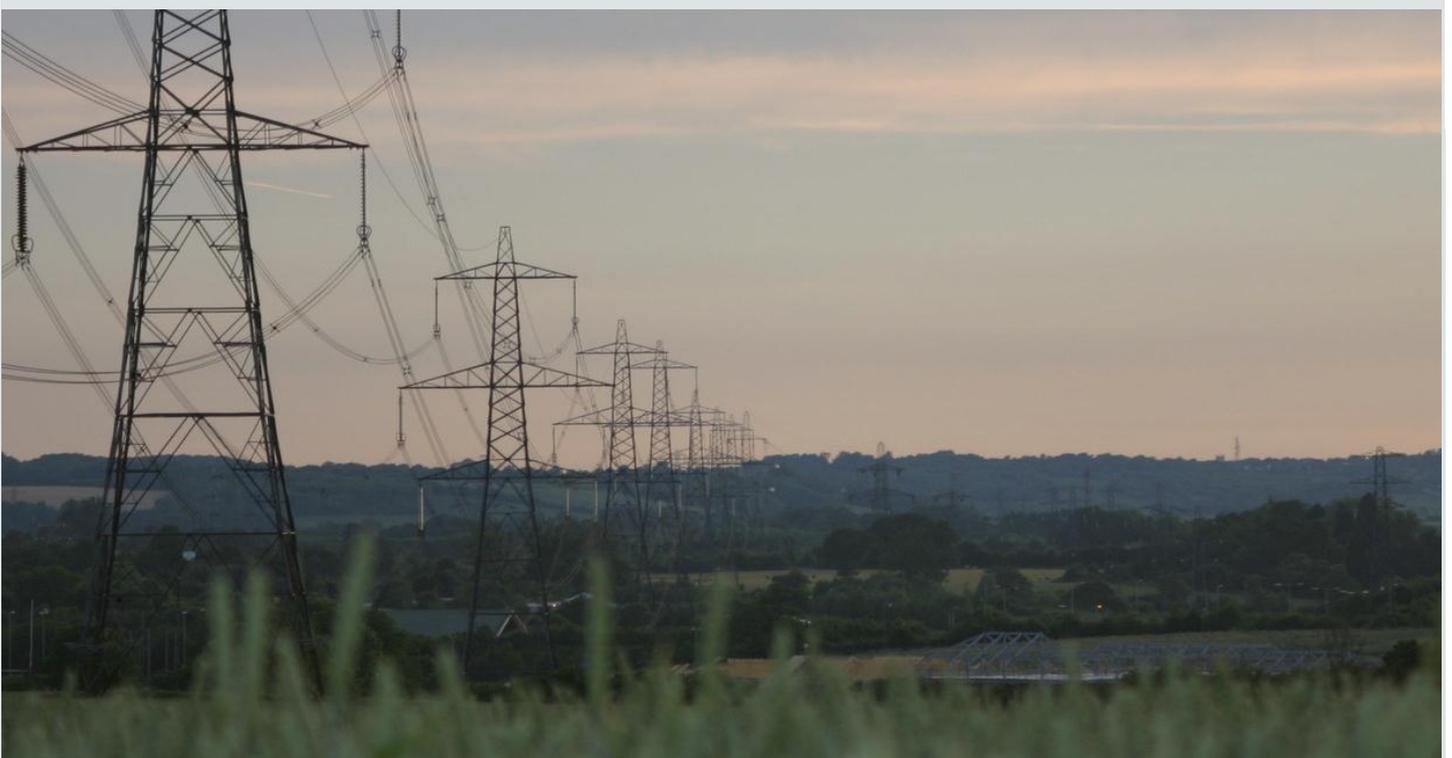# INDEPENDENT MARKET OPERATOR

Compliance of the IMO's market software systems and processes for software management

7 November 2013

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EXECUTIVE SUMMARY

This report sets out the results of the market audit by PA Consulting Group in carrying out its audit of the IMO's market software and processes for software management.

This market audit has been carried out under Market Rule 2.14.3 (c) which requires that;

The IMO must ensure that the Market Auditor carries out the audits of such matters as the IMO considers appropriate, which must include:

  a. *the compliance of the IMO's internal procedures and business processes with the Market Rules*

  b. *the IMO's compliance with the Market Rules and Market Procedures*

  c. *the IMO's market software systems and processes for software management.*

Summary of non-compliance incidents

We have observed 13 non-material incidents of non-compliance.

Twelve of these were instances where the IMO's testing and release processes were not followed. Three instances relate to software versions released without independent certification, and nine to delayed or omitted post-release verification testing. All but one relate to the settlement system. None of the cases were material, as market outcomes were not affected.

The other additional non-material non-compliance is because the IMO was unable to replicate the results of a past settlement run due to errors in the original run, though was able to provide explanations of the differences between the two. The errors in the original run would have been accounted for in the next settlement adjustment.

We have observed one rule change which has still yet to be reflected in production software. Nevertheless, this non-implementation is not material, as it has not affected market outcomes due to the IMO manually performing the affected calculations where necessary.

General comments on the IMO's processes for software management

The IMO has continued to improve its software management processes. In particular, the IMO's practices around change, test and release of the WEMS systems are excellent. The IMO has clearly taken the improvement opportunity afforded by the significant system changes made for the

introduction of the new balancing and load following markets, although procedure documentation needs to be expanded to cover the new processes.

Settlement system change, test and release processes, while improved from last year, are still not as well managed as for WEMS. The increasing level of customisation in the settlement system makes it even more important to apply the same level of rigour as for WEMS.

We note that the process of replicating a settlement run using a prior version of software was quite involved and time-consuming.

Opinion

We have not observed anything that causes us to believe that the IMO's processes for software management are not compliant with the Market Rules, in all material respects.

It is our opinion that the IMO's software correctly implements the calculations embodied in the market rules, in all material respects, except for the calculation of capacity refunds for partially commissioned intermittent generators under Market Rule 4.26.1A(a)(ivA)[1].

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[1]This non-implementation is not material, as the IMO has manually calculated capacity refunds for any generators falling under this rule.

CONTENTS

1   INTRODUCTION

This document sets out the results of the market audit by PA Consulting Group in carrying out its assessment of the IMO's market software systems and processes for software management.

1.1   Scope of the market audit

This market audit has been carried out under Market Rule 2.14.3 which requires that:

The IMO must ensure that the Market Auditor carries out the audits of such matters as the IMO considers appropriate, which must include:

    a.   *the compliance of the IMO's internal procedures and business processes with the Market Rules*

    b.   *the IMO's compliance with the Market Rules and Market Procedures*

    c.   *the IMO's market software systems and processes for software management.*

This document covers our audit under sub-paragraph (c).

1.2   Audit period

The period covered by the audit is 11 August 2012 to 9 August 2013..

1.3   Market audit process

We have approached the audit in two components, respectively examining:

1.   IMO's software management processes and controls; and

2.   Changes to the software itself.

With respect to the software management processes and controls we have:

- Examined the documented processes for software management;
- Compared them to actual operational practices; and
- Reviewed the compliance of operational practices with the Market Rules.

With respect to the software changes, we have:

- Reviewed all system changes implemented since the last audit;
- Assessed whether those changes have potential for material effect on prices and quantities;
- Reviewed whether or not those changes have been certified as required under the Rules;
- Reviewed all rule changes commencing since the last audit;
- Assessed whether a rule change requires a change to the systems; and
- Identified where those changes have not been implemented.

Our process was designed to provide limited assurance as defined by International Standard on Assurance Engagements ISAE 3000 "Assurance engagements other than audits or reviews of historical financial information" issued by the International Auditing and Assurance Standards Board.

1.4   Structure of this report

The report is in two parts:

- Chapter 2 *Compliance of the IMO's software management processes and controls* reports on the compliance of the market software management processes;
- Chapter 3 *Compliance of the IMO software* reports on the compliance of the market software with the Market Rules.

2 COMPLIANCE OF THE IMO'S SOFTWARE MANAGEMENT PROCESSES AND CONTROLS

Appropriate management of the market software by the IMO is essential given the nature of the business risk to both the IMO and the Western Australia Electricity Market.

Although there are no relevant Market Procedures relating to this subject, there are two relevant Internal Procedures:

- Internal Procedure: IT Support Pack;
- Internal Procedure: WEMS Software Configuration Management Plan; and

2.1 Market Rules

The Market Rules set out certain obligations with respect to the IMO's software management systems and controls.

The requirements set out in Market Rule 2.36.1 are:

Where the IMO 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 the IMO 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.*

2.2 Changes to software management processes and controls

This audit period has been one of consolidation for the IMO's IT processes and practices. In particular, the IMO has continued to improve processes for changes to WEMS software, increasing the automation of previously manual testing and release activities. These processes are robust and generally working well, although they are not always well documented. Nevertheless room for improvement remains, especially in the management of settlement software.

2.2.1 Changes to documentation, frameworks and tools

We noted last year that the IMO had introduced a new internal procedure, the WEMS Software Configuration Management Plan (SCMP) which overlapped the existing (and more detailed) Change Management Procedure. The Change Management Procedure has now been deprecated, as it no longer reflects the IMO's change processes. However, no additional detail has been included in the WEMS SCMP, with the result that the change process (though working well in practice) is not well captured in documentation.

The IMO is planning updates to the WEMS SCMP to:

- Expand the scope to include all speciality software used by the IMO, including Settlement, new tools for supporting market operations and finance activities, and the gas bulletin board;
- Clarify change and release processes, including the scope of the Change Control Board
- Incorporate explicit design approvals into change process for major work
- Include more coverage of testing practices
- reflect the IMO's new code repository and build tools Mercurial and Bamboo.

JIRA continues to be the main workflow tool, but its function as a knowledge base is increasingly being taken over by Confluence - a wiki-based tool that IMO staff use for various activities, including as a design repository.

None of the internal procedure documentation explicitly references the Market Rule obligations as is the practice in other IMO internal procedures. We also noted a few cases where personnel details in the IT support pack were out of date.

2.2.2 Changes to practice

The WEMS change, test and release cycle is performing extremely well. This is partly due to the control that the IMO has over the cycle, with development performed in-house, and industry standard test automation, build and release processes and tools in place. The IMO create test strategies, plans, detailed records, and results summaries for each major release, ensuring that the software is well proven before arriving in production, with a solid audit trail. Further, the IMO has embedded change, test, and release process requirements into contracts with external service suppliers, most importantly the Market Systems Support contract.

We noted a definite improvement from last year in the quality and quantity of information captured in JIRA for settlement releases - evidence that the IMO has been working to bring settlement releases into line with the standard process. However, settlement change, test and release processes are still not as well managed as for WEMS, and we believe that there is more that the IMO could do to bring them into line. As an example, the pre-release certification check appears to have been missed on three occasions - though marked in JIRA as 'certification required', it was not performed prior to release. Although the changes were relatively simple, they still had potential for impact on market outcomes. We are also concerned that the increasing level of customisation in the settlement system[2] means that the IMO can no longer reasonably treat it as an off-the-shelf product provided by an

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[2] Particularly since balancing market commencement

external vendor, as certification testing in the audit period has increasingly identified errors in supposedly production ready software.

Planned updates to expand the scope of the WEMS SCMP provide a good opportunity to further align management of the settlement software.

2.3 IMO Compliance with the Market Rules

The IMO's software management processes remain sufficient to comply with the market rules:

- With respect to 2.36.1(a), the IMO continues to maintain 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 and database entries;
- With respect to 2.36.1(b), the IMO maintains the ability to roll back versions of the market software by restoring previous database versions and re-installing previous versions of the software. However, the IMO was not able to reproduce past results for an example case;
- With respect to 2.36.1(c), the IMO tests all new releases of the market software prior to their being placed in service. However, we have observed several instances where post-implementation testing was not carried out appropriately;
- With respect to 2.36.1(d), three software releases were not independently certified prior to implementation;
- With respect to 2.36.1(e), the IMO provides documentation on the functionality of the market software and the IMO is also provided with copies of the release notes provided by the vendors. Given the degree of confidentiality over the software imposed by the vendors, PA accepts that the degree to which the IMO provides documentation is sufficient for compliance with this Market Rule.

2.3.1 Non-compliance with 2.36.1(b)

As part of our audit activities, we asked the IMO to reproduce the results of a past settlement run using the appropriate prior version of the settlement software. The IMO was able to restore the previous version of software, and re-run the calculations, but was unable to exactly replicate the past outputs, due to difficulties replicating errors in the original input data, and errors in the calculation order in the original run. These errors in the original run would have been accounted for in the next settlement adjustment.

While the IMO did provide reasonable (qualitative) explanations for the differences, and we were able to account for the exact quantity of some of the differences, we were unable to perform sufficient analysis to confirm conclusively that all the quantitative differences were explained.

The inability to replicate the results does not of itself affect market outcomes.

2.3.2 Non-compliance with 2.36.1(c)

We have observed nine instances[3] where the IMO's testing of market software releases was, in our view, less timely than appropriate. All cases relate to post-implementation verification testing of releases, where JIRA records show that testing was completed significantly after the release, or not at all. None of these instances is material, as we do not believe that market outcomes were affected.

2.3.3 Non-compliance with 2.36.1(d)

We have observed three instances where the IMO has implemented software changes without independent certification of their correctness. Specific cases are covered in Chapter 3; all cases relate to settlement releases. None of the cases were material, as subsequent certification showed that the software is calculating correctly.

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[3] Eight settlement, one WEMS

2.3.4 Tools external to the core market systems

The IMO has identified a number of tools which are external to the core market systems, but still used in calculations with potential for material impact on market outcomes.

For the purposes of compliance with the Market Rules, it is unclear whether these tools - many in spreadsheet form - are covered under the 'software' referred to in clause 2.36.1. Nonetheless, the IMO has determined that as part of prudent operation of the market, these tools should also be subject to certification where they meet the criteria in the Internal Procedure: Market Audits.

These tools are not subject to the same rigour of change and release management as the core market software. It is therefore difficult to determine when a version change occurs, and build in appropriate controls. Nevertheless, several of these tools have been certified since the last audit, as noted in chapter 3.

2.4   Opinion

We have not observed anything that causes us to believe that the IMO's processes for software management do not comply with the Market Rules, in all material respects.

While we have observed a number of instances where the IMO's software management processes are not compliant with the market rules, none of these instances is material.

3 COMPLIANCE OF THE IMO SOFTWARE

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

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

- The Reserve Capacity system;
- The Energy Market systems (including the Short Term Energy Market, the Balancing Market and the Load Following Ancillary Service Market); and
- The Settlement systems.

Where a tool outside of the core market systems has been tested and certified, that certification is also covered.

3.1 Approach taken to reviewing the market software

3.1.1 Initial software testing

Verification of the market software results is generally conducted using 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 the IMO's market software, we use both approaches.

Because much of the software tested is embedded in the market systems, the tests to be performed have generally been specified by PA and then conducted by IMO staff. PA has then reviewed the test results to determine whether the results are in accordance with the requirements of the Market Rules.

3.1.2 Repeat software testing

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 procedure. The second exists where such a change control procedure is lacking.

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

- Examining the market software change procedures to ensure that they are robust;
- Examining the changes made to the market systems software to determine whether the changes required independent testing and certification; and
- Carrying out such testing and certification on those software changes as required.

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

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

3.2 Market software certification prior to the 2012-13 audit period

This section provides a summary of the full set of tests conducted on the core IMO market systems previously along with the results of those tests.

For the 2008-2011 audit periods, the information presented is organised around the tests conducted. The following table sets out:

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

Table 1: Summary of previous tests conducted 2008-2011

System	Subject	Test	Result	Year
Market Systems	STEM & Non-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
		NST 1 Dispatch Merit Order	PASS	2008

System	Subject	Test	Result	Year
		NST 2 Dispatch Instructions	PASS	2008
		NST 3 Administered Balancing Prices	PASS	2008
		NST 4 Reserve Capacity Obligation Quantities		
Settlement	Ancillary services Settlements	Test AS1: USHARE and Reserve Share	PASS	2008
		Test AS2: Reserve Cost Share	PASS	2008
		Test AS3 Availability Cost Spinning Reserve	PASS	2008
		Test AS4: Consumer Share	PASS	2008
		Test AS5: Load Following Share	PASS	2008
		Test AS6: Ancillary Services Settlement Amount	PASS	2008
Settlement	STEM Settlement	Test SS1: Calculating STEM Settlement Amounts	PASS	2008
Settlement	Reserve Capacity Settlement	Test RCS1: Calculating Reserve Capacity Settlement Amount for Supply	PASS	2008
		Test RCS2: Calculating Reserve Capacity Settlement Amount for Demand	PASS	2008
		Test RCS3: Calculating Reserve Capacity Refund Settlement Amount	PASS	2008
		Test RCS4: Calculating Reserve Capacity Rebates and Offsets	PASS	2008
Settlement	Balancing Settlement	Test BS1: Authorised Deviation Settlement Amounts	PASS	2008
		Test BS2: Authorised Deviation Settlement Amounts for Verve Energy	PASS	2008
		Test BS3: Unauthorised Deviation Settlement Amounts	PASS	2008
		Test BS4: Resource Plan Deviation Settlement Amount	PASS	2008
		Test BS5: Dispatch Instruction Settlement Amounts	PASS	2008
Settlement	Other Settlement	Test OS1: Reconciliation Settlement Amount	PASS	2008
		Test OS2: Market Fee Settlement Amount	PASS	2008
		Test OS3: NCS, CO and NCC Settlement Amounts	PASS	2007
Settlement	Other Settlement	Test OS1: Reconciliation Settlement Amount	PASS	2008
		Test OS2: Market Fee Settlement Amount	PASS	2008
		Test OS3: NCS, CO and NCC Settlement Amounts	PASS	2008
Settlement	Other Settlement	Test OS1: Reconciliation Settlement Amount	PASS	2008

System	Subject	Test	Result	Year
		Test OS2: Market Fee Settlement Amount	PASS	2008
		Test OS3: NCS, CO and NCC Settlement Amounts	PASS	2008
Settlement	Meter Data Warehouse	Peak determination methodology relating to Temperature Dependent Loads	PASS	2008
Market Systems	Non-STEM	Maximum Alternative Maximum Stem Price calculation	PASS	2008
Market Systems	Non-STEM	Incremental Reserve Capacity Ratio calculation	PASS	2008
Market Systems	Non-STEM	Prudential Requirements calculation	PASS	2008
Market Systems	STEM & Non-STEM	Change to the resource plan calculation	PASS	2009
Settlement	Other Settlement	Settlement of intermittent load generators	PASS	2009
Market Systems	Reserve Capacity	Supplementary Reserve Capacity calculation	PASS	2009
Settlement	Reserve Capacity	Change of Reserve Capacity date range from August - 30 November inclusive to 1 June - 30 September	PASS	2010
Settlement	Reserve Capacity	Early Certified Reserve Capacity calculation	PASS	2010
Settlement	Ancillary Service Settlement	Treatment of negative MCAP on the settlement of Ancillary Services	PASS	2010
Settlement	Reserve Capacity	Calculation of net STEM shortfall	PASS	2010
Settlement	Reserve Capacity	Determination of capacity shortfall for curtailable loads	PASS	2010
Settlement	Ancillary Service Settlement	Ancillary Service Availability Cost calculation	PASS	2011
Market Systems	STEM	Inclusion of more than 50 participants in STEM auction and dispatch merit order calculations	PASS	2011
Settlement	Capacity Refunds	Capacity Refunds calculation: Relief from capacity refund and unauthorised deviation penalties for consequential outages (RC_2010_23)	PASS	2011

Table 2: Production software changes in the 2011-12 audit period

System	Version number	Changes to calculations affecting market outcomes?	Certification status

System	Version number	Changes to calculations affecting market outcomes?	Certification status
Settlement	PST 2.2.3 Update 28	No	Maintained
Settlement	PST 2.5 Update 10	No	Maintained
Settlement	PST 2.5 update 11	Yes	Certified
Settlement	PST 2.5 updates 12 and 16	Yes	Certified
Settlement	PST 2.5 update 13	No	Maintained
Settlement	PST 2.5 update 17	Yes	Certified
Settlement	PST 2.5 update 18	No	Maintained
Settlement	PST 2.5 update 19	No	Maintained
Settlement	PST 2.5 update 21B	No	Maintained
Settlement	PST 2.5 Update 22	Yes	Certified
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

We have reviewed the relevant IMO IT system change control logs (including release notes, JIRA records, and database logs) and have confirmed that, *other than set out in section 3.3*, the above software has not been materially changed since the referenced tests were performed.

3.3   2012-13 market software certification

3.3.1   Certification of core market software

There were 17 releases of new settlement software between 11 August 2012 and 10 August 2013. There were 8 releases of new market systems software in the same period.

Most of these changes maintained certification without additional testing, as they did not involve changes that would be expected to have material impact on prices or quantities. The changes are set out in Table 3, along with the certification status of the software version. Comments are **shown in bold** where the release was implemented without certification. Table 3 only includes releases implemented in the production environment, and does not include versions which were only implemented in a development or test environment.

Table 3: Production software changes in the 2012-13 audit period

System	Version number	Changes to calculations affecting market outcomes?	Certification status	Comment
Settlement	PST 2.9 Updates 2, 4, 5, 6, 7, 8, 9, 10 and 11	Yes	Certified	Significant changes for new balancing and load following markets
Settlement	PST 2.9 updates 11.1 and 11.2	No	Maintained	
Settlement	PST 2.9 update 11.3	No	Maintained	
Settlement	PST 2.9 update 11.5	No	Maintained	
Settlement	PST 2.9 update 14	No	Maintained	
Settlement	PST 2.9 update 14.1	No	Maintained	
Settlement	PST 2.9 update 14.2	Yes	**Certified after implementation**	Minor calculation change While certification was not performed at the time, later certification testing showed the calculations to be correctly implemented.
Settlement	PST 2.9 update 14.3	Yes	**Certified after implementation**	Changes to use tolerance values provided by System Management in place of those provided by WEMS. While certification was not performed at the time, later

System	Version number	Changes to calculations affecting market outcomes?	Certification status	Comment
				certification testing showed the calculations to be correctly implemented.
Settlement	PST 2.9 update 14.5	No	Maintained	
Settlement	PST 2.9 updates 15, 15.1 and 15.2	No	Maintained	
Settlement	PST 2.9 updates 14.4 and 16	Yes	Certified	Changes to out of merit generation and constrained on and off amount calculations for Non-Scheduled Generators as amended by RC_2012_19.
Settlement	PST 2.9 update 18	No	Maintained	
Settlement	PST 2.9 update 14.7	No	Maintained	JIRA records contain no record of post-implementation verification completion.
Settlement	PST 2.9 updates 19, 19.1 and 23	Yes	**Certified after implementation**	Minor calculation change While certification was not performed at the time, later certification testing showed the calculations to be correctly implemented.
Settlement	PST 2.9 updates 24 and 25	No	Maintained	
Settlement	PST 2.9 update 26	No	Maintained	
Settlement	PST 2.9 update 27	Yes	Certified	Changes for RC_2008_29, Demand Side Programmes. This change was identified in the previous audit as a rule change that had not yet been implemented.
WEMS	3.2.8	No	Maintained	
WEMS	3.3.12	No	Maintained	

System	Version number	Changes to calculations affecting market outcomes?	Certification status	Comment
WEMS	3.4.11	Yes	Certified	Includes changes to TES calculations in case of missing data
WEMS	3.5.6	Yes	Certified	Includes changes to RCOQ calculations for Demand Side Programmes
WEMS	3.6.12	Yes	Certified	New functionality to calculate relevant demand for Demand Side Programmes
WEMS	3.6.13	No	Maintained	
WEMS	3.6.15	No	Maintained	
WEMS	3.6.16	No	Maintained	

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

3.3.2 Certification of tools outside core market systems

In addition to certification of core market systems, PA has certified changes to supporting tools as shown in Table 4.

Table 4: 2012-2013 supporting tool certification

System	Subject	Certification scope	Date certified
WEMS-Settlements Interface	Data transfer	All data transfers between WEMS version 3.2.8 and POMAX Settlements Version 2.9 Update 11.1.	4 September 2012
Protected Excel Workbook	Reserve Capacity	Calculation of Maximum Reserve Capacity Price	19 November 2012
WEMS-Settlements Interface	Data transfer	Intermittent load facility association and status data transfer between WEMS version 3.5.6 and POMAX Settlements Version 2.9 Update 15.2.	25 March 2013

3.3.3 Rule changes in the audit period

There were 17 market rule changes commencing between 11 August 2012 and 10 August 2013. Most of these rule changes did not require any changes to market software. Rule changes are listed in Table 5, along with an indication of whether the rule change requires a change to market software that would affect market outcomes, and whether that change has been implemented.

Table 5: Market rule changes commencing in the 2012-2013 audit period

Rule change reference	Title and description	Date commenced	System change required?	System change implemented?	System and version
RC_2011_02	Reassessment of Allowable Revenue during a Review Period	1/07/2013	No	N/A	
RC_2012_04	Consequential Outage Definition	1/09/2012	No	N/A	
RC_2012_06	Clarification of Reviewable Decisions and Definitions of Regulations	1/06/2013	No	N/A	
RC_2012_07	Loss Factor Determination	20/05/2013	No	N/A	
RC_2012_09	Clarification and Calculation of Availability Curve	1/01/2013	No	N/A	
RC_2012_12	Commissioning Test Plans	1/04/2013	No	N/A	
RC_2012_15	Four Month Commissioning Test Period for New Generating systems	1/03/2013	No	N/A	
RC_2012_16	Alignment of Settlement Tolerances and Tolerance Ranges	1/01/2013	Yes - Settlement only	Yes	Settlements 2.9 update 14.3
RC_2012_19	Constrained On/Off Compensation for Non-Scheduled Generators	1/02/2013	Yes - Settlement only	Yes	Settlements 2.9 update 14.4
RC_2012_20	Consideration of Network Constraints for Certified Reserve Capacity	1/07/2013	No	N/A	
RC_2012_21	5-Yearly Reveiw of Planning Criterion	1/05/2013	No	N/A	
RC_2012_24	Cure Notices and Credit Support	1/06/2013	No	N/A	
RC_2012_25	Constrained On/Off Compensation Removal where a Facility is Non-compliant with Dispatch Instructions	1/05/2013	No	N/A	
RC_2013_01	Clarification of Dispatch Compliance Obligations	1/07/2013	No	N/A	

Rule change reference	Title and description	Date commenced	System change required?	System change implemented?	System and version
RC_2013_02	Clarification of the Minimum TES Calculation	1/08/2013	No	N/A	
RC_2013_03	LFAS Facility Definition	1/06/2013	No	N/A	
RC_2013_06	Exclusion of LFAS Quantities from Daily Ancillary Service Files	15/05/2013	No	N/A	

In all cases, if a Rule change required a change to market software, the software has been changed. Certification information for those changes is covered in Table 3.

3.3.4 Rule changes from previous audit periods

We note that one rule change that commenced in the previous audit period (RC_2010_22) is still yet to be reflected in production software. This rule change alters the calculation of capacity refunds for partially commissioned intermittent generators. Changes to the settlement software have been developed, but no certificate has yet been issued for the release, as test results have shown non-compliance with market rule 4.26.1A (a) (ivA).

Nevertheless, this non-implementation is not material, as the IMO has manually calculated capacity refunds for any generators falling under this rule.

3.4   Opinion

It is our opinion that the IMO's software correctly implements the calculations embodied in the market rules, in all material respects, except for the calculation of capacity refunds for partially commissioned intermittent generators under Market Rule 4.26.1A(a)(ivA).

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