



INDEPENDENT MARKET OPERATOR

Final report - Audit 2: Compliance of the
IMO's market software systems and
processes for software management

20 October 2014



PA Regional Office:

PA Consulting Group
Level 13, Allied Nationwide Finance Tower,
142 Lambton Quay,
Wellington 6011,
New Zealand

Tel: +64 4 499 9053

Fax: +64 4 473 1630

www.paconsulting.com

Version no:

FINAL

Prepared by: Tim Robinson, Alastair Duffy

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 two non-material incidents of non-compliance. One where the IMO's release process was not followed, in relation to delayed post-release verification testing for a single settlement system release, and another where a settlement system release was not independently certified prior to implementation. Neither incident was material, as market outcomes were not affected.

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, and in particular we note the improvements to the Software Configuration Management Plan document, and the increased level of automation in the WEMS build and release process. The IMO should include database patches in the WEMS version control and release management process.

The IMO has taken the opportunity afforded by the upcoming major settlement system release to make significant improvements to Settlement system change, test, and release processes, , though opportunities for further improvement still remain.

We also note that the IMO was able to replicate the results of a past settlement run.

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.

¹This non-implementation is not material, as the IMO has manually calculated capacity refunds for the sole facility affected by this rule.

CONTENTS

EXECUTIVE SUMMARY	1
Summary of non-compliance incidents	1
General comments on the IMO's processes for software management	1
Opinion	1
1 INTRODUCTION	3
1.1 Scope of the market audit	3
1.2 Audit period	3
1.3 Market audit process	3
1.4 Structure of this report	4
2 COMPLIANCE OF THE IMO'S SOFTWARE MANAGEMENT PROCESSES AND CONTROLS	5
2.1 Market Rules	5
2.2 Changes to software management processes and controls	5
2.3 IMO Compliance with the Market Rules	6
2.4 Opinion	7
3 COMPLIANCE OF THE IMO SOFTWARE	8
3.1 Approach taken to reviewing the market software	8
3.2 Market software certification prior to the 2013-14 audit period	9
3.3 2013-14 market software certification	14
3.4 Opinion	17

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 10 August 2013 to 31 July 2014.

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 three relevant Internal Procedures:

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

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:

- 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;*
- 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;*
- ensure that appropriate testing of new software versions is conducted;*
- 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*
- 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.*

Rule 2.36.2 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.

2.2 Changes to software management processes and controls

The IMO has continued to improve its IT processes and practices. Increased levels of automation and better process documentation reduce the risk of non-compliance, and processes continue to be robust and fit for purpose. The IMO has less ability to control settlement system development practices than it does for WEMS, as the settlement system is developed by a third party vendor, while WEMS is

effectively developed in house by the IMO. Nevertheless, the IMO does have ability to manage some parts of the settlement system release lifecycle. The management of settlement software has continued to improve over the course of the audit year, but opportunities for further improvement still remain.

2.2.1 Changes to documentation, frameworks and tools

As planned, the IMO has updated and expanded its Software Configuration Management Plan beyond WEMS. It now covers the settlement system, as well as all software developed by the IMO. It has been expanded to include more detail of the change process, including test and release artefacts, and to reference the relevant Rule obligations implemented by software management processes. However, some less critical processes remain undocumented, including the early parts of the change cycle (how changes are identified), and design authority functions.

Workflow processes in JIRA (the IMO's workflow tool, used for development activities as well as operational support) have been streamlined, in line with applying consistent processes across all IMO software. The use of Confluence as a knowledge base continues to expand, and it now holds project management information, and some limited system architecture and design material.

2.2.2 Changes to practice

The WEMS change, test and release cycle continues to perform well. The IMO has continued to automate build and deployment activities, to the point where there is limited scope for manual error in the release process. We note that version control processes do not currently accommodate WEMS patches which involve only database package code changes, and recommend that the IMO prioritise their planned initiative to formalise version control tracking for database objects.

Practices around the settlement system are largely unchanged from last year. The IMO will release a major upgrade to the settlement system in Q4 2014, and is planning to take that opportunity to enhance software management processes for the settlement system. In particular, this will mean a more structured approach to testing (which the IMO is part way through implementing), and ensuring that a full system release is possible each time, rather than incremental patches being the only option.

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. The IMO was able to reproduce past results exactly for a sample 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. We have observed one instance where post-implementation testing was not carried out appropriately;
- With respect to 2.36.1(d), one software version was 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 also holds release artefacts including detailed release notes for each release. 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(c)

We have observed one instance where the IMO's testing of a settlement release was, in our view, less timely than appropriate. This relates to post-implementation verification release testing, where JIRA records show that testing was completed significantly after the release. This instance is not material, as we do not believe that market outcomes were affected.

2.3.2 Non-compliance with 2.36.1(d)

We observed one instance (separate from that discussed in section 2.3.1) where the IMO implemented a software version without independent certification of its correctness. The specific case relates to a change to WEMS database code. The case was not material, as subsequent certification showed that the software is calculating correctly.

2.3.3 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 one instance where the IMO's software management processes was not compliant with the market rules, this instance is not 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.

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. We conducted extensive testing of both WEMS and settlements prior to the introduction of balancing and load following markets in 2012, , and are currently comprehensively testing the IMO Settlements system prior to the upcoming major release of version 3.4.

3.2 Market software certification prior to the 2013-14 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. Table 1 sets out:

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

For the 2011-2013 audit periods, Table 2 sets out the specific market software component releases, and their certification status.

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
		NST 2 Dispatch Instructions	PASS	2008
		NST 3 Administered Balancing Prices	PASS	2008
		NST 4 Reserve Capacity		

System	Subject	Test	Result	Year
		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		
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		
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		
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		
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

System	Subject	Test	Result	Year
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 2011-13 audit periods

System	Version number	Changes to calculations affecting market outcomes?	Certification status
WEMS	2.6.6	No	Maintained
WEMS	2.6.7	Yes	Certified

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

System	Version number	Changes to calculations affecting market outcomes?	Certification status
Settlement	PST 2.5 update 19	No	Maintained
Settlement	PST 2.5 update 21B	No	Maintained
Settlement	PST 2.5 Update 22	Yes	Certified
Settlement	PST 2.9 Updates 2, 4, 5, 6, 7, 8, 9, 10 and 11	Yes	Certified
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
Settlement	PST 2.9 update 14.3	Yes	Certified
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
Settlement	PST 2.9 update 18	No	Maintained
Settlement	PST 2.9 update 14.7	No	Maintained
Settlement	PST 2.9 updates 19, 19.1 and 23	Yes	Certified
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

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 2013-14 market software certification

3.3.1 Certification of core market software

There were 9 releases of new settlement software between 10 August 2013 and 31 July 2014. There were 9 releases of new market systems software in the same 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 but one release having material impact on market prices or quantities were certified prior to release. The changes are set out in Table 3, along with the certification status of the software version. 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 2013-14 audit period

System	Version number	Release date	Changes to calculations affecting market outcomes?	Certification status	Comment
WEMS	3.7.9	9 Sep 2013	No	Maintained	
WEMS	3.7.12	17 Sep 2013	No	Maintained	
WEMS	3.7.13	10 Oct 2013	Yes	Certified	Changes to calculation of minimum TES in situations where more than one outage applies concurrently
WEMS	3.8.5	27 Nov 2013	No	Maintained	
WEMS	3.8.6	2 Dec 2013	No	Maintained	
WEMS	3.9.2	18 Dec 2013	Yes	Certified	Changes for RC_2013_18 Market Rule changes arising due to the merger of the Electricity Retail Corporation and Electricity Generation Corporation
WEMS	3.9.2 (AS-2456)	28 Jan 2014	Yes	Certified after implementation	Minor calculation change. While certification was not performed at the time, later certification showed the calculations to be correctly implemented.
WEMS	3.10.99-15	14 May 2014	Yes	Certified	Changes for RC_2012_03 Assignment of Capacity Credits to Network Control Facilities
WEMS	3.10.99-59	25 Jun 2014	No	Maintained	
Settlement	PST 2.9 update 27.2	13 Sep 2013	No	Maintained	
Settlement	PST 2.9 updates 28,	23 Sep 2013	Yes	Certified	Changes for RC_2013_11 Selection of the 12 Peak Trading Intervals used for

System	Version number	Release date	Changes to calculations affecting market outcomes?	Certification status	Comment
	29 and 30				Calculation of IRCR
Settlement	PST 2.9 update 27.1	3 Oct 2013	No	Maintained	
Settlement	PST 2.9 update 31	24 Dec 2013	Yes	Certified	Changes for RC_2013_18 Market Rule changes arising due to the merger of the Electricity Retail Corporation and Electricity Generation Corporation
Settlement	PST 2.9 updates 32, 32.1 and 33	4 Mar 2014	Yes	Certified	Changes for: RC_2013_18 Market Rule changes arising due to the merger of the Electricity Retail Corporation and Electricity Generation Corporation and RC_2013_08 Market Participant Fees - Clarification of GST Treatment
Settlement	PST 2.9 update 35	10 Mar 2014	No	Maintained	
Settlement	PST 2.9 update 39	19 Mar 2014	No	Maintained	
Settlement	PST 2.9 updates 34 and 38	26 Mar 2014	Yes	Certified	Changes to ensure correct start dates for interest calculations, and IRCR for non-registered intermittent load
Settlement	PST 2.9 update 40	14 Apr 2014	Yes	Certified	Changes to ensure correct calculation of balancing portfolio constrained off amounts

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: 2013-2014 supporting tool certification

System	Subject	Certification scope	Date certified
SPARTA	Invoicing and billing	Snapshot release 1.0.2 – 'invoiced not paid' amounts	5 Sep 2013
Protected Excel Workbook	Reserve Capacity	Calculation of Maximum Reserve	3 October 2013

System	Subject	Certification scope	Date certified
		Capacity Price	
Protected Excel Workbook	Reserve Capacity	Calculation of Maximum Reserve Capacity Price	29 October 2013

3.3.3 Rule changes in the audit period

There were 11 market rule changes commencing between 10 August 2013 and 31 July 2014. 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 2013-2014 audit period

Rule change reference	Title and description	Date commenced	Calculation change required?	Calculation change implemented ?	System and version
RC_2012_03	Assignment of Capacity Credits to Network Control Facilities	12/08/2013	Yes	Yes	WEMS 3.10.99-15
RC_2012_09	Clarification and Calculation of Availability Curve	1/11/2013	No	N/A	
RC_2012_11	Transparency of Outage Information	1/10/2013	No	N/A	
RC_2012_22	Commitment and De-commitment Notification Requirements	1/09/2013	No	N/A	
RC_2012_23	Prudential Requirements	01/05/2014	No	N/A	
RC_2013_05	LoadWatch, EOI and RDQ Provision	2/09/2013	No	N/A	
RC_2013_07	Correction of Minor, Typographical and Manifest Errors	25/11/2013	No	N/A	
RC_2013_08	Market Participant Fees - Clarification of GST Treatment	1/01/2014	Yes	Yes	Settlement 2.9 update 33
RC_2013_11	Selection of the 12 Peak Trading Intervals used for Calculation of IRCR	23/09/2013	Yes	Yes	Settlements 2.9 update 28
RC_2013_17	Correction to estimated output of Intermittent Generation for purposes	1/05/2014	No	N/A	

Rule change reference	Title and description	Date commenced	Calculation change required?	Calculation change implemented ?	System and version
	of Appendix 9				
RC_2013_18	Market Rule changes arising due to the merger of the Electricity Retail Corporation and Electricity Generation Corporation	30/12/2013 and 01/01/2014	Yes	Yes	WEMS 3.9.2 Settlements 2.9 Updates 31 and 32

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 a 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 the single facility 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).



CONSULTING
TECHNOLOGY
INNOVATION

We are an employee-owned firm of over 2,500 people, operating globally from offices across North America, Europe, the Nordics, the Gulf and Asia Pacific.

We are experts in energy, financial services, life sciences and healthcare, manufacturing, government and public services, defence and security, telecommunications, transport and logistics.

Our deep industry knowledge together with skills in management consulting, technology and innovation allows us to challenge conventional thinking and deliver exceptional results with lasting impact.

Corporate headquarters

123 Buckingham Palace Road
London SW1W 9SR
United Kingdom
Tel: +44 20 7730 9000

paconsulting.com

This document has been prepared by PA on the basis of information supplied by the client and that which is available in the public domain. No representation or warranty is given as to the achievement or reasonableness of future projections or the assumptions underlying them, management targets, valuation, opinions, prospects or returns, if any. Except where otherwise indicated, the document speaks as at the date hereof.

© PA Knowledge Limited 2014.
All rights reserved.

This document is confidential to the organisation named herein and may not be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise without the written permission of PA Consulting Group. In the event that you receive this document in error, you should return it to PA Consulting Group, 123 Buckingham Palace Road, London SW1W 9SR. PA accepts no liability whatsoever should an unauthorised recipient of this document act on its contents.