



ROBINSON BOWMAKER PAUL



# AUSTRALIAN ENERGY MARKET OPERATOR

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

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# EXECUTIVE SUMMARY

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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

The audited entity for this report is AEMO.

## AUDIT PERIOD

The Audit Period is 1 July 2018 to 30 June 2019, 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"><li>• The compliance of AEMO’s Internal Procedures and business processes with the WEM Rules</li><li>• AEMO’s compliance with the WEM Rules and Market Procedures</li><li>• The compliance of AEMO’s market software systems and processes for software management with clause 2.36.1 of the WEM Rules.</li></ul>
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 11 January 2019.

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	Energy Price Limits Procedure, IRCR and CC Allocation Procedure, Settlements Procedure and Confluence work instructions relating to these procedures
Reserve Capacity	Certification of Facilities Procedure and related Confluence work instructions on Relevant Level calculation and review of access arrangements
Finance	WEM GSI Procedure
System Management Operations Governance and Integration	Daily System Management Operations Contingency and Backup Procedure, Dispatch Advisory Guidelines, Internal Procedure - Internal WEM Rule Compliance, Internal Procedure – Tolerance Ranges, Daily System Management Operations Procedure, Weekly Ad-hoc Market Operations Procedure, SCADA Cleansing Guidelines; Internal Procedure – Monitor Rule Participant Compliance, Internal Guideline – Equipment List
System Management - System Operations	AEMO Perth Central Park Control Centre Business Continuity Plan, AEMO WA RTO Reclassifying Contingency Events Guideline, Electronic Logbook - Assumptions Process, Electronic Logbook - Dispatch Controller, Electronic Logbook - Security Controller, Internal Procedure - Manage Real-Time Dispatch, Internal Procedure - Manage Real-Time System Security, FAQ for Dispatch, Internal Guideline – Generator Synchronisation, Internal Guideline – Dispatch of Demand Side Programmes,
System Management - Planning	FAQ for Commissioning, Internal Guideline – Generator Planned Outages, Internal Procedure - Operational Forecasting, Internal Procedure - Plan and Procure Ancillary Service Quantities, Internal procedure – Synergy Dispatch Planning, Internal procedure – Transmission Network Planned Outages
IT	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 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 market operators with which we are familiar.

## 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 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	<b>Critical:</b> 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	<b>Significant:</b> 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.
	<b>Medium:</b> 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.
	<b>Low:</b> 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 Procedures<sup>1</sup> 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<sup>2</sup>.

The first two activities were conducted as part of our field visits in May 2019 and July 2019.

Remaining activities (including review of self-reported incidents arising after our field visit) have been undertaken remotely.

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

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

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

Table 4: Audit focus areas

Workstream	Proposed focus area
Electricity Market Operations	Settlement and verification (including preparing meter data for settlement)
	Review of prepayment application tool
	Certification of Constrained Access Facilities (including derivation of Relevant Level)
	Energy Price Limits review
	Preparation of WEM budget and market fees
	Application of interest on prudential security
Electricity System Operations	Ancillary Services Dispatch
	Use of latest BMO in dispatch
	Support and currency of control room software tools
	Dispatch of Synergy plant
	Control room business continuity plans
	Dispatch of facilities under NCS contracts
	System Management internal procedures
	Systems Operations inputs into settlement processes

## AUDIT THEMES AND FINDINGS

### Comment

#### ***Strong compliance culture and accountability prevalent across AEMO***

AEMO teams generally have a strong culture of compliance where self-reporting of issues is encouraged and the approach to compliance risk management is proactive rather than reactive.

This is supported by the following:

- Audit findings from previous years have been consistently addressed and closed. There are no opening findings from last year’s audit and more than half of all findings from the current Audit Period have already been closed. Additionally, notwithstanding the findings with respect to compliance risk associated with ancillary services settlement information, AEMO has



implemented improvements to their tool suite which should decrease the frequency of settlement errors. The closed findings include many long-standing issues from System Management.

- The majority of WEM Rules breaches are self-reported by AEMO staff.
- Our site visits have indicated that AEMO teams maintain and apply effective controls to manage compliance risk in most cases. The quality of controls in settlement, market operations and reserve capacity are particularly robust.

### ***Significant increase in uncontrollable distributed generation having an increasing impact on system operations***

The SWIS is continuing to see rapid installation of uncontrollable distributed energy resources (DER) – especially rooftop photovoltaics. This has a number of impacts on the system, including:

- Days with multiple large and sudden load variations (e.g. partially cloudy days)
- Low minimum demand periods
- Increasingly rapid load variations during the evening ramp

This is having a major impact on the management of the system by the System Management controllers. In particular, we have observed the following trends:

- The standard Metrix load forecasts are becoming increasingly inaccurate, resulting in increased use of alternate 'Similar day' forecasts, with periods of switching between multiple alternate forecast methodologies
- An increased use of the High Risk Operating State to maintain system security
- An increase in the number of trading periods in which the standard LFAS provision is insufficient, so Backup LFAS being used.

These measures are the tools that AEMO currently have available to manage system security given the increase in uncontrollable generation, and to date these measures have been sufficient. However, given the continued rapid installation of DER – of the order of several hundred MW per year – at some point in the future the system will reach a state in which these measures are insufficient. Projects are planned, such as the development of an inertia tool, to address these issues but are held up to a large extent by the SMST and PSO projects, and the wider market reform process.

This situation will require careful monitoring to ensure that AEMO has the tools required to manage situation at the time that they are required.

***Further opportunity to improve controls associated with preparing ancillary services settlement information***

A recurring theme from past audits has been the manual nature of processes (and resulting compliance risk) associated with System Management's preparation of monthly ancillary services cost information which is passed an input to settlement. There have been recurring breaches in this area for multiple past audits. System Management has improved the quality of the tools used to calculate spinning reserve payments; these improvements should reduce the frequency of settlement errors pertaining to spinning reserve inputs to settlement. However, we have noted the following:

- When calculating System Restart Service (SRS) costs, there has been no formal process in place to claw back payments due to non-performance. As a result, SRS providers have been overpaid an estimated \$204,539 since at least July 2016.
- There is no formal process in place to ensure that the ancillary service cost calculations are aligned with the respective service provider contracts.
- There is opportunity to improve validation controls when preparing ancillary services inputs to settlement. For example:
  - In 19WEM1.44, the erroneously pro-rated monthly SRS payment input was applied incorrectly for seven months resulting in underpayment of \$990K to the SRS provider; while SM's internal procedures indicated a second-stage validation occurs prior to the costs being sent to settlement, it is evident that the quality of this validation was not robust enough to detect the error.
  - During our controls testing, AEMO was unable to provide evidence that second-stage validation occurred when preparing ancillary services inputs to settlement.

Hence, there is opportunity to improve the robustness of the process used by System Management to prepare ancillary services cost information for settlement purposes.

***Occasional IT issues preventing dispatch according to the latest Balancing Merit Order reduced in frequency but remain an issue***

This has been a long-standing problem, with several instances of the problem being self-reported by AEMO each year. AEMO has been working with Western power to address the underlying causes with some success. This year, fewer instances were self-reported than previously (2 vs. 6 in the previous audit year); however, our compliance testing revealed that there were more instances of

not using the latest BMO than were self-reported, due to planned or unplanned WEMS outages. In each of these cases, there had been no changes to the BMO, so the BMO used for Balancing Market dispatch was still correct and therefore no WEM rule breach had occurred.

### ***AEMO IT systems remain complex, and are set to become increasingly complex***

We have previously reported on the complexity of AEMO's IT environment. This complexity exists both in the large number of systems and tools used to implement AEMO's obligations, and the large and diverse stack of technologies used to implement these systems and tools. This year, we identified 39 discrete technologies used to implement AEMO's current technologies.

This complexity is set to increase with the transfer of Western Power systems into AEMO with the SMST project, which will introduce another 9 technologies to this stack.

It therefore remains critical that AEMO continue to modernise and refresh systems to reduce this complexity, with clear options to address the legacy issues and systems, even if they are dependent on the path taken in ongoing market reform.

### **Summary**

Table 5 below summarises the total number of audit issues (broken down by risk rating) reported during the 2017/18 and 2018/19 Audit Periods. Table 6, Table 7, and **Error! Reference source not found.** further break these numbers down by compliance rating.

Each issue corresponds to one non-compliance, risk on non-compliance, or an area with potential for improvement.

The overall number of issues has decreased from 50 in the 2017/18 audit year to 35 in the 2018/19 audit year. However, the number of high risk rated issues has increased significantly from 2 in the 2017/18 audit year to 6 in the 2018/19 audit year. 4 of the high risk issues relate to System Management; 2 are to Market Operations.

It should be noted that some of the increases in numbers of findings from the 2017/18 audit year to the 2018/19 audit year are attributable to a change in reporting practice: In previous years, multiple instances of similar breaches were aggregated into a single finding, whereas this year, each individual breach has been reported as a separate finding.

Table 5: Audit issue summary by risk rating and open/closed status, 2017/18 and 2018/19.

	2017/18 Issues	2018/19 Issues				
Risk Rating	Total	Total	Closed		Open	
			AEMO	RBP	AEMO	RBP
High	2	6	4	0	0	2
Medium	12	13	8	0	4	1
Low	36	16	13	1	0	2
Totals	50	35	25	1	4	5
			26		9	

Table 6: Audit issue summary by risk rating and open/closed status, compliance rating 1 issues.

	Compliance Rating 1				
Risk Rating	Total	Closed		Open	
		AEMO	RBP	AEMO	RBP
High	6	4	0	0	2
Medium	12	8	0	4	0
Low	14	13	1	0	0
Totals	32	25	1	4	2
		26		6	

Table 7: Audit issue summary by risk rating and open/closed status, compliance rating 2 issues.

	Compliance Rating 2				
Risk Rating	Total	Closed		Open	
		AEMO	RBP	AEMO	RBP
High	0	0	0	0	0
Medium	1	0	0	0	1
Low	2	0	0	0	2
Totals	3	0	0	0	3
		0		3	



Table 8: Summary of audit issues

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.01	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Process</b> SM - Power System Operations</p>	<p><b>Risk Rating</b> Medium</p> <p><b>Compliance Rating</b> 1</p>	Incorrectly constraining a Market Participant to a level greater than that of their Balancing Merit Order position	<p>No further action.</p> <p>AEMO has addressed the issue.</p>
19WEM1.02	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Process</b> SM - Power System Operations</p>	<p><b>Risk Rating</b> Medium</p> <p><b>Compliance Rating</b> 1</p>	Incorrectly granting permission for a facility to synchronize which was not in line with the Facility's Dispatch Instruction	Ensure that this situation is included in controller training, and that all controllers receive this training.
19WEM1.03	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Process</b></p>	<p><b>Risk Rating</b> High</p> <p><b>Compliance Rating</b> 1</p>	Not using latest BMO due to denial of service cyber attack in 3 <sup>rd</sup> party IT system.	<p>No further action.</p> <p>AEMO has addressed the issue.</p>

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	SM - Operations, Governance and Integration			
19WEM1.04	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Incorrectly constraining a facility to a level lower than that of their Balancing Submission	No further action. AEMO has addressed the issue.
19WEM1.05	Issue Type AEMO reported non-compliance Process SM - Operations, Governance and Integration	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	Not using the latest BMO due to WP IT issues	No further action. AEMO has addressed the issue.
19WEM1.06	Issue Type AEMO reported non-	<b>Risk Rating</b> Low	Incorrectly calculating refund amount to facility on approved planned outage	No further action. AEMO has addressed this issue.

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	compliance Process Market operations	<b>Compliance Rating</b> 1		
19WEM1.07	Issue Type AEMO reported non-compliance Process SM - Operations, Governance and Integration	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Failure to publish aggregate forecast output of non-scheduled generators by deadline	No further action. AEMO has addressed the issue.
19WEM1.08	Issue Type AEMO reported non-compliance Process SM - Planning	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Incorrectly granting opportunistic maintenance on two consecutive days	No further action. AEMO has addressed the issue.
19WEM1.09	Issue Type AEMO reported non-compliance Process	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Incorrect settlements caused by failure to add new participant to metering calculation	No further action. We are satisfied AEMO has adequate controls in place to manage issues for which recommendations are still being implemented.



Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	Market operations			
19WEM1.10	Issue Type AEMO reported non-compliance Process Market operations	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Failure to publish new distribution loss factors by deadline	No further action. AEMO has addressed the issue.
19WEM1.11	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Failure to issue Dispatch Advisory for out of merit generation	No further action. AEMO has addressed the issue.
19WEM1.12	Issue Type AEMO reported non-compliance Process SM - Planning	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Incorrectly approving day-ahead opportunistic maintenance to run over more than one trading day	No further action. AEMO has addressed the issue.
19WEM1.13	Issue Type AEMO reported non-	<b>Risk Rating</b> Medium <b>Compliance</b>	Failure to issue Dispatch Advisory for out of merit generation	No further action. AEMO has addressed the issue.

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	compliance Process SM - Power System Operations	<b>Rating</b> 1		
19WEM1.14	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Incorrectly granting on the day opportunistic maintenance within an hour of commencement	No further action. AEMO has addressed the issue.
19WEM1.15	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Incorrectly granting on the day opportunistic maintenance within an hour of commencement	No further action. AEMO has addressed the issue.
19WEM1.16	Issue Type AEMO reported non-compliance	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Failure to send Synergy dispatch plan by deadline	No further action. AEMO has addressed the issue.

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	Process SM - Planning			
19WEM1.17	Issue Type AEMO reported non-compliance Process SM - Operations, Governance and Integration	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Incorrect Resource ID in settlement data	No further action. AEMO has addressed the issue.
19WEM1.18	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Incorrect operating state in dispatch advisory during loss of SCADA visibility	<ul style="list-style-type: none"> <li>• Ensure that the recommendations from the incident report are implemented</li> <li>• Conduct a BCP exercise using the above single point of contact and script.</li> </ul>
19WEM1.19	Issue Type AEMO reported non-compliance Process SM -	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Failure to calculate dispatch volumes for curtailed facility	No further action. AEMO has addressed the issue.

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	Operations, Governance and Integration			
19WEM1.20	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Failure to withdraw DA when situation was resolved.	No further actions. AEMO has addressed the issue.
19WEM1.21	Issue Type AEMO reported non-compliance Process SM - Power System Operations	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	Failure to issue retrospective dispatch instructions on time	Ensure that the monitoring of control room logs as specified in finding is documented in the appropriate procedure
19WEM1.23	Issue Type RBP reported non-compliance Process Finance	<b>Risk Rating</b> Low <b>Compliance Rating</b>	Failure to publish historic financial report for financial year ending 2018	No further action recommended. However, see related finding 19WEM1.34 relating to general lack of finance controls.

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
		1		
19WEM1.34	Issue Type RBP reported compliance risk Process Finance	<b>Risk Rating</b> Low <b>Compliance Rating</b> 2	Lack of formalised business processes and controls relating to WEM obligations	We recommend: <ul style="list-style-type: none"> <li>Calendar alerts be instituted for key publication/submission deadlines such as budget, fees, historic financial reports and allowable revenue submissions.</li> </ul> <p>The process for the above functions be documented including specification of key controls. As indicated above, a process for determining Declared Market Projects and GSI projects should be included in the budget/Allowable Revenue process description.</p>
19WEM1.36	Issue Type RBP reported non-compliance Process Market operations	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	Multiple instances of latest updated BMO not being used created due to WEMS outages	<ul style="list-style-type: none"> <li>Ensure that all instances of not using or creating an up to date BMO are investigated and reported as self-reported breaches where appropriate, so that progress in resolving these issues can be monitored.</li> <li>Review incident management process to ensure that all potential incidents are investigated, and refresh process to SM Market Operations team</li> </ul>

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.40	Issue Type RBP reported compliance risk Process SM - Planning	<b>Risk Rating</b> Low <b>Compliance Rating</b> 2	No formalised process for second-stage validation by Principal Engineer (PE) for TDC updates	<ul style="list-style-type: none"> <li>We recommend SM formally document the checks that are to be performed when reviewing TDC changes.</li> <li>We also recommend SM institute a more robust audit trail with respect to these checks (e.g. email containing detail of what checks were performed and the results).</li> </ul>
19WEM1.43	Issue Type RBP reported compliance risk Process SM - Planning	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 2	Potential risk areas still exist in AS monthly data preparation	<p>We recommend:</p> <ol style="list-style-type: none"> <li>SM formally document the checks that are to be performed when reviewing monthly AS cost calculations. We also recommend SM institute a more robust audit trail with respect to these checks (e.g. email containing detail of what checks were performed and the results).</li> <li>SM institute formal controls to ensure annual or other contractual changes are reflected in the AS tools (e.g. procedure sets out process to be followed when updating different contracts; calendar alerts based on contract milestones; JIRA entries</li> </ol>

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
				<p>(similar to what is used by the settlements team to track key events during a cycle)).</p> <p>3. As per our recommendations in 19WEM1.44, SM should ensure a legal review of contracts is performed to ensure any conditions relating annual fee indexation or clawbacks (due to non-performance) are reflected correctly in the monthly cost calculation process.</p>
19WEM1.44	Issue Type RBP reported non-compliance Process SM - Operations, Governance and Integration	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	Systemic and historic errors in SRS payments	<p>We further recommend that SM develop and document (in their internal procedures) a robust process to calculate SRS payments. The process should include controls to ensure:</p> <ol style="list-style-type: none"> <li>1. Contractual arrangements are accurately reflected in payments (a legal review of the compliance of SM's process with the contractual arrangements should be undertaken, and repeated whenever a contract is renegotiated)</li> <li>2. Clawback payments are accurately calculated</li> </ol>

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
				3. Annual indexation calculations are performed correctly, and that the base monthly value is updated if a pro-rated value is used to reflect indexation occurring part way through a month.
19WEM1.52	Issue Type AEMO reported non-compliance Process SM - Operations, Governance and Integration	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	Incorrect calculation Contracted Spinning Reserve quantity	No further action - see recommendations for finding 19WEM1.43.
19WEM1.54	Issue Type AEMO reported non-compliance Process SM - Operations, Governance and Integration	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Erroneous TES calculation and constraint payments (plus potentially RC refunds and Relevant Level) due to erroneous upload of ex-post outage file.	No further action. AEMO has addressed the issue.



Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.55	Issue Type AEMO reported non-compliance Process Reserve Capacity	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Reserve capacity testing report published 53 days late	No further action. AEMO has addressed this issue.
19WEM1.56	Issue Type AEMO reported non-compliance Process Market operations	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Incorrect constraint payment calculations for two facilities since October 2017 due to error in Settlement Tolerance import	No further action. AEMO has addressed the issue
19WEM1.57	Issue Type AEMO reported non-compliance Process Market operations	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	September 2018 IRCR published late	No further action. AEMO has robust controls in place to mitigate recurrence.
19WEM1.58	Issue Type AEMO reported non-compliance Process	<b>Risk Rating</b> Low <b>Compliance</b>	Market Advisory not issued for WEMS FTP issue.	No further action. AEMO has addressed the issue.

Ref	Type & Process	Risk & Compliance Ratings	Finding	Recommendation
	Market operations	<b>Rating</b> 1		
19WEM1.59	Issue Type AEMO reported non-compliance Process SM - Planning	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	Confidential participant data sent to Synergy with Dispatch Plan	No further action. AEMO has addressed the issue.
19WEM1.60	Issue Type AEMO reported non-compliance Process Market operations	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	Historic error in Market Fee calculation	No further action. However, the issue will remain open until the defect has been fixed.

## OPINION

### Qualifications

We have noted 2 instances of material non-compliance with the WEM Rules; our definition of materiality is set out on page 7:

- **19WEM1.44:** Historic and systemic errors in System Restart Cost calculations have led to over-recovery of costs from participants since at least July 2016.
- **19WEM1.60:** Software defect has led to erroneous market fee calculations since market start; market fees will continue to be incorrect until AEMO's vendor is able to address the issue<sup>3</sup>.

### Conclusion

#### *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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<sup>3</sup> Due to the complexity of the metering and settlement systems, a manual workaround is impracticable.

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# 1 INTRODUCTION

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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.

## 1.2 AUDIT PERIOD

The Audit Period is 1 July 2018 to 30 June 2019, 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 9: 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.
2.14.3	Defines the scope of the audit to include, at minimum: <ul style="list-style-type: none"><li>• The compliance of AEMO's Internal Procedures and business processes with the WEM Rules.</li><li>• AEMO's compliance with the WEM Rules and Market Procedures.</li><li>• The compliance of AEMO's market software systems and processes for software management with clause 2.36.1 of the WEM Rules.</li></ul>
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 the Settlement Risk Review undertaken in December 2018.
- **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 the October 2017 initial NSTEM settlement run to check whether AEMO can recreate system outputs

## 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 11 January 2019 (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 10: Procedures reviewed to assess control application

AEMO functional area	Procedures against which control application has been assessed
Market Operations	Energy Price Limits Procedure, IRCR and CC Allocation Procedure, Settlements Procedure and Confluence work instructions relating to these procedures
Reserve Capacity	Certification of Facilities Procedure and related Confluence work instructions on Relevant Level calculation and review of access arrangements
Finance	WEM GSI Procedure
System Management Operations Governance and Integration	Daily System Management Operations Contingency and Backup Procedure, Dispatch Advisory Guidelines, Internal Procedure - Internal WEM Rule Compliance, Internal Procedure – Tolerance Ranges, Daily System Management Operations Procedure, Weekly Ad-hoc Market Operations Procedure, SCADA Cleansing Guidelines; Internal Procedure – Monitor Rule Participant Compliance, Internal Guideline – Equipment List
System Management - System Operations	AEMO Perth Central Park Control Centre Business Continuity Plan, AEMO WA RTO Reclassifying Contingency Events Guideline, Electronic Logbook - Assumptions Process, Electronic Logbook - Dispatch Controller, Electronic Logbook - Security Controller, Internal Procedure - Manage Real-Time Dispatch, Internal Procedure - Manage Real-Time System

AEMO functional area	Procedures against which control application has been assessed
	Security, FAQ for Dispatch, Internal Guideline – Generator Synchronisation, Internal Guideline – Dispatch of Demand Side Programmes,
System Management - Planning	FAQ for Commissioning, Internal Guideline – Generator Planned Outages, Internal Procedure - Operational Forecasting, Internal Procedure - Plan and Procure Ancillary Service Quantities, Internal procedure – Synergy Dispatch Planning, Internal procedure – Transmission Network Planned Outages
IT	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 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 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 11: Compliance and risk ratings

Compliance rating	Risk Rating
1: Instances of non-compliance with the WEM Rules	<b>Critical:</b> 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	<b>Significant:</b> 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 areas for improvement that do not affect compliance risk	<b>Medium:</b> 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.
	<b>Low:</b> 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 are based on AEMO’s corporate risk matrix. The only difference from AEMO’s internal ratings is that we assess the financial impact to market participants in addition to AEMO.

Please refer to Section 15.1 for more information.

### 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 Procedures<sup>4</sup> 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.
- The first two activities were conducted as part of our field visits in May 2019 and July 2019. Remaining activities (including review of self-reported incidents arising after our field visit) have been undertaken remotely.

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

- Electricity Market Operations
  - Settlement and verification (including preparing meter data for settlement)
  - Review of prepayment application tool
  - Certification of Constrained Access Facilities (including derivation of Relevant Level)
  - Energy Price Limits review
  - Preparation of WEM budget and market fees

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<sup>4</sup> In some cases we have reviewed draft versions of Internal Procedures that had not been formally approved as at the time of the review.

- Application of interest on prudential security
- Electricity System Operations
  - Preparation of System Operations inputs into settlement. This includes:
    - Ancillary services cost information
    - SCADA cleansing
    - Review and updating of changes to Temperature Dependence Curves
  - Dispatch, including:
    - Out of merit dispatch/use of latest BMO
    - Control room operations
    - Control room staff rostering
    - Event logging
    - Dispatch advisories
    - Ancillary Service enablement
    - High-risk operating states
    - GIA dispatch
  - Dispatch planning, including:
    - Accuracy of load forecasts/use of alternate forecasts

#### **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 AEMO's electricity market software.

## **1.7 ACKNOWLEDGMENTS**

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



## 2 WEM RULES CHAPTER 1 - INTRODUCTION

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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:

- Transitional functions for AEMO to prepare for WEM reform
- Transitional calculation of Individual Reserve Capacity Requirements and the Capacity Credit Allocation Process relating to the Reduction of Prudential Exposure (ROPE) project.

### 2.2 AEMO PROCEDURES

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

### 2.3 COMPLIANCE WITH CHAPTER 1

We reviewed AEMO's compliance with transitional rule clause 1.26.4 to verify that AEMO published the 12 Peak Intervals within 5 Business Days of 1 May 2019. We have confirmed that AEMO published the 12 Peak Intervals in accordance with clause 1.26.4.

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

## 3 WEM RULES CHAPTER 2 - ADMINISTRATION

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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

There have been minor cosmetic changes to the Registration Process (Section 2.33) of Chapter 2 to enhance clarity.

### 3.2 AEMO PROCEDURES

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

### 3.3 OPERATIONAL COMPLIANCE WITH CHAPTER 2

#### 3.3.1 Audit activities

- We have reviewed self-reported instances of non-compliance with Chapter 2 of the WEM Rules
- We have conducted compliance testing to:
  - Review whether standing data request changes pertaining to Temperature Dependence Curve (TDC) changes were processed and updated within the timeframes required under Section 2.34 of the WEM Rules.
  - Xx
- We have conducted (retrospective) business process walkthroughs to:
  - Assess whether Finance employs appropriate controls to meet their budget and market fee preparation and publication obligations
  - Assess whether System Management employs appropriate controls when reviewing TDC change requests and updating their system with those changes.

- We have performed sample control testing to audit whether controls documented in the Weekly Ad Hoc Internal Procedure were applied in practice when processing TDC changes.

Note, we were unable to perform control testing on Finance's budget and market fee processes due to the lack of audit trail.

### 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 12: Operational compliance findings associated with Chapter 2 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.10	<p><b>Issue Type</b></p> <p>AEMO reported non-compliance</p> <p><b>Obligation</b></p> <p>2.27.10</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>1</p>	<p><b>Failure to publish new distribution loss factors by deadline</b></p> <p>On 26 September 2018, AEMO received details of two new Distribution Loss Factors which AEMO is required to published within two business days from receiving it. The New Distribution Loss Factors were not published on the AEMO WEM website until 31 October 2018 and therefore a breach of MR2.27.11.</p> <p>The loss factors in question were received outside the annual process (1 June); at the time no controls existed to ensure they were published and as such were missed due to human error. The impact was immaterial as only publication was affected (published one month late).</p> <p>The correct loss factors were picked up by metering system as part of standing data delivery from Western Power.</p> <p>To prevent recurrence, AEMO has developed a new work instruction for receiving loss factors outside annual review period. We have sighted this work instruction and confirm that a formal process now exists to manage loss factors submitted outside the annual process.</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.23	<p><b>Issue Type</b></p> <p>RBP reported non-compliance (Recurring issue)</p> <p><b>Obligation</b></p> <p>2.22A.5</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>1</p>	<p><b>Failure to publish historic financial report for financial year ending 2018</b></p> <p>WEM Rule 2.22A.5 requires AEMO to publish a historic financial report by 31 October showing AEMO's actual financial performance against budgeted financial performance for the previous financial year. AEMO published the historic financial report for the financial year ending 30 June 2018 six months late on 7 May 2019 (due to be published 31 October 2018). This is a recurring breach.</p>	<p>No further action recommended. However, see related finding 19WEM1.34 relating to general lack of finance controls.</p>
19WEM1.34	<p><b>Issue Type</b></p> <p>RBP reported compliance risk</p> <p><b>Obligation</b></p> <p>2.22A, 2.24, 2.43</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>2</p>	<p><b>Lack of formalised business processes and controls relating to WEM obligations</b></p> <p>The Finance team has no formalised processes in place to meet their obligations under the WEM Rules. The existing process documentation is extremely high level and reiterates WEM rule mandated timelines and selected obligations.</p> <p>While our interview with the Finance team indicated that there is some level of checking that occurs (e.g. to ensure that published outputs are correct), we only have the team's verbal assertion with no evidence that this occurs in practice.</p> <p>Likewise, there are no formal controls in place to ensure that publication deadlines are met (e.g. calendar reminders). We further note that there has been a further breach of the requirement to publish historic WEM reports this year (see 19WEM1.23). This breach is a recurring one.</p> <p>During our interviews the Finance team also appeared to be unfamiliar with the term "Declared Market Project". This indicates that AEMO has no</p>	<p>We recommend:</p> <ul style="list-style-type: none"> <li>• Calendar alerts be instituted for key publication/submission deadlines such as budget, fees, historic financial reports and allowable revenue submissions.</li> </ul> <p>The process for the above functions be documented including specification of key controls. As indicated above, a process for determining Declared Market Projects and GSI projects should be included in the</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			process in place to determine whether a project should be classified as a Declared Market Project in accordance with the WEM Rules.	budget/Allowable Revenue process description.
19WEM1.40	<p><b>Issue Type</b></p> <p>RBP reported compliance risk</p> <p><b>Obligation</b></p> <p>2.34</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>2</p>	<p><b>No formalised process for second-stage validation by Principal Engineer (PE) for TDC updates</b></p> <p>SM Ops' weekly ad-hoc procedure indicates that the PE must review TDC changes and indicate whether there are any issues. However, we have noted:</p> <ul style="list-style-type: none"> <li>In all four TDC changes submitted during the audit period, there was no evidence of any checks being performed. For 47329 and 47330, there was an email from the PE dated 6 Mar 2019 indicating approval to proceed, but there was no evidence of what checks had been performed. For 47481 and 47482, there was an email from the PE dated 27 March 2019 indicating that they need to discuss with Western Power the ability of the facility to meet Technical Requirements. However, there was no evidence that any checks were ever completed.</li> <li>It is unclear what checks the PE performs.</li> </ul>	<ul style="list-style-type: none"> <li>We recommend SM formally document the checks that are to be performed when reviewing TDC changes.</li> <li>We also recommend SM institute a more robust audit trail with respect to these checks (e.g. email containing detail of what checks were performed and the results).</li> </ul>

## 4 WEM RULES CHAPTER 3 – POWER SYSTEM SECURITY AND RELIABILITY

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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; De-commitment and Reserve Capacity Obligations; and Settlement Data relating to power system operation.

### 4.1 RULE AMENDMENT

There has been a minor typographical change to the definition of Emergency Operating State (clause 3.5.1).

### 4.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 3 of the WEM Rules in all material respects.

### 4.3 OPERATIONAL COMPLIANCE WITH CHAPTER 3

#### 4.3.1 Audit activities

We have:

- Reviewed instances of non-compliance with Chapter 3
- 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:
  - Real-Time control room operations
- Conducted compliance testing on:
  - Ancillary service activation for SR and LFAS
  - Control room staffing rosters vs. fatigue management guidelines and availability of relief

- Forecast accuracy and use of alternate forecasts
  - Consistency and accuracy of control room logs
  - Issuance of Dispatch Advisories for constrained facilities
- Reviewed BCP exercise reports



### 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 13: Operational compliance findings associated with Chapter 3 of the WEM Rules

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.08	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Obligation</b> 3.19.2A(b)</p>	<p><b>Risk Rating</b> Low</p> <p><b>Compliance Rating</b> 1</p>	<p><b>Incorrectly granting opportunistic maintenance on two consecutive days</b></p> <p>On 6 November 2018 System Management incorrectly granted Opportunistic Maintenance to a facility. The SM controller approved On-the-day Opportunistic Maintenance but had not been informed that SM planning had approved Day-Ahead Opportunistic Maintenance for the following day. This resulted in Opportunistic Maintenance being granted for two consecutive trading days, which is not allowed under the rules.</p> <p>This was dealt with and resolved as an isolated incident caused by human error.</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>
19WEM1.12	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Obligation</b> 3.19.2(a)</p>	<p><b>Risk Rating</b> Low</p> <p><b>Compliance Rating</b> 1</p>	<p><b>Incorrectly approving day-ahead opportunistic maintenance to run over more than one trading day</b></p> <p>On 16 January 2019, System Management incorrectly approved a Day Ahead Opportunistic Maintenance (DAOM) for a facility, after the Network Provider changed the dates on a previously rejected request.</p> <p>The cause was human error on the part of the SM Planning staff member,</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
			assuming that the Network Provider would follow an agreed procedure.	
19WEM1.14	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 3.19.2(b)	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	<b>Incorrectly granting on the day opportunistic maintenance within an hour of commencement</b>  On 2 January 2019, System Management granted a Market Participant approval for an "On the Day Opportunistic Maintenance" within an hour of the pre-outage commencement. The request was made at 08:00 for an outage at 09:00.  Note that the request could not have been made prior to 08:00, as that would have been the previous trading day. Thus, requesting ODOM at 08:00 for and 09:00 is a borderline case, but it has been AEMO's interpretation to disallow these since September 2018. The controller on duty was not aware of this and has now been informed.	No further action.  AEMO has addressed the issue.
19WEM1.15	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 3.19.2(b)	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	<b>Incorrectly granting on the day opportunistic maintenance within an hour of commencement</b>  On 14 November 2018, System Management granted a Market Participant approval for an "On the Day Opportunistic Maintenance" within an hour of the pre-outage commencement.  Similarly to 19WEM1.15, the request was made at 08:01 for an outage at 09:00.	No further action.  AEMO has addressed the issue.

Ref	Issue type & obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.18	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Obligation</b> 3.5.1(f)</p>	<p><b>Risk Rating</b> Medium</p> <p><b>Compliance Rating</b> 1</p>	<p><b>Incorrect operating state in dispatch advisory during loss of SCADA visibility</b></p> <p>System Management issued a Dispatch Advisory (DA) with the wrong Operating State (High Risk as opposed to Emergency) during a loss of SCADA visibility which forced power system control away from its primary control centre.</p> <p>The cause of this breach was confusion as to who has frequency control of the system during the relocation to the East Perth backup site.</p> <p>Recommendations from the incident report for this event are:</p> <ul style="list-style-type: none"> <li>- Assign a single point of contact during a relocation event</li> <li>- Develop a script to be followed to ensure that Western Power have frequency control</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure that the recommendations from the incident report are implemented</li> <li>• Conduct a BCP exercise using the above single point of contact and script.</li> </ul>

## 5 WEM RULES CHAPTER 4 – RESERVE CAPACITY RULES

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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

Appendix 5 (Step 5A) was amended to reflect changes pertaining to RC\_2018\_01 to remove a manifest error in the calculation of New Notional Wholesale Meters in the IRCR calculation.

There has also been a small number of minor cosmetic changes to the wording of rules relating to the Long-Term PASA (Section 4.5) and Reserve Capacity Performance Monitoring (Section 4.27) to enhance clarity.

### 5.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 4 of the WEM Rules in all material respects.

### 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
- We have performed (retrospective) business process walkthroughs of the certification process, focussing on the certification of constrained access facilities.
- We have performed sample control testing to audit whether controls documented in the Certification of Facilities Internal Procedure were applied in practice during the deferred 2018/19 Reserve Capacity Cycle.

### 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 14: Operational compliance findings associated with Chapter 4 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.06	<p><b>Issue Type</b></p> <p>AEMO reported non-compliance</p> <p><b>Obligation</b></p> <p>4.26.1A(a)(ii)(1)</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>1</p>	<p><b>Incorrectly calculating refund amount to facility on approved planned outage</b></p> <p>The settlements system incorrectly calculated a refund amount applicable to a Synergy Scheduled Generator during the period 12/02/2018 to 15/11/2018 when the facility was on an approved planned outage.</p> <p>This breach was the result of a software defect which led to the RCM Settlement system failing to identify that the Refund Exempt Planned Outage Count (REPOC) had exceeded the threshold specified under WEM Rule 4.26.1C (8,400MW calculated over the preceding 1,000 Trading Intervals). The defect caused the system to pull the wrong date range from the RCM Operations system and to calculate the REPOC parameter over a single day, instead of 1,000 Trading Intervals.</p> <p>As a result, Refund Exempt Planned Outages were not initially identified for facility over a nine-month period from February 2018 to November 2018, and the affected participant did not pay refunds of approximately \$244K).</p> <p>A fix has been deployed to the system to rectify the issue and the error is to be washed up in the adjustment process.</p>	<p>No further action.</p> <p>AEMO has addressed this issue.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.55	<p><b>Issue Type</b></p> <p>AEMO reported non-compliance</p> <p><b>Obligation</b></p> <p>4.25.11</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>1</p>	<p><b>Reserve capacity testing report published 53 days late</b></p> <p>Clause 4.25.11 requires AEMO to publish details of reserve capacity tests every three months. The Reserve Capacity Testing Internal Procedure is consistent with this rule and requires quarterly publication of the above reports within 10BD of 31 March, 30 June, 30 September and 31 December. The reserve capacity tests conducted in the quarter October - December 2018 should have been published in mid-January (according to the internal procedure) but, due to human error, were instead published late on 3 April 2019.</p> <p>We note that market participants can access their testing results any time via the new RCM portal (hence inability to access the report would not have had any market impact).</p> <p>AEMO has since implemented calendar reminders to prevent recurrence of this breach.</p>	<p>No further action.</p> <p>AEMO has addressed this issue.</p>
19WEM1.57	<p><b>Issue Type</b></p> <p>AEMO reported non-compliance</p> <p><b>Obligation</b></p> <p>4.1.28(b)</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>1</p>	<p><b>September 2018 IRCR published late</b></p> <p>In accordance with clause 4.1.28 of the WEM Rules, the IRCR for September 2018 was required to be published on 25 July 2018.</p> <p>As a result of human error, the IRCR for September 2018 was not published to Participant Information Reports (PIR) by 25 July 2018.</p> <p>On 30 July 2018, a market participant alerted AEMO that the IRCR was not visible on the PIR. Market Operations subsequently published the PIRs in WEMS MPI on 30 July 2018.</p>	<p>No further action.</p> <p>AEMO has robust controls in place to mitigate recurrence.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>The impact is low as the IRCR was published soon after the deadline and it is unlikely that there would have been any material market impact due to this delay.</p> <p>We note that a robust process for publishing the IRCR to PIRs exists already and that the error occurred as a result of the staff member not following the procedure instructions to completion. AEMO's remedial action was to remind staff members of the importance of completing procedural steps.</p>	

## **6 WEM RULES CHAPTER 5 – NETWORK CONTROL SERVICES**

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

Until this audit year, there were no contracts for NCS, so AEMO had no active obligations under Chapter 5 of the WEM Rules.

Now, the new Generator Interim Access regime has used NCS contracts as a mechanism to implement constrained network access for new generation facilities.

As of May 2019, there was only one facility operating under NCS.

### **6.1 RULE AMENDMENT**

There have been no amendments to Chapter 5 of the WEM Rules.

### **6.2 AEMO PROCEDURES**

AEMO's Internal Procedures are compliant with Chapter 5 of the WEM Rules in all material respects.

### **6.3 OPERATIONAL COMPLIANCE WITH CHAPTER 5**

We have conducted compliance testing on dispatch of GIA-constrained facilities.

We note that GIA constraints are applied as a post-process after the real-Time Dispatch Engine (RTDE). If a GIA constraint is binding, RTDE is not re-run with the constraint applied as an input. Therefore, the energy shortfall arising from the curtailment of the GIA generator will not necessarily come from the next generator in the BMO, but rather from the Synergy portfolio. This is not an ideal outcome, but one that is strictly in compliance with the rules given the use of NCS to implement the GIA constraints.



## 7 WEM RULES CHAPTER 6 – THE ENERGY MARKET

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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

A There have been no amendments to Chapter 6 of the WEM Rules.

### 7.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 6 of the WEM Rules in all material respects.

### 7.3 OPERATIONAL COMPLIANCE WITH CHAPTER 6

#### 7.3.1 Audit activities

Changes in chapter 6 relate to activities automated in AEMO's market software, which is covered by in-year testing and certification activities.

We have additionally:

- Performed compliance testing to assess whether AEMO has met its obligations with respect to performing the annual review of Energy Price Limits (EPL) required under clause 6.20.6
- Reviewed procedures to assess whether AEMO has appropriate controls to manage the EPL review.

### 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 15: Operational compliance findings associated with Chapter 6 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.09	<p><b>Issue Type</b></p> <p>AEMO reported non-compliance</p> <p><b>Obligation</b></p> <p>6.17.2, 9.3.7, 3.14.1, 9.13.1</p>	<p><b>Risk Rating</b></p> <p>Medium</p> <p><b>Compliance Rating</b></p> <p><b>1</b></p>	<p><b>Incorrect settlements caused by failure to add new participant to metering calculation</b></p> <p>Due to a process error, AEMO failed to add a new participant to the POMAX metering aggregation query in May 2016 to reflect their initial metered consumption values. As a result, for the March 2016 invoice period onward the balancing market quantities for the market participant did not take into account their energy consumption and has therefore been incorrect; the amount that would have been payable by the participant has been incorrectly attributed to Synergy via the Notional Wholesale Meter instead.</p> <p>This error was discovered in September 2018 when customer churn led to the affected participant acquiring a large number of customer NMIs, and AEMO's routine validation procedures noted the discrepancy. This error led to a number of breaches<sup>5</sup>:</p> <ul style="list-style-type: none"> <li>• Clause 6.17.2 – incorrect Balancing Metered Quantities</li> <li>• Clause 9.3.7 – incorrect Consumption Share</li> <li>• Clause 3.14.1 – incorrect LF_Share</li> <li>• Clause 9.13.1 – incorrect Monthly Participant Load.</li> </ul>	<p>No further action.</p> <p>We are satisfied AEMO has adequate controls in place to manage issues for which recommendations are still being implemented.</p>

<sup>5</sup> This breach is reported only with respect to Chapter 6 as it was a single underlying issue which caused multiple breaches.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>AEMO has since:</p> <ul style="list-style-type: none"> <li>• Instituted controls to ensure the error does not recur when new participants join the market</li> <li>• Commissioned an independent settlement risk review to evaluate residual risk associated with settlement processes</li> <li>• Implemented the majority of the recommendations arising from the risk review above. The outstanding recommendations requiring closure are in progress awaiting implementation.</li> </ul>	
19WEM1.56	<p><b>Issue Type</b></p> <p>AEMO reported non-compliance</p> <p><b>Obligation</b></p> <p>6.17.9(a)</p>	<p><b>Risk Rating</b></p> <p>Low</p> <p><b>Compliance Rating</b></p> <p>1</p>	<p><b>Incorrect constraint payment calculations for two facilities since October 2017 due to error in Settlement Tolerance import</b></p> <p>Settlement Tolerances are used to determine constraint payments. In general, if the difference between ‘intended’ generation and actual generation are different by an amount greater than the tolerance, then the facility is eligible for constraint payments.</p> <p>In 2017, SM updated the Settlement Tolerance value for two facilities. Market Operations uploaded the new values to Brady Settlement; however, this upload failed, and the settlement system continued to use the outdated tolerance value. As a result, the affected facilities were paid out constraint payments in some instances where they should not have (resulting in over-recovery from Market Customers). In total, \$9,905 of constraint payments were erroneously over-recovered from market customers (\$298 of which are outside the adjustment window and cannot be corrected). \$9,606.16 of the over-recovery has been corrected via adjustments.</p> <p>Remedial actions have included:</p> <ul style="list-style-type: none"> <li>• Correction of infrastructure and system configuration issues, including changing the file storage location and software configuration to access storage location</li> <li>• Upload of correct values</li> </ul>	<p>No further action.</p> <p>AEMO has addressed the issue</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<ul style="list-style-type: none"> <li>Improvement of Work Instructions to clarify process to update and verify settlement tolerance values.</li> </ul> <p>We have reviewed the updated Work Instruction, which is sufficient to mitigate recurrence.</p>	

## 8 WEM RULES CHAPTER 7 – DISPATCH

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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

There have been no amendments to Chapter 7 of the WEM Rules.

### 8.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 7 of the WEM Rules in all material respects.

### 8.3 OPERATIONAL COMPLIANCE WITH CHAPTER 7

#### 8.3.1 Audit activities

We have:

- Reviewed instances of non-compliance with Chapter 7
- Conducted business process walkthroughs to:
  - Assess whether System Management employs appropriate controls when preparing SCADA data for settlement
  - Review Real-Time control room operations
- Conducted compliance testing on:
  - Dispatch of GIA-constrained facilities
  - Consistency and accuracy of control room logs
  - Issuance of Dispatch Advisories for constrained facilities

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

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.01	<p><b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.6.1D</p>	<p><b>Risk Rating</b> Medium <b>Compliance Rating</b> 1</p>	<p><b>Incorrectly constraining a Market Participant to a level greater than that of their Balancing Merit Order position</b></p> <p>On 31 May 2018, AEMO System Management incorrectly constrained a Market Participant to a level greater than that of their Balancing Merit Order position. This occurred when the facility was islanded due to a weather-related safety concern.</p> <p>The constraint was not compliant with rule 7.6.1D as there was no actual or threatened High Risk Operating State at the time.</p> <p>Subsequent to this event, AEMO have liaised with the participant to agree on how the islanding of the facility should be represented in BMO, however the main cause was human error by the controller.</p> <p>No further action.</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>
19WEM1.02	<p><b>Issue Type</b> AEMO reported non-compliance</p>	<p><b>Risk Rating</b> Medium <b>Compliance</b></p>	<p><b>Incorrectly granting permission for a facility to synchronize which was not in line with the Facility's Dispatch Instruction</b></p> <p>On 6 April 2018, AEMO System Management incorrectly granted permission</p>	<p>Ensure that this situation is included in controller training, and that all controllers receive this training.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	<b>Obligation</b> 7.9.4(a)	<b>Rating</b> 1	<p>for a facility to synchronise (after it had been offline due to operational issues) which was not in line with the Facility's Dispatch Instruction. This is recorded as a systems deficiency in AEMO's compliance log, but this is mainly human error by the AEMO controller, as permissions were incorrectly given by phone.</p>	
19WEM1.03	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.6.1C	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	<p><b>Not using latest BMO due to denial of service cyber attack in 3rd party IT system.</b></p> <p>On 30 July 2018 and 31 July 2018, Western Power's IT Services experienced a cyberattack resulting in a total network failure. This caused several Balancing Merit Order files (BMO's) not being uploaded and the potential for Out of Merit Dispatch.</p> <p>The root cause of the potential out of merit dispatch was the cyber attack on Western Power, and we are satisfied that WP and AEMO have taken appropriate steps as a result.</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>
19WEM1.04	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.6.1D	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	<p><b>Incorrectly constraining a facility to a level lower than that of their Balancing Submission</b></p> <p>On 28 July 2018, AEMO System Management incorrectly constrained a facility to a level lower than that of their Balancing Submission after the facility returned from an extended outage.</p> <p>As corrective actions from this breach, AEMO have improved the Electronic</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			Logbook guidelines to request the generated value from the Market Participant when constraining the facility, and added a note to the Dispatch FAQs regarding the use of generated values with the SOCC_UI.	
19WEM1.05	Issue Type AEMO reported non-compliance Obligation 7.6.1C	Risk Rating High Compliance Rating 1	<b>Not using the latest BMO due to WP IT issues</b>  On 15 August 2018, Western Power's IT services experienced a failure of a Security Device, which led to an inability of files transfer to WP. As a result, six Balancing Merit Order (BMO) files were not uploaded. As System Management were not using the latest BMO for Dispatch, there was the potential for Out of Merit Dispatch to Occur.	No further action.  AEMO has addressed the issue.
19WEM1.07	Issue Type AEMO reported non-compliance Obligation 7.6A.2(e)	Risk Rating Low Compliance Rating 1	<b>Failure to publish aggregate forecast output of non-scheduled generators by deadline</b>  On 5/10/2018 System Management failed to determine by 4.00pm on the Scheduling Day associated with a Trading Day the aggregate forecast output of all Non-scheduled Generators for the Trading day. The file was sent at 4.06pm and not the required 4.00pm deadline, after AEMO Market Operations advised SM Operations that the file had not been sent. As a preventative action, AEMO have implemented a MOSMI alert at 3pm to ensure that the file is sent on time.	No further action.  AEMO has addressed the issue.
19WEM1.11	Issue Type AEMO	Risk Rating Medium	<b>Failure to issue Dispatch Advisory for out of merit generation</b>	No further action.



Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	reported non-compliance <b>Obligation</b> 7.11.5(g)	<b>Compliance Rating</b> 1	On 3 December 2018, System Management failed to issue a Dispatch Advisory for potential Out of Merit Generation after a facility was constrained for Security Reasons. The cause was human error - not following the Dispatch Advisory Guidelines.	AEMO has addressed the issue.
19WEM1.13	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.11.5(g)	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	<b>Failure to issue Dispatch Advisory for out of merit generation</b>  On 8 February 2019, System Management failed to issue a Dispatch Advisory for a potential Out of Merit Generation after a facility was constrained following a trip of approximately 116MW and a DI of 165MW. The cause was human error - not following the Dispatch Advisory Guidelines.	No further action.  AEMO has addressed the issue.
19WEM1.16	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.6A.2(c)	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	<b>Failure to send Synergy dispatch plan by deadline</b>  On 23 February 2019, System Management did not provide a Market Participant a required file (The Dispatch Plan, forecast of energy requirements for the Balancing Portfolio and forecast of ancillary service requirements) by the scheduled 4.00pm deadline. The file was sent at 5.39pm. The cause was an isolated error in the email system, which did not deliver the email after the AEMO staff member sent it.	No further action.  AEMO has addressed the issue.
19WEM1.17	<b>Issue Type</b> AEMO reported non-compliance	<b>Risk Rating</b> Medium <b>Compliance</b>	<b>Incorrect Resource ID in settlement data</b>  System Management included the wrong Resource ID within the AS_ACTIVATION_INSTRUCTIONS data for ALINTA_PNJ_U2 who were	No further action.  AEMO has addressed the issue.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	<b>Obligation</b> 7.13.1 (e); 7.13.1(eC)	<b>Rating</b> 1	recently certified for LFAS and added to the existing reporting tool. The cause of the error was a typographical error when updating the reporting tool to add the two recently certified Alinta Pinjara facilities. The error was picked up and raised by AEMO Market Operations, and the error was corrected.  The reporting tool has since been updated to obtain the resource IDs from SMITTS, rather than using manual entry.	
19WEM1.19	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.5.5B	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	<b>Failure to calculate dispatch volumes for curtailed facility</b>  GREENOUGH_RIVER_PV1 was curtailed for a Network line outage on 19/01/2019. System Management did not calculate and provide Dispatch Volumes for the period of curtailment as required by MR 7.7.5B. The cause of the error was the SM Operations staff member missing the control room log entry that specified the curtailment.  As a preventative measure, the importance of thoroughly checking the control room logs has been reinforced with the SM Operations staff. More consistent application of electronic logbook guidelines would also reduce the risk of this kind of error - see finding 19WEM1.61	No further action.  AEMO has addressed the issue.
19WEM1.20	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.11.4	<b>Risk Rating</b> Medium <b>Compliance Rating</b> 1	<b>Failure to withdraw DA when situation was resolved.</b>  System Management issued a Dispatch Advisory (DA) and failed to withdraw the DA once the situation was resolved.  On 17/03/2019 at 00:06 a DA was issued in relation to a trip of a major unit which occurred at 23:31 on 16/03/2019 and briefly brought the Operating	No further actions.  AEMO has addressed the issue.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>State into a High Risk Operating State (the frequency dropped below 49.68Hz for around one minute according to data and the "Details" within the DA). The DA did not contain an End Date, End Hour or End Interval. The DA was only withdrawn before 7:00am following System Management Operations morning shift noticing that the DA did not have an End Date/Time or was withdrawn. As such WEM Rule 7.11.4 was breached due to not withdrawing the DA as soon as practicable.</p> <p>The cause of the error was a lack of education, as the controllers assumed the End Date, End Hour and End Interval fields were optional. The Dispatch Advisory Guidelines have been re-sent to all control room staff.</p>	
19WEM1.21	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Obligation</b> 7.13.1 (c); 7.13.1(eF)</p>	<p><b>Risk Rating</b> Medium</p> <p><b>Compliance Rating</b> 1</p>	<p><b>Failure to issue retrospective dispatch instructions on time</b></p> <p>Due to a Western Power line outage System Management constrained two Facilities on via the SOCCUI setpoint on 21/03/2019m 23/03/2019 and 24/03/2019. A retrospective Dispatch Instruction was not issued until 27/03/2019. The two facilities in question do not respond to constraints applied via the SOCCUI; the controllers must manually change the set point for these facilities. Then SM Operations need to issue retrospective DIs to reflect the setpoint changes. This was overlooked, and not done until several days later when the Market Participant alerted AEMO.</p> <p>As a preventative action, monitoring of control room logs will be performed to look for events for the two affected facilities.</p>	<p>Ensure that the monitoring of control room logs as specified in finding is documented in the appropriate procedure</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.36	<b>Issue Type</b> RBP reported non-compliance <b>Obligation</b> 7A.3.6	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	<b>Multiple instances of updated BMO not being created due to WEMS outages</b>  There are multiple instances during the audit year of not creating an updated BMO for the trading period due to planned or unplanned WEMS outages. SM OGI have asserted these are not breaches as no BMO was created (due to the WEMS outages). However, not creating a BMO for a trading period using the latest balancing submissions is arguably a breach of 7A.3.6.  For planned WEM outages, AEMO manages noncompliance risk by blocking participant access to WEMS, so that participants cannot make submissions that would make the BMO used for dispatch out of date.	<ul style="list-style-type: none"> <li>• Ensure that all instances of not using or creating an up to date BMO are investigated and reported as self-reported breaches where appropriate, so that progress in resolving these issues can be monitored.</li> <li>• Review incident management process to ensure that all potential incidents are investigated, and refresh process to SM Market Operations team</li> </ul>
19WEM1.54	<b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.13.1A(b) and consequentially 6.15.3, upcoming 9.19.1, potentially 4.26.1(e),	<b>Risk Rating</b> Low <b>Compliance Rating</b> 1	<b>Erroneous TES calculation and constraint payments (plus potentially RC refunds and Relevant Level) due to erroneous upload of ex-post outage file.</b>  Clause 7.13.1A(b) requires SM to record a schedule of planned, forced and consequential outages for each trading interval of each trading day by noon of the 15th business day following the relevant trading day. On 18 December 2018, SM created an ex-post outage file under clause 7.13.1A(b) for trade day 29 November 2018. The ex-post outage file was first created on SM systems, then extracted as an XML to be sent via FTP to the settlement systems. The ex-post outages contained in this XML file are used to : (a) calculate the Theoretical Energy Schedule (TES) under clause 6.15.3 so that constraint payments can be calculated	No further action. AEMO has addressed the issue.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
	4.26.1C, 4.26.2, 4.26.6		<p>(b) calculate Reserve Capacity refunds</p> <p>(c) publish outage information to the AEMO website.</p> <p>Due to human error, the XML extraction process was interrupted and the resulting XML file which contained the ex-post outages had incomplete information (i.e. outages were missing for some facilities). This incomplete XML file was used for settlement as a result of which:</p> <p>(a) The TES calculation for a particular facility for trading day 29 November 2018 was incorrect, and they were incorrectly assigned a constrained-off payment of \$14,931 (breach of clause 6.15.3). This is to be corrected via adjustments.</p> <p>(b) Reserve capacity refunds of \$270 was incorrectly applied to a facility (denoting a breach of clause 4.26.1).</p> <p>(c) The Facility Capacity Rebate was determined from the incorrect outages leading to some generators incorrectly receiving a Facility Capacity Rebate (breach of clause 4.26.6). This has been corrected in adjustments.</p> <p>(c) There were minor consequential breaches with no impact including: incorrect classification of outages as refund exempt or payable (clause 4.26.1C); incorrect publication of the Refund Exempt Planned Outage (REPO) count (clause 10.5.1(z)); incorrect Net STEM Shortfall calculation based off incorrect outage information (clause 4.26.2).</p> <p>Market Operations proposes to address the constraint payment error through an adjustment which will be a technical breach of clause 9.19.1<sup>6</sup>.</p>	

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<sup>6</sup> While this is a technical breach of the WEM Rules, we note that AEMO’s proposed actions are aligned with the intent of the WEM Rules to mitigate adverse financial impacts on participants.

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>Since the breach, SM have improved their XML file creation tool to ensure the extraction process cannot be interrupted while running. This will prevent recurrence of similar breaches.</p>	
19WEM1.59	<p><b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 7.6A.2.(c); 10.2.2(b)</p>	<p><b>Risk Rating</b> Low <b>Compliance Rating</b> 1</p>	<p><b>Confidential participant data sent to Synergy with Dispatch Plan</b></p> <p>On 20/03/19, an updated dispatch plan was prepared and sent to Synergy. Due to an erroneous spreadsheet that was used to prepare the dispatch plan, an extra worksheet was included that included a full day of individual participant data, rather than the aggregated data that should have been sent. The specific date of the individual participant data is not known, but it was at least a week old at the time of the incident.</p> <p>The cause of the breach was the incorrect spreadsheet, which had been created for a new dispatch plan creation procedure. The spreadsheet has been corrected, and all other users' templates have been checked for this issue.</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>

## 9 WEM RULES CHAPTER 7A – BALANCING MARKET

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

### 9.1 RULE AMENDMENTS

There have no amendments to Chapter 7A of the WEM Rules.

### 9.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 7A of the WEM Rules in all material respects.

### 9.3 OPERATIONAL COMPLIANCE WITH CHAPTER 7A

#### 9.3.1 Audit activities

We have:

- Reviewed instances of non-compliance with Chapter 7
- Conducted business process walkthroughs to:
  - Review Real-Time control room operations relating to Balancing Market Dispatch
- Conducted compliance testing on:
  - Dispatch of GIA-constrained facilities
  - Use of latest BMO in dispatch

### 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 17: Operational compliance findings associated with Chapter 7A of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.58	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Obligation</b> 7A.3.6, 6.19.3, 7.6.1C</p>	<p><b>Risk Rating</b> Low</p> <p><b>Compliance Rating</b> 1</p>	<p><b>Market Advisory not issued for WEMS FTP issue.</b></p> <p>A communications issue between AEMO's WEMS and SMMITS systems between 16:34 and 17:16 on 01/09/2018 caused two BMO files, which had been created by WEMS, not being sent to System Management. As a result, System Management were not dispatching according to the latest BMO during this time. This is a breach of rule 7A.3.6.</p> <p>Rule 6.19.3 requires a Market Advisory to be issued as soon as practicable after AEMO becomes aware of an event that may impact on market operations. No Market Advisory was issued for this event, so rule 6.19.3 was also breached.</p> <p>The cause of the first breach was a configuration error, which has been rectified. The cause of the second breach was oversight by an AEMO staff member. AEMO Market Operations staff have been reminded by email of the requirements under 6.19.3.</p>	<p>No further action.</p> <p>AEMO has addressed the issue.</p>



# 10 WEM RULES CHAPTER 7B – LOAD FOLLOWING SERVICE MARKET

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

## 10.1 RULE AMENDMENTS

There have been no amendments to Chapter 7B of the WEM Rules.

## 10.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 7B of the WEM Rules in all material respects.

## 10.3 OPERATIONAL COMPLIANCE WITH CHAPTER 7B

### 10.3.1 Audit activities

- We compliance tested whether AEMO has provisioned LFAS 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

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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

A minor amendment has been made to clause 8.4.5 to remove the requirement for the Meter Data Agent (Western Power) to confirm by telephone that it has not received a Meter Data submission.

### 11.2 AEMO PROCEDURES

AEMO's 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

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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

There have two minor amendments to Chapter 9 of the WEM Rules:

- Minor change to clause 9.4.7 to remove the requirement for AEMO to confirm receipt of a Capacity Credit Allocation by telephone.
- Typographical error removed from clause 9.9.3A.

### 12.2 AEMO PROCEDURES

AEMO's Internal Procedures are compliant with Chapter 9 of the WEM Rules in all material respects.

### 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 metering and settlement validation activities.
- Undertaken (retrospective) business process walkthroughs of the preparation of spinning reserve cost inputs into settlement
- Performed compliance testing to audit:
  - Spinning reserve (SR) inputs to settlement were correct and compliant with the WEM Rules and the relevant contracts for provision of that service.

- System Restart Services (SRS) inputs to settlement were correct and compliant with the WEM Rules and the relevant contracts for provision of that service

### 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 18: Operational compliance findings associated with Chapter 9 of the WEM Rules

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
19WEM1.43	<p><b>Issue Type</b> RBP reported compliance risk</p> <p><b>Obligation</b> 9.9.2, 9.9.3, 9.9.4</p>	<p><b>Risk Rating</b> Medium</p> <p><b>Compliance Rating</b> 2</p>	<p><b>Potential risk areas still exist in AS monthly data preparation</b></p> <p>The process for preparing monthly AS inputs has some risk areas that could be improved:</p> <ul style="list-style-type: none"> <li>SM Ops' weekly ad-hoc procedure indicates that the PE must review monthly AS cost calculations performed by the SM Ops team. However, it is unclear what checks the PE performs and AEMO has been unable to provide us any evidence that these checks occurred for the April 2019 calculations.</li> <li>There is no formal mechanism for ensuring contractual updates are reflected in any of the tools. For example, some contracts need to be renegotiated while others are updated annually (either based on CPI or a static value) in accordance with the contract. The System Restart payment for the Pinjar facilities are linked to both CPI changes and the payment in the previous 12-month period. Changes typically occur at the start of the financial year; however, there is no control in place to ensure this update occurs in a timely and accurate manner.</li> </ul>	<p>We recommend:</p> <ol style="list-style-type: none"> <li>SM formally document the checks that are to be performed when reviewing monthly AS cost calculations. We also recommend SM institute a more robust audit trail with respect to these checks (e.g. email containing detail of what checks were performed and the results).</li> <li>SM institute formal controls to ensure annual or other contractual changes are reflected in the AS tools (e.g. procedure sets out process to be followed</li> </ol>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<ul style="list-style-type: none"> <li>The process for adjusting SRS payments for availability is currently manual (but will be automated in Q3/Q4. At the moment, however, this is prone to error as it is manual and undocumented. We also note that the process for adjusting for outages is not transparent; for example it is unclear as to whether a facility is considered to be completely out if there is a partial forced outage and how ex-post outages which are not available at the time the SRS payments are calculated are dealt with - see finding 19WEM1.44.</li> </ul>	<p>when updating different contracts; calendar alerts based on contract milestones; JIRA entries (similar to what is used by the settlements team to track key events during a cycle)).</p> <p>3. As per our recommendations in 19WEM1.44, SM should ensure a legal review of contracts is performed to ensure any conditions relating annual fee indexation or clawbacks (due to non-performance) are reflected correctly in the monthly cost calculation process.</p>
19WEM1.44	<b>Issue Type</b> RBP reported non-compliance <b>Obligation</b> 9.1.3, 9.19.3(b)	<b>Risk Rating</b> High <b>Compliance Rating</b> 1	<b>Systemic and historic errors in SRS payments</b> Clause 9.9.4(a) of the WEM Rules requires AEMO to calculate the monthly payment for each contracted Ancillary Service, which includes System Restart Services (SRS).  Due to gaps in the process for calculating SRS monthly costs (see also 19WEM1.43), AEMO has been calculating the total SRS	We further recommend that SM develop and document (in their internal procedures) a robust process to calculate SRS payments. The process

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>cost payable incorrectly since market start. During the audit we have noted that all facilities currently providing SRS have been paid incorrect amounts as follows:</p> <ul style="list-style-type: none"> <li>• The first issue has existed at least since July 2016 and resulted in SM omitting clawback payments when contracted facilities failed to meet the performance and technical requirements as specified in their respective contracts. As a result, the relevant participants have been overpaid for providing SRS services since market start. The impact of these overpayments is summarised below for the audit year and for the period 1 July 2016 to 30 June 2018: <ul style="list-style-type: none"> <li>♦ The total amount of overpayment in respect of existing contracts during the audit year has been \$92,232.</li> <li>♦ AEMO estimates that the historic level of overpayment since July 2016 (for existing and historic contracts) has been \$204,539.</li> </ul> </li> </ul> <p>AEMO is currently reviewing current and historic contracts to assess the practicality of clawing back overpayments; noting that only errors in the past 12 months can be washed up via the adjustments process.</p> <ul style="list-style-type: none"> <li>• The second issue relates to this audit year only. AEMO underpaid one of the SRS providers by \$141K per month from November 2018 to May 2019. The relevant contract has an annual indexation that occurs part way through a month. To reflect this indexation, SM updated their SRS tool with a</li> </ul>	<p>should include controls to ensure:</p> <ol style="list-style-type: none"> <li>1. Contractual arrangements are accurately reflected in payments (a legal review of the compliance of SM's process with the contractual arrangements should be undertaken, and repeated whenever a contract is renegotiated)</li> <li>2. Clawback payments are accurately calculated</li> <li>3. Annual indexation calculations are performed correctly, and that the base monthly value is updated if a pro-rated value is used to reflect indexation occurring part way through a month.</li> </ol>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>temporary (lower) pro-rated monthly payment for the last week of October 2018. From November 2018, the full monthly payment should have applied; however, SM failed to update their tool to reflect the full monthly payment. The underpayment of \$990K to the participant will be washed up via the adjustment process (to be triggered by the participant lodging a dispute).</p> <p>To prevent recurrence, SM is developing automated tools for each SRS facility that will calculate the payments including clawbacks based on outage data. These tools will not be ready till at least September 2019; in the interim SM will use a manual workaround to reflect outages.</p>	
19WEM1.52	<p><b>Issue Type</b> AEMO reported non-compliance</p> <p><b>Obligation</b> 9.9.2(l), 9.9.2(f), 9.9.2(h) and 9.9.2(i)</p>	<p><b>Risk Rating</b> High</p> <p><b>Compliance Rating</b> 1</p>	<p><b>Incorrect calculation Contracted Spinning Reserve quantity</b></p> <p>Clause 9.9.2 of the WEM Rules defines the total payments for spinning reserves in a trading interval as well as each market participant's share of the total payment to be a function of (amongst other parameters) the MW amount of spinning reserves procured through contracted services.</p> <p>Due to an error in one of the tools used to derive the spinning reserve payments for reserves procured through contracted services, SM overestimated the amount of spinning reserves provided by two facilities under contracted services. The effect of this was that another participant's facilities were underpaid for the amount of ("uncontracted") spinning reserves provided between July to September 2018 by a total of \$2.2M. There was no impact on the amount paid to facilities providing spinning</p>	<p>No further action - see recommendations for finding 19WEM1.43.</p>



Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>reserves under contracted services, as these payments amounts were calculated correctly in the SM tool and inputted directly into the settlement system as a "manual line item".</p> <p>The error has been treated as a dispute and washed up as part of the adjustments process.</p> <p>Since the error manifested, SM has improved its suite of tools used to calculate payments for contracted spinning reserves. This includes automated retrieval of input information, automated export of data to SMITTS and cell protection. The improvements should mitigate recurrence to some extent. However, there is still room for improvement as noted our recommendations under finding 19WEM1.43 to improve validation processes used to verify contracted spinning reserves payments.</p>	
19WEM1.60	<p><b>Issue Type</b> AEMO reported non-compliance <b>Obligation</b> 9.13.1</p>	<p><b>Risk Rating</b> High <b>Compliance Rating</b> 1</p>	<p><b>Historic error in Market Fee calculation</b></p> <p>Market fees are a function of a participant's generation and load across all connections points in a given month.</p> <p>When calculating the load component, WEM Rule 9.13.1 requires that the calculation should sum the absolute value of all metered schedules for dispatchable, non-dispatchable and interruptible loads for a given participant for all trading intervals in a given month. Due to a system defect, the settlement calculation was summing the metered schedules and then taking the absolute values.</p> <p>The defect has two consequences:</p>	<p>No further action.</p> <p>However, the issue will remain open until the defect has been fixed.</p>

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<ul style="list-style-type: none"> <li>• In any given year, some participants will be paid less than they should have been charged while others would have been overcharged. The magnitude of the over and under-recoveries vary year on year. For example, AEMO has estimated that since market start, the maximum amount overcharged has ranged from \$564 to \$220K, while the maximum amount undercharged has ranged from -\$407 to -\$59K. During the audit year, the maximum amount overcharged was \$83K and the maximum amount undercharged was -\$23K.</li> <li>• The nature of the defect means that Market Customers with a higher proportion of non-dispatchable loads with generation would benefit the most (as their metered schedule input would have been underestimated), while Market Customers with a lower proportion of non-dispatchable loads generation would have been overcharged).</li> <li>• AEMO's under-recovery of fees is reflected as an increase in the fee rate in the following year. This means that participants in a given year subsidies those participants that were undercharged in the previous year.</li> </ul> <p>AEMO has raised the issue with Brady (system owner) to develop a software fix for AEMO's metering and settlements system in order to rectify the incorrect calculation; however, due to other AEMO projects on Brady's pipeline, it is unclear when the fix will be implemented. Until the fix is implemented, this breach will continue to occur; given the complexity of the</p>	

Ref	Issue Type & Obligation	Risk & Compliance Ratings	Finding	Recommendation
			<p>metering and settlement systems, a manual workaround is not practicable.</p> <p>After the software is implemented AEMO will issue adjustment settlements to correct settlement amounts which fall within the open Non-STEM settlement period (previous 12 months following software installation).</p> <p>Our risk rating of high indicates moderate impact and almost certain probability of recurrence due to the delay in the system fix and inability to institute a manual work around.</p> <p>Note that this error was not found in the certification testing of the settlement system. The reason it was not found is that the data required to detect this error is not part of the output of the settlements system; Future certification testing should ensure that additional data is requested to detect this type of error.</p>	

## **13 WEM RULES CHAPTER 10 – MARKET INFORMATION**

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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**

There have been no amendments to Chapter 10 of the WEM Rules.

### **13.2 AEMO PROCEDURES**

AEMO's Internal Procedures are compliant with Chapter 10 of the WEM Rules in all material respects.

### **13.3 OPERATIONAL COMPLIANCE WITH CHAPTER 10**

We have conducted no audit activities pertaining to Chapter 10 of the WEM Rules.

We have noted no instances of non-compliance or compliance risk associated with AEMO's obligations under Chapter 10 of the WEM Rules.

# 14 MARKET SYSTEMS AND SOFTWARE MANAGEMENT

## PROCESSES

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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
- RCM
- RTDE

#### 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 2017-18 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	3.27-1410-1	29/08/2018	No	Maintained	
RCM	1.9-2787-2	29/08/2018	Yes	Certified	Certification date 27/07/2018
WEMS	3.27-1410-2	6/09/2018	No	Maintained	
POMAX	3.4.25	10/09/2018	No	Maintained	
WEMS	3.27-1410-4	25/09/2018	No	Maintained	
RCM	1.9-2787-4	25/09/2018	No	Maintained	
POMAX	3.4.26	25/10/2018	No	Maintained	
WEMS	3.28-1438-2	29/11/2018	No	Maintained	
RCM	1.10-2842	13/11/2018	No	Maintained	
RCM	1.10-2871-6	29/11/2018	No	Maintained	
WEMS	3.28-1438-6	6/12/2018	No	Maintained	

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.

### **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 SOFTWARE MANAGEMENT PROCESSES**

Software management processes are also reviewed in the Gas audit. We carried out a single review covering both audits.

### **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)

### **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 20: 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.
2.36.1(c)	AEMO has conducted appropriate testing on all new releases of market software prior to their being placed in service.



Clause	Comment on compliance
2.36.1(d)	AEMO has ensured that all software versions are covered by an independent certification prior to implementation, with the exception of POMAX settlements version 3.4.18 and all subsequent versions to the end of the audit period – see finding 18WEM1.12
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.

# 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 21: 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 areas for improvement 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 22: 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.
High	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.

Table 23: Risk rating matrix

		CONSEQUENCE				
		<i>Immaterial</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>	<i>Extreme</i>
LIKELIHOOD	<i>Almost Certain</i>	Medium	Medium	High	Critical	Critical
	<i>Likely</i>	Low	Medium	High	Critical	Critical
	<i>Possible</i>	Low	Medium	High	High	Critical
	<i>Unlikely</i>	Low	Low	Medium	Medium	High
	<i>Rare</i>	Low	Low	Medium	Medium	High

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 multiple occurrences
Possible	11% - 50%	May occur, but not expected in most circumstances; statistical record of a few occurrence
Unlikely	1% - 10%	Conceivable but unlikely to occur in any given year; statistical record of at least one occurrence
Rare	<1%	Will only occur in exceptional circumstances; no history of occurrence

### 15.1.3 AEMO impact ratings

AEMO’s impact rating matrix is provided below. When assessing the financial impact of non-compliance and risk on market participants, we have used the Financial (AEMO) category below as a guideline to assign risk ratings

<i>Consequence</i>	<i>Reputation and Stakeholders</i>	<i>Financial (AEMO)</i>	<i>Safety</i>	<i>Environment</i>	<i>Market &amp; System Impact</i>	<i>Legal &amp; Compliance</i>
<b>Extreme</b>	<ul style="list-style-type: none"> <li>Significant long term damage to stakeholder and public confidence and relationships.</li> <li>Continued adverse media exposure.</li> <li>Significant financial impact drives participant(s) towards insolvency.</li> </ul>	> \$25M	<ul style="list-style-type: none"> <li>Single fatality or permanent injury or multiple notifiable injuries.</li> </ul>	<ul style="list-style-type: none"> <li>Major environmental harm. e.g. major pollution incident causing significant damage or potential to health or the environment; and/or</li> <li>Fines and prosecution likely.</li> </ul>	<ul style="list-style-type: none"> <li>Involuntary disruption of supply to a state(s) for any duration.</li> <li>Market suspension in multiple jurisdictions or markets.</li> </ul>	<ul style="list-style-type: none"> <li>Corporate fine &gt; \$1M.</li> <li>Imprisonment or fine for personal liability to Officer or Director.</li> <li>Regulatory action likely.</li> <li>Litigation involving Class actions.</li> </ul>
<b>Major</b>	<ul style="list-style-type: none"> <li>Significant short term damage to stakeholder confidence and relationships. Some loss of public confidence.</li> <li>Short term adverse media exposure.</li> <li>Significant financial impact on participant(s).</li> </ul>	\$5M - \$25M	<ul style="list-style-type: none"> <li>Notifiable injury requiring hospitalisation &gt; 5 days (incapacity beyond 3 months).</li> </ul>	<ul style="list-style-type: none"> <li>Long term or serious environmental damage; and/or</li> <li>Multiple complaints received; and/or</li> <li>Potential for prosecution.</li> </ul>	<ul style="list-style-type: none"> <li>Involuntary disruption of supply to a large portion of a state, for any duration.</li> <li>Market suspension in one jurisdiction or market.</li> </ul>	<ul style="list-style-type: none"> <li>Corporate fine \$100K &gt; \$1M.</li> <li>Fine for personal liability to officer or director.</li> <li>Likely investigation by a Regulator.</li> <li>Litigation involving protracted Court actions possible.</li> </ul>
<b>Moderate</b>	<ul style="list-style-type: none"> <li>Some damage to stakeholder confidence and relationships.</li> <li>Some adverse media exposure.</li> <li>Adverse financial impact on participant(s).</li> </ul>	\$500K- \$5M	<ul style="list-style-type: none"> <li>Injury requiring &lt; 5 days hospitalisation or increased level of medical treatment (6 days to 3 months incapacity).</li> </ul>	<ul style="list-style-type: none"> <li>Moderate environmental impact; and/or</li> <li>Will cause complaints; and/or</li> <li>Possible fine.</li> </ul>	<ul style="list-style-type: none"> <li>Market(s) operating in administered state, but not suspended.</li> </ul>	<ul style="list-style-type: none"> <li>Corporate fine with no personal liability to Officer or Director.</li> <li>Likely to give rise to questions from a Regulator.</li> <li>Possible dispute resolution process*.</li> </ul>
<b>Minor</b>	<ul style="list-style-type: none"> <li>Manageable reduction in stakeholder confidence.</li> <li>Limited media exposure.</li> <li>Little to no financial impact on participant(s).</li> </ul>	\$100k - \$500K	<ul style="list-style-type: none"> <li>Routine medical treatment only (up to 5 days incapacity).</li> </ul>	<ul style="list-style-type: none"> <li>Minor environmental harm; and/or</li> <li>Potential for complaints; and/or</li> <li>Fine unlikely.</li> </ul>		<ul style="list-style-type: none"> <li>Compliance breach with no penalties.</li> <li>Regulator attention, litigation or dispute resolution* unlikely.</li> </ul>
<b>Immaterial</b>	<ul style="list-style-type: none"> <li>No reduction in stakeholder confidence.</li> <li>No media exposure.</li> <li>No financial impact on participant(s).</li> </ul>	<\$100K	<ul style="list-style-type: none"> <li>First aid.</li> </ul>	<ul style="list-style-type: none"> <li>Little or no environmental harm; and/or</li> <li>No fines or complaints.</li> </ul>		<ul style="list-style-type: none"> <li>No breach or minor technical breach of compliance obligation.</li> <li>No reasonable prospect of regulatory attention, litigation or dispute resolution.</li> </ul>

## 15.2 HISTORICAL MARKET SOFTWARE CERTIFICATION PRIOR TO THE 2017-18 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 full regression tests were carried out to verify that the market software systems comply with the requirements of the WEM Rules and Market Procedures. Since the 2008-9 year, compliance of the market software has been determined by:

- Examining 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. Comprehensive testing of new WEMS components was carried out for the introduction of balancing and load following markets in 2012.

POMAX 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 2011-2018 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	STEM ST1: Two Participants	PASS	2008
		STEM ST2: Multiple Optima Clearing Quantities	PASS	2008
		STEM ST3: Multiple Optima Clearing Prices	PASS	2008
		STEM ST4: Price set at Min-STEM price by default bid	PASS	2008
		STEM ST5: Price set at Alt-Max-STEM price by default bid	PASS	2008
		STEM ST6: Bilateral position outside of Price Curve	PASS	2008
		STEM ST7: Three Participants	PASS	2008

System	Subject	Test	Result	Year
Market Systems	Non-STEM	Prudential Requirements calculation	PASS	2008
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



<b>System</b>	<b>Version number</b>	<b>Changes to calculations affecting market outcomes?</b>	<b>Certification status</b>
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
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

System	Version number	Changes to calculations affecting market outcomes?	Certification status
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
WEMS	3.17-1149-11	Yes	Certified
WEMS	3.18-1183-5	No	Maintained
WEMS	3.19-1192-10	No	Maintained
WEMS	3.19-1192-13	No	Maintained
WEMS	3.21-1236-20	No	Maintained
WEMS	3.22-1297-5	Yes	Certified
WEMS	3.23-1336-1	No	Maintained
WEMS	3.24-1356	No	Maintained
Metering	11 update 14	Yes	Certified
Metering	11.0.20	No	Maintained
Metering	11.0.25	No	Maintained
Metering	11.0.27	No	Maintained
Metering	11.0.28	No	Maintained
Metering	11.0.35	Yes	Certified
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
Settlements	3.4.16	Yes	Certified
Settlements	3.4.17	No	Maintained
Settlements	3.4.18	Yes	Not Certified

System	Version number	Changes to calculations affecting market outcomes?	Certification status
Settlements	3.4.22	No	Not Certified
Settlements	3.4.21	No	Not Certified
RTDE	1.27-1	Yes	Certified
RCM	1.0-1803	Yes	Certified
RCM	1.1-2098-8	Yes	Certified
RCM	1.2-2176-5	Yes	Certified
RCM	1.3-2272-1	Yes	Certified
RCM	1.4-2366-2	Yes	Certified
RCM	1.5-2570	No	Maintained