No recommendations – the relevant Internal Procedure has been updated to incorporate this recommendation.</p>
17 GSI 2.06	<p>Issue Type RBP reported compliance issue</p> <p>Obligation Rule 103, Rule 104 (New issue)</p>	<p>Risk Rating Low</p> <p>Compliance Rating 2</p>	<p>Documentation for GSOO Data Collection process can be improved. Data for the GSOO is obtained from multiple sources including the GBB, AEMO subscriptions, public website, AEMO contract data, Gas Market Participants and external (forecasting) consultants. During site visits we noted that the GSOO procedure did not reflect accurately the data collection process. As data collection is a crucial part of the GSOO, it should be documented at a high level at least (precise data requirements may change from year to year so there is limited value in documenting the process in detail). AEMO has since documented the data collection process in the GSOO Internal Procedure.</p>	<p>No recommendations – the relevant Internal Procedure has been updated to incorporate this recommendation.</p>

8 PART 7 – BUDGET AND FEES

Part 7 of the GSI Rules covers AEMO’s allowable revenue, budget and fees.

8.1 RULE AMENDMENTS

Amendments to Part 7 include only transitional changes to reflect the transfer of IMO functions to the ERA.

8.2 AEMO PROCEDURES

AEMO’s GSI Procedures and Internal Procedures are compliant with Part 7 of the GSI Rules in all material respects.

We have noted a small number of obligations that are undocumented.

Table 13: Procedural findings associated with the GSI Rules

Ref	Finding	Risk & Compliance Rating	Recommendation
17GSI2.07	A small number of obligations are undocumented	Low Level 3	AEMO should update its procedures to document the missing obligations.

8.3 OPERATIONAL COMPLIANCE WITH PART 7

8.3.1 Audit activities

- We have conducted (retrospective) business process walkthroughs to determine whether AEMO has complied with the GSI Rules and its Internal Procedures and whether AEMO has applied appropriate controls in the following areas:
 - Determination and publication of AEMO budget (Part 7, Division 3 of the GSI Rules)
 - Preparation and sending of GSI fees invoices (Part 7, Division 4 of the GSI Rules)

- We have reviewed GSI initial and adjustment invoices for one quarter to check whether Gas Market Participants were invoiced for the correct amounts.
- We have reviewed the GSI Fees Tool to evaluate whether the fees calculations are compliant with rule 116 of the GSI Rules. See also Section 12.2.

8.3.2 Audit findings

Instances of non-compliance and areas of compliance risk associated with Part 7 are summarised in the table below.

Table 14: Operational compliance findings associated with Part 7 of the GSI Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
17 GSI 2.02	Issue Type RBP reported compliance issue Obligation Rule 111(1)(b) (New issue)	Risk Rating Low Compliance Rating 1	<p>Failure to publish historical GSI Financial Report. The GSI Rules require AEMO to publish by 30 October a historical financial report comparing actuals to budgeted amounts. AEMO failed to publish the GSI Financial Report for the 2015/16 financial year on 30 October 2016 due to an oversight.</p> <p>Other GSI budgeting and fee obligations follow the overall AEMO budget cycle which happens to be aligned to the rule mandated timelines (i.e. all budgets and fees published by end of the financial year (30 June)). The historical financial reports are unique to WA and do not follow the financial year cycle – hence oversight and failure to publish is possible without adequate controls.</p> <p>AEMO published the 2015/16 historical financial report in June 2017 and has instituted calendar alerts to ensure the breach does not recur.</p>	AEMO should update its Internal Procedures to document this process
17 GSI 2.03	Issue Type AEMO Self- reported non- compliance Obligation	Risk Rating Low Compliance Rating 1	<p>GSI Fees adjustment calculated incorrectly (Q1 2017) due to error in procedure. AEMO calculated GSI fee adjustments using incorrect Aggregated Shipper Delivery Quantities for Q1 2016 in Q1 2017 as a result of a manual error. AEMO's documented procedures for calculating GSI fees adjustments were incorrect where AEMO issued a corrected initial invoice under GSI Rule 118(2). The procedure specified</p>	No recommendations – AEMO has implemented adequate remedial actions.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	Rule 116(2) (New issue)		<p>incorrectly the date range for the data to be extracted for adjustment calculation when a correction has been undertaken for the initial invoice run under rule 118(2) of the GSI Rules. As a result, incorrect adjustment invoices were sent out for the Q1 2016 invoice adjustment. Gas Market Participants have been told to ignore the adjustment invoices. Hence, there was no adverse financial impact.</p> <p>AEMO has updated its procedures to reflect correct date ranges when a corrected initial invoice is issued under rule 118(2) of the GSI Rules and has also reminded staff of the process to follow when an invoice is rerun under rule 118(2) of the GSI Rules.</p>	
17 GSI 2.04	Issue Type RBP reported compliance issue Obligation Rule 117 (New issue)	Risk Rating Low Compliance Rating 2	<p>GSI invoicing process is manual with some risk of error. AEMO uses a certified semi-automated tool to calculate GSI fees payable and to generate invoice summaries. These summaries are then converted into Gas Market Participant invoices using an undocumented manual process to create invoices based on the outputs of the GSI fees tool. The process involves manually inputting hard-coded formula to calculate total fees payable based on the initial and adjustment fees calculated by the GSI fees tool. Further manual manipulation is further required if a Gas Market Participant has multiple facilities due to the shortcomings of the invoicing tools.</p> <p>We note that AEMO does conduct validation and error checking by comparing final invoice amounts to the invoiced summaries produced by the GSI fees tool. However, given the volume of data such validation may miss errors.</p>	<ul style="list-style-type: none"> • Document the process used to create invoices including validation/error checking controls • Investigate ways to enhance the efficiency of the invoice creation process and to reduce the amount of manual manipulation

9 PART 8 – RULE CHANGES

Part 8 of the GSI Rules details the process for making changes to the GSI Rules.

9.1 RULE AMENDMENTS

Amendments to Part 8 include only transitional changes to reflect the transfer of IMO functions to the ERA.

9.2 AEMO PROCEDURES

AEMO has no obligations under Part 8 of the GSI Rules. Therefore, AEMO has no procedures relating to Part 8.

9.3 OPERATIONAL COMPLIANCE WITH PART 8

As noted above, AEMO has no obligations under Part 8 of the GSI Rules. Therefore, we have conducted no audit activities in relation to Part 8.

10 PART 9 – GSI PROCEDURES

Part 9 of the GSI Rules details the process for developing and changing GSI Procedures.

10.1 RULE AMENDMENTS

Amendments to Part 9 include only transitional changes to reflect the transfer of IMO functions to the ERA.

10.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 9 of the GSI Rules in all material respects. Please refer to Table 13Table 13 for audit findings relating to AEMO's procedures

10.3 OPERATIONAL COMPLIANCE WITH PART 9

No procedure changes have been progressed or implemented during the Audit Period. Therefore, we have conducted no audit activities relating to Part 9.

There have been no self-reported instances of non-compliance with Part 9.

11 PART 10 – COMPLIANCE AND ENFORCEMENT

Part 10 of the GSI Rules describes the monitoring, investigating and enforcing compliance of Gas Market Participants with the GSI Rules and GSI Procedures. It also covers auditing of AEMO's own compliance.

11.1 RULE AMENDMENTS

Amendments to Part 10 include only transitional changes to reflect the transfer of IMO functions to the ERA.

11.2 AEMO PROCEDURES

AEMO's GSI Procedures and Internal Procedures are compliant with Part 10 of the GSI Rules in all material respects. Please refer to Table 13Table 13 for audit findings relating to AEMO's procedures.

11.3 OPERATIONAL COMPLIANCE WITH PART 10.

We have conducted no audit activities relating to Part 10.

There have been no self-reported instances of non-compliance with Part 10.

12 GSI SYSTEMS AND IT CONTROLS

This chapter covers the compliance of AEMO's software systems for the GBB and GSI Fees calculations and software management processes with the GSI Rules and GSI Procedures, in accordance with rule 174(2)(c) of the GSI Rules.

- Section 12.1 sets out our review of AEMO's software systems for the GBB and the calculation of GSI Fees
- Section 12.2 sets out our review of AEMO's general IT controls, including processes for software management.

12.1 COMPLIANCE OF AEMO SOFTWARE

The software testing and certification process assesses whether the mathematical formulations specified in the GSI Rules and GSI Procedures have been correctly implemented by the software.

The software systems covered by this section of the review are:

- The Gas Bulletin Board (GBB)
- The GSI Fee Calculation Tool.

12.1.1 Certification of the GBB

The initial version of the GBB was certified in June 2013, prior to the official start of GBB operations on 1 August 2013. Since that time, a number of minor changes have been made to the GBB systems, none of which, in the IMO's or AEMO's opinion, required certifying under rule 19.

19 Certifying GBB software

(1) Subject to this rule, AEMO must ensure that any version of the GBB software used by AEMO has been certified as compliant with the Rules and Procedures by an independent auditor.

(2) AEMO may implement changes to the current version of the GBB software without obtaining certification under subrule (1) where AEMO considers that the change will not have a material impact on any one or more of the following:

(a) the provision of information to AEMO by Gas Market Participants under the Rules;

(b) the processing and publication of information on the GBB or the EMF; or

(c) the calculation and processing of GSI Invoices.

(3) Where AEMO considers that changes to the current version of the GBB software are urgently required and essential for the efficient operation of the GBB, AEMO may implement the changes to the current version of the GBB software prior to certification under subrule (1), and must obtain that certification as soon as practicable.

Details of production software changes made prior to this Audit Period are shown in Table 15. Releases with certification status of 'maintained' did not require additional testing, as they did not involve changes that would be expected to have material impact on prices or quantities.

Table 15: Previous production software changes

System	Version number	Release date	Material impact under 19(2)?	Certification status
GBB	1.0	01/08/2013	Yes	Certified
GBB	1.0.9	20/08/2013	No	Maintained
GBB	1.1.3	11/12/2013	No	Maintained
GBB	1.1.4	19/12/2013	No	Maintained
GBB	1.2.0	23/01/2014	No	Maintained
GBB	1.2.38	30/01/2014	No	Maintained
GBB	1.2-57.7	25/06/2014	No	Maintained
GBB	1.3-145	27/08/2014	No	Maintained
GBB	1.3-145-3	8/01/2015	No	Maintained
GBB	1.4-193	18/03/2015	No	Maintained
GBB	1.4-201	20/05/2015	No	Maintained
GBB	1.4-209-7	9/09/2015	No	Maintained
GBB	1.5-255-3	3/11/2015	No	Maintained

System	Version number	Release date	Material impact under 19(2)?	Certification status
GBB	1.6-289-4	29/11/2015	No	Maintained
GBB	1.6-289-7	30/03/2016	No	Maintained
GBB	1.7-303-6	21/06/2016	No	Maintained

For this audit, we reviewed the release notes for all changes made to the GBB during the Audit Period and assessed the changes in relation to rule 19(2) of the GSI Rules. In each case, we agreed with AEMO that certification was not required. The details of these changes are shown in Table 16.

Table 16: Changes to GBB systems in the Audit Period

System	Version number	Release date	Material impact under 19(2)?	Certification status	Comment
GBB	1.8-316-4	7/11/2016	No	Maintained	Updates to web user interface

12.1.2 Certification of the GSI Fee Calculation Tool

While the GSI Fee Calculation Tool is not specifically required to be certified under the GSI Rules, the calculation of GSI Fees is a part of this compliance audit.

There have been no changes to the GSI Fee Calculation Tool in the Audit Period, and none since the tool was certified in June 2016.

We have nevertheless reviewed the versions of the GSI Fee Calculation tool (used for the Q1 2017 fee calculations) to ensure the fee amounts are compliant with rule 116 of the GSI Rules.

During our review, we assumed the data extraction functionality was accurate; given there have been no changes to the tool since June 2016, this is a reasonable assumption. We have instead focussed on the unlocked components of the excel front-end.

Our review has indicated that the tool is compliant with GSI Rule 116. We have, however, noted that the tool calculates the quantity in rule 116(1) of the GSI Rules³ assuming that unrecoverable amounts

³ $F(p) = [Budget(y) + Regulator Fees(y)] \times \frac{days\ in\ p}{days\ in\ y} + U(p) - UR(p)$

(U(p)) and recovered unrecoverable amounts (UR(p)) are zero. In the event these quantities are non-zero, a manual adjustment must be made to the input quantities. However, this adjustment is covered in AEMO's work instructions. Therefore, the risk of non-compliance is negligible.

12.1.3 Compliance of GSI software with the GSI Rules

We have no audit findings to report with respect to the compliance of the GSI software with the GSI Rules.

12.2 GENERAL IT CONTROLS (INCLUDING SOFTWARE MANAGEMENT)

General IT controls are also reviewed in the Electricity Compliance Audit. We carried out a single review covering both audits. For consistency, we report the same findings here using the same reference number, although we note that there may be references to functions or sites that are not part of AEMO's GSI function.

12.2.1 Audit activities

We reviewed AEMO's policies and procedures for:

- Business continuity
- Service management
- User-facing information security policies and procedures

We carried out compliance testing on:

- User password requirements
- Release notes
- Service management records (including AEMO Jira and ServiceNow incident, problem, change and release records)
- Data centre specifications;
- Application and system logs
- Backup schedule, and backup restoration tasks

12.2.2 Management of the GBB software

AEMO's obligations in this regard are specified in rule 18(1) of the GSI Rules.

18(1) Where AEMO uses software (GBB software) and IT systems (GBB systems) to receive, store, collate and publish information for the operation of the GBB, AEMO must:

- (a) maintain a record of which version of GBB software was used at each point in time;
- (b) where changes are made to GBB software, maintain records of the differences between each version and the reasons for the changes between versions;
- (c) ensure that appropriate testing of new GBB software versions is conducted; and
- (d) ensure that any version of the GBB software used by AEMO has been certified in accordance with rule 19.

The changes made to the GBB during the Audit Period are listed in the Table 16 in the previous section.

12.3 AUDIT FINDINGS

There have been no self-reported or other instances of non-compliance with rule 18(1) of the GSI Rules.

12.3.1 Compliance of software management processes with the GSI Rules

AEMO's software management processes for the GBB remain sufficient to comply with the GSI Rules.

Table 17: Comment on AEMO's compliance with rule 18(1) of the GSI Rules during the Audit Period

Clause	Comment on compliance
18(1)(a)	AEMO has maintained a record of all versions of market software used together with their dates in service, in the form of JIRA and ServiceNow records.
18(1) (b)	AEMO has maintained records of the differences between each version and the reasons for the differences, in the form of release notes and JIRA records.
18(1) (c)	AEMO has conducted appropriate testing of all new releases of the market software prior to their being placed in service.
18(1) (d)	AEMO has ensured that all software versions are covered by an independent certification prior to implementation where required.

12.3.2 General findings

Our findings associated with the review of AEMO’s general IT controls is summarised below. Please note that these findings are also reported in the 2016/17 Electricity Compliance Audit Report and apply to the GSI Compliance Audit as well.

Table 18: Operational compliance findings associated with general IT controls

Ref	Issue Type	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.39	(New issue)	Risk Rating Low Compliance Rating 2	The current backup regime and architecture is not documented. Regular backup testing does occur, with no more than six months elapsing between restoration tests. but coverage is unclear. AEMO has a project underway to refresh the backup infrastructure and regime in line with organisational standards.	Ensure that current backup refresh project delivers documentation for the architecture of the backup environment
17 WEM 2.40	(New issue)	Risk Rating Medium Compliance Rating 2	AEMO maintains redundant IT systems, so that the market can continue to operate in the event of losing one data centre. Both data centres are regularly exercised, by running production market systems from each location at regular intervals. While this is perhaps the most critical part of AEMO's business continuity preparation, other aspects of business continuity have not been explored. We have not seen evidence of any business continuity testing beyond system failover and backup restoration testing. This means that reliance on key people, office premises, physical equipment, and communications channels has not been tested. This applies to both CBD and EPCC activities, and is particularly concerning for control room operations.	Plan and conduct regular desk-based and live business continuity exercises covering selected credible contingency scenarios

Ref	Issue Type	Risk & Compliance Ratings	Finding	Recommendation
17 WEM 2.41	(New issue)	Risk Rating Low Compliance Rating 2	AEMO's Encryption Standard requires backup media to be encrypted where technically possible. AEMO WA backup media is not encrypted.	Consider backup media encryption as part of backup refresh project.
17 WEM 2.43	(New issue)	Risk Rating Low Compliance Rating 3	IT applications support and development has been insourced to new application support team. Team members are all new recruits, and are largely from a development background and relatively new to service management concepts. This increases the risk of problems in support processes.	Ensure support staff have appropriate service management training
17 WEM 2.44	(New issue)	Risk Rating Low Compliance Rating 3	AEMO CBD does have a configuration management database of sorts, but definitions used are inconsistent. Different people have used different concepts of what a "product" is, what a "configuration item" is, and which assets should be recorded and how. This significantly reduces the usefulness of a CMDB or CMS.	Ensure support staff have appropriate service management training Consider refreshing CMDB as part of the wider AEMO service management programme
17 WEM 2.45	(New issue)	Risk Rating Low Compliance Rating 2	Best practice for a critical infrastructure organisation like AEMO would be to have full, UTI Tier III, site level redundancy for critical systems, with sufficient geographic separation to avoid having both sites affected by the same incident. AEMO's IT infrastructure is located in two WA data centres. The newer facility is certified as UTI Tier III. The older facility does have redundancy on many levels, the facility is not certified as Tier III, and does not meet the Tier III requirements. The two facilities are 10.25km apart, both close to the centre of Perth.	Consider moving to a more distant Tier III aligned data centre site as part of next data centre lifecycle refresh project

13 APPENDIX – COMPLIANCE AND RISK RATINGS

This appendix contains information on the compliance and risk ratings used to classify audit findings.

13.1 COMPLIANCE AND RISK RATINGS

Audit findings are categorised as follows:

Table 19: Compliance ratings

Compliance rating	Description
1	Instances of non-compliance with the GSI Rules
2	Findings that are not an instance of non-compliance, but pose compliance risk
3	Findings related to minor housekeeping issues that do not affect compliance risk

Risk rating descriptors for audit findings were set in consultation with AEMO and are based on AEMO's corporate risk matrix (including definitions of impact and likelihood).

Table 20: Risk ratings

Risk rating	Description
Critical	Potential for catastrophic impact on market or system operations or other market outcomes if not addressed immediately. Requires executive actions and monitoring at board level.
Significant	Potential for major impact on market or system operations or other market outcomes if not addressed as a matter of priority. Requires senior management attention with regular monitoring at executive meetings.
Medium	Potential for moderate impact on market or system operations or other market outcomes if not addressed within a reasonable timeframe. Requires management attention with regular monitoring.
Low	Potential for minor impact on market or system operations or other market outcomes if not addressed in the future. Requires team level attention with regular monitoring.

AEMO's definitions of likelihood and consequence are provided in the sections below.

13.2 AEMO LIKELIHOOD RATINGS

Likelihood	Annual Probability	Qualitative Description
Almost Certain	>90%	Will occur in most circumstances; statistical record of several occurrences
Likely	51% - 90%	Can be expected to occur in most circumstances; statistical record of some occurrence
Possible	11% - 50%	May occur, but not expected in most circumstances; statistical record of at least one occurrence
Unlikely	1% - 10%	Conceivable but unlikely to occur in any given year; no history of occurrence
Rare	<1%	Will only occur in exceptional circumstances; no history of occurrence

13.3 AEMO IMPACT RATINGS

Type of impact	EXTREME	MAJOR	MODERATE	MINOR	IMMATERIAL
Reputation & Stakeholders	Significant long-term damage to stakeholder confidence and relationships; total loss of public confidence; intensive adverse media exposure	Significant short-term damage to stakeholder confidence and relationships; some loss of public confidence; adverse media exposure	Some damage to stakeholder confidence and relationships	Manageable reduction in stakeholder confidence	No lasting effects
AEMO Financial Impact	>\$25M	>\$5M-25M	>\$500K-\$5M	>\$100K-\$500K	<\$100K
Safety	Single fatality or permanent injury or widespread impact on public safety	Serious injury requiring hospitalisation >5 days or localised impact on public safety	Injury requiring <5 days hospitalisation or medical treatment	Medical treatment only	First aid
Infrastructure, Assets & Environment	Permanent long-term effect and or rectification not possible	Significant effect, difficult rectification	Measurable effect, easy rectification	Measurable effect, no rectification required	No measurable damage or effect
Market	Loss of supply to >50% of customer demand in any one jurisdiction or >25% across multiple jurisdictions Market suspension in one jurisdiction or market	Loss of supply to >25% of customer demand in any one jurisdiction or >10% across multiple jurisdictions Market suspension in one jurisdiction or market	Loss of supply to >10% of customer demand in any one jurisdiction or >5% across multiple jurisdictions Market operating in an administered state for > 5 days for gas market or >1 day for electricity market	Loss of supply to >5% of customer demand in any one jurisdiction or >2% across multiple jurisdictions Market operating in an administered state for <5 days for gas market	No restriction of supply No disruption to markets

Type of impact	EXTREME	MAJOR	MODERATE	MINOR	IMMATERIAL
				or <1 day for electricity market	
Legal & Regulatory	<p>Imprisonment or fine >\$100 personal liability to officer or director of company</p> <p>Disqualification as officer/director</p> <p>Regulator or parliamentary inquiry with loss of market participants and public confidence</p>	<p>>\$100K personal liability to officer or director</p> <p>Disqualification as officer/director</p> <p>Regulator or parliamentary inquiry with substantial loss of reputation, financial cost, loss of stakeholder confidence, political impact</p>	<p>Fine of less than \$100K and no personal liability</p> <p>Regulator or government inquiry with loss of reputation or adverse government impact</p>	<p>Nominal fine</p> <p>Regulator or government inquiry resolved by routine management procedures</p>	<p>No fine</p> <p>No government or regulator inquiry</p>