



# **Philippine Electricity Market Corporation (PEMC)**

## **5<sup>th</sup> Independent Operational Audit Report of Systems and Procedures on Market Operations**

**For the Period 23 June 2013 to  
25 December 2014**

# 5<sup>th</sup> Independent Operational Audit Report of the Systems and Procedures on Market Operations for the Philippine Electricity Market Corporation (PEMC)

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# Preface

## Introduction

RSM Bird Cameron is pleased to submit our independent audit report for the 5<sup>th</sup> Independent Market Operations Audit of the Market Operator systems and procedures for the Philippine Electricity Market Corporation (“PEMC”), for the period 26 June 2013 to 25 December 2014.

PEMC appointed RSM Bird Cameron as the 5<sup>th</sup> Market Operations Auditor to conduct a limited and reasonable assurance engagement of specified Wholesale Electricity Spot Market (“WESM”) and Retail Contestability and Open Access (“RCOA”) activities of PEMC as required by the WESM and Retail Rules and Manuals. In particular, the WESM rules sets out the mandate of the Market Operations Audit.

The PEM Board under WESM Rules Clause 1.4.5.2 is responsible to oversee and monitor the activities of the Market Operator (“MO”) and System Operator (“SO”) to ensure they fulfil their responsibilities under the WESM Rules, and act in a manner consistent with the WESM Rules.

The WESM Rules sets out the mandate of the Market Operations Audit. Clause 1.5.2 requires the PEM Auditor to:

- Conduct annual audits of the MO and the settlement system and any other procedures, persons, systems or other matters relevant to the spot market;
- Test and check any new items or versions of software provided by the MO for use by WESM members;
- Review any procedures and practices which are covered by the WESM Rules at the direction of the PEM board;
- Recommend changes to the WESM Rules where the PEM Auditor detects deficiencies as a consequence of an audit, review, test, check or other form of review; and
- Publish on the market information website the results of any findings and recommendations.

## Overview of PEMC and WESM

The WESM was established as part of the package of electric power industry reforms mandated in Republic Act No. 9136, or the Electric Power Industry Reform Act of 2001 (“EPIRA”), to provide the mechanism for identifying and setting the price of actual variations from the quantities transacted under contracts between sellers and purchasers of electricity. The Department of Energy (“DOE”) with electric power industry participants, developed detailed rules (“WESM Rules”) to govern the conduct of the WESM.

### PEMC

PEMC was incorporated in November 2003 as the governance arm of the WESM. PEMC’s functions are prescribed in the WESM rules with the various WESM committees providing the governance functions of PEMC. These include:

- PEM Auditor;
- Rules Change Committee;
- Disputes Resolution Administrator;
- Market Surveillance Committee; and
- Technical Committee.

The Market Assessment Group (“MAG”) provides technical and administrative support to the above mentioned PEM Committees.

### Commencement of RCOA

The Energy Regulatory Commission (“ERC”) declared the commencement of the Retail Competition and Open Access (“RCOA”) on 26 December 2012. Commercial operations commenced on 26 June 2013 whereby PEMC was designated as the Central Registration Body (“CRB”) under the RCOA Regime. The Integration of retail competition in the WESM aims to promote competition, customer choice and empowerment, transparency, accountability and greater efficiency in the power industry and to reflect the true cost of electricity. The rules for the integration of retail competition in the WESM were adopted on 9 January 2013 (Retail Rules). The Retail Rules form part of the rules that govern the operation of the WESM and are read and used in connection with the WESM Rules.

## Preface (Cont.)

### Audit and Review Requirements

The PEM Audit Market Manual Section 7.2.2 outlines the general objectives of the annual audit of the spot market are as follows:

- Assess procedures and working processes in the MO;
- Assess the usefulness and appropriateness of systems settlement system, data management and other processes used by the MO to administer the WESM, in order to:
  - identify the appropriate steps and measures to help the MO effectively and efficiently perform its responsibilities in time and form in accordance with the WESM Rules;
  - review that the MO practices and work processes ensure the necessary transparency, independence, predictability and non-discrimination, and are in compliance with the WESM Rules and best international practices;
  - assess if the systems, calculations, information flows and data management protect accuracy and quality of the data and results in generation scheduling, dispatch, prices and settlement, as well evaluate if internal controls exist and are sufficient to guarantee security and confidentiality where appropriate;
  - proposing recommendations to improve the procedures to collect and process the information and the controls of quality and security of data in the WESM;
  - assess the usefulness and appropriateness of the interfaces and exchange of information between the SO and the MO in relation to generation scheduling, constraints and dispatch; and
  - review compliance of the MO with the WESM Rules.

The Retail Rules Clause 4.8 also requires the PEM Auditor to conduct review and audit of the metering arrangements and compliance of the Retail Metering Services Providers and the CRB annually or for such other period as determined by the PEM Board.

A review of metering arrangements has recently been completed as a separate engagement and therefore that aspect of compliance is excluded from the scope of this audit.

Our obligation is to report findings from the 5<sup>th</sup> Market Operations Audit to the PEM Board.

### Conclusions

We have reached conclusions on the two broad aspects of the 5<sup>th</sup> Market Operations Audit, being **reasonable assurance** conclusions for Task 1: Certifications of the Market Dispatch Optimisation Model (“MDOM”) and Billings, Settlement and Metering (“BSM”) Softwares, and **limited assurance** conclusion for Tasks 2 to 5.

#### *Reasonable Assurance Conclusion (Certifications) for MDOM and Settlements and Billings*

Our certifications form part of this report on **pages 13 to 17**, and should be read in conjunction with this conclusion. However in summary, we certify that, providing the software is used in the manner intended and is provided with correct input data, the MDOM Software and BSM Software used by PEMC will perform substantially in compliance with WESM Rules as amended by the DOE Department Circulars up to and including DC2014-03-0008 and RCOA Rules, together with the associated WESM and Retail Manuals.

#### *Qualified Limited Assurance Conclusion*

Our limited assurance conclusion for Tasks 2 to 5 as set out on **pages 19 to 21** has been qualified on the basis of a:

- **high risk** non-compliance issue identified;
- the limited access to supporting documentation in relation to the ISO 9001:2008 and ISO 27001:2013 audit conducted during 2014; and
- two high risk issues remained outstanding from a prior audit period.

## Preface (Cont.)

### Summary of Audit Coverage and Findings

#### Issues Reported to the PEM Audit Committee

We reported our findings throughout the audit to PEMC management and the PEM Audit Committee through three Progress Reports. In these reports, we identified:

- one instance of 'non-compliance' that was assessed as **high** risk for the audit period;
- two instances of 'non-compliance' that were assessed as **low** risk for the audit period. Of these non-compliance issues, one was resolved prior to 25 December 2014, and the other two remained outstanding. We assessed these breaches as low risk in light of the action taken by PEMC; and
- other issues ranging from **high** to **low** risk where internal controls in relation to the operation of the WESM can be improved.

In total there were 21 issues identified, of which the most significant issue identified was in relation to:

- WESM members trading within the audit period while suspended by PEMC.

The number of issues identified for each task and their risk and compliance ratings are as follows:

Scope Area								Total
	1	3	3	1	2	3	3	
Task 1: Market Software and Systems Review	-	-	-	-	-	4	-	4
Task 2: Information Security and Technology Review	-	1	1	-	-	1	1	4
Task 3: Process and Compliance Review	1	-	1	1	2	6	-	11
Task 4: Bid-to-Bill Analysis	-	-	-	-	-	-	-	-
Task 5: Review of Rules and Manuals	-	-	-	1	-	1	-	2
<b>Total</b>								<b>21</b>

The non-compliance issues identified included the following:

Issue Summary	Risk	Compliance
<b>WESM members trading while suspended</b> WESM members SORECO I, SORECO II, BATELEC II and CASURECO II were suspended during our audit period, however each member continued to trade within the WESM. This is a non-compliance with the WESM Rules Clause 2.7.2.		
<b>Development of Central Registration Body Performance Standards and Annual Reporting</b> PEMC did not publish a report on the performance of the Central Registration Body since the commencement of the commercial operations of RCOA on the 26 June 2013. This is a technical breach of the Retail Rules clauses 1.4.2.3 and 1.4.2.5.		
<b>Payment of registration fee and inconsistencies between the WESM Rules and the Internal Business Procedures</b> The requirements of the Internal Business Procedure (IBP – CPC.PRC.01) were not consistent with the WESM Rules Clause 2.5.1.		

## Preface (Cont.)

### Summary of Audit Coverage and Findings (Cont.)

#### *Status of Prior Period Issues*

We have followed-up on action taken by PEMC for all issues reported within the 4<sup>th</sup> Market Operations Audit reports (some of which relate to previous audit periods). The table summarises the status of the issues reported as at the date of this report.

Audit Area	Number of PEMC Actions	R	O	P
Market Software	14	7	7	-
IT Systems	8	5	-	3
Market Documentation	4	1	3	-
Process and Compliance	14	9	4	1
Bid-to-Bill Analysis	7	1	6	-
<b>Total</b>	<b>47</b>	<b>23</b>	<b>20</b>	<b>4</b>

Of the issues outstanding we have assessed the following as **high risk**, and these have been considered in the basis for forming our conclusions.

**Issue 6.4.10 (4<sup>th</sup> Market Operations Audit Report)** – Breaches in the area of Prudential Requirements as PEMC does not have any effective means of enforcement. Our follow-up procedures indicated the following:

- There has been no review of the policies to facilitate immediate disconnection of participants who have been non-compliant with collection and payment obligations or prudential requirements. It was noted that during the audit period there were four participants identified still trading during the audit period.
- There has been no enforcement of real-time EFT facilities and it is noted that a number of participants still pay their settlement invoices by cheque. We noted that 1 out of 24 Trading Participants payments had not been cleared by November 26 2013 resulting in a default due to late receipt of cheques; and
- The CRSS is still to be implemented, as such there has been no change to the monitoring of actual exposure from a monthly basis to a weekly basis.

**Issue 5.1.3 Load Forecasting (Requirement of System Operator Audit) (4<sup>th</sup> Market Operations Audit Report)** – Nodal forecasts were noted to have poor accuracy. Nodal load forecasts had high errors with significant proportion of nodal forecasts having absolute percentage errors outside the 3%, 10% and 50% tolerance bands. It was recommended that the System Operator should initiate a review of their SCADA system and the processes used to update real-time information with a view to investigating how the accuracy of their real-time data can be improved. It was also recommended that the System Operator be subjected to an audit/review similar to that of the Market Operator, where compliance with the WESM rules is assessed and IT systems and business process are examined. Our follow-up procedures indicated the following:

- At the 18 December 2014 Regular Commission Meeting, the ERC approved the resolution authorizing the PAC, through an independent third party reviewer, to conduct an independent review of the operations of NGCP. The said review will be conducted in accordance with the Terms of Reference (TOR) likewise approved by the Commission;
- The draft TOR was published by the ERC on its website for comments of all concerned parties; and
- The work plan and timetable of the 1st System Operator review will be prepared by ERC in coordination with the PAC.

## Preface (Cont.)

### Summary of Audit Coverage and Findings (Cont.)

#### *Status of Prior Period Issues (Cont.)*

**Issue 5.1.2 Market Network Model (4th Market Operations Audit Report)** - The inclusion of MERALCO's sub-transmission assets that connect Market Trading Nodes (MTN) in the Market Network Model (MNM) has a significant impact on dispatch and pricing in the WESM. Whilst PEMC has completed its necessary actions to resolve this issue, due to the lack of information and data received from MERALCO the issue and risk still exists from an industry and market perspective. The DOE is currently expediting MERALCO's provision of real-time snapshot data of its sub-transmission and distribution network to PEMC and the NGCP for the achievement of this undertaking. The status of this issue should be followed up with all outstanding issues within the 6<sup>th</sup> Market Operations Audit.

#### *Interface with the System Operator*

In addition to the above, we conducted a specific review of PEMC's interface with the System Operator and reliance on data provided. We obtained an understanding of the types of input data received, the consistency of the data received and how the data is managed by PEMC.

Based on the analysis conducted it was evident that PEMC is reliant on critical inputs required to operate the electricity market that include:

- Outage schedule for power facilities;
- Electricity Market System (EMS) System Snapshots;
- Eight-day load pattern data;
- Notification of start-up and shutdown of generating units; and
- Re-dispatch instruction for generators in the event of must-run units for under-generation.

As a separate organisation, PEMC does not have transparency or comfort on the adequacy of the controls of the System Operator. We acknowledge that the Energy Regulatory Commission ("ERC") is in the progress of arranging an audit of the System Operator. A reasonable assurance audit of the System Operator will provide the whole electricity industry with a level of assurance on the processes and internal controls of the System Operator. We compared the PEM with fourteen other jurisdictions, in respect to whether the markets operated with a joint Market Operator and System Operator or Separate, and whether compliance audits were conducted of the System Operator. We noted in the majority of the Jurisdictions (85%), the System Operator was subjected to an independent compliance audit.

#### *Risk and Compliance Ratings*

##### Compliance Ratings

We have assigned compliance ratings to instances noted representing the extent of compliance and the impact on the WESM operations. The following ratings were applied:

Rating		Description
Level 1	1	Evidence of non-compliance with review criteria. These should be addressed as a matter of high priority.
Level 2	2	Issues which could possibly result in non-compliance with review criteria, but where no evidence of actual non-compliance was found. However, there is considered to be insufficient formal evidence of controls in place, or being actioned in relation to these issues. These should generally be addressed within one to two months.
Level 3	3	Housekeeping matters and opportunities for improving internal controls and procedures relating to electricity market operations. These should be addressed within three to six months.

## Preface (Cont.)

### Summary of Review Coverage and Findings (Cont.)

#### Risk Ratings

The risk ratings applied are consistent with the likelihood and consequences matrix presented in PEMC's Risk Assessment and Prioritization Procedure:

		SEVERITY OF IMPACT				
		<i>Insignificant</i>	<i>Minor</i>	<i>Significant</i>	<i>Major</i>	<i>Catastrophic</i>
PROBABILITY OF OCCURRENCE	Certain	Low	Medium	High	Extreme	Extreme
	Likely	Low	Medium	High	High	Extreme
	Possible	Low	Medium	Medium	High	High
	Unlikely	Low	Low	Medium	Medium	Medium
	Improbable	Low	Low	Low	Low	Low

The ratings have been tailored to reflect the impact on the WESM as follows:

Rating		Description
Extreme		Issues which may have a catastrophic impact on WESM operations if they are not addressed immediately and require executive action with regular reporting at Board level.
High		Issues which may have a major impact on WESM operations if they are not addressed as a matter of priority. These issues require senior management attention with regular monitoring and reporting at executive and Board meetings.
Medium		Issues which may have a moderate impact on WESM operations if they are not addressed within a reasonable timeframe. These issues require management attention with regular ongoing monitoring.
Low		Issues which may have a minor impact on electricity market operations if they are not addressed in the future. These issues are the responsibility of management with regular monitoring and reporting at staff meetings.
Efficiency / Opportunity		Housekeeping matters and opportunities for improving internal controls and procedures and efficiency relating to WESM operations.

Status of Implementation		
Resolved		All agreed actions have been implemented successfully.
Partially Resolved		Some agreed actions have been implemented and due date has not surpassed.
Outstanding		Agreed actions have yet to be implemented or some agreed actions have been implemented but due date has surpassed.

## Preface (Cont.)

### Overview of Market Software and Systems

A number of business processes are supported by IT systems and communication networks in order to facilitate PEMC's objectives of supporting the efficient trading of electricity between generators and wholesale customers. The systems are designed to meet the performance and reliability requirements of the WESM Rules, expectations of WESM Member and provide security for commercially sensitive information.

The systems and data flows between the MO, market participants and SO are depicted below.

#### Market Network Model ("MNM")

The MNM is a mathematical representation of the power system used for the purpose of determining dispatch schedules and energy prices and preparing market projections. It contains information on the technical characteristics of the transmission network, the connectivity, capacities and limitations of each network element. It also represents the node assignments and size of each generator and load. The node assignments indicate where each generator injects power to the transmission network and where each load draws power from the transmission network.

The MNM also identifies the Market Trading Nodes on which the transactions for Trading Participants shall be referenced. The components of the MNM interact with one another in accordance with dispatch schedule of the generation units, customer demand and the physical laws that govern the operation of the network components.

### Overview of Market Software and Systems (Cont.)

These interactions are complex by nature but should be balanced to maintain the reliable and secure operation of the power system by the SO, and fair and economic market dispatch and nodal prices by the MO.

#### Market Dispatch Optimization Model ("MDOM")

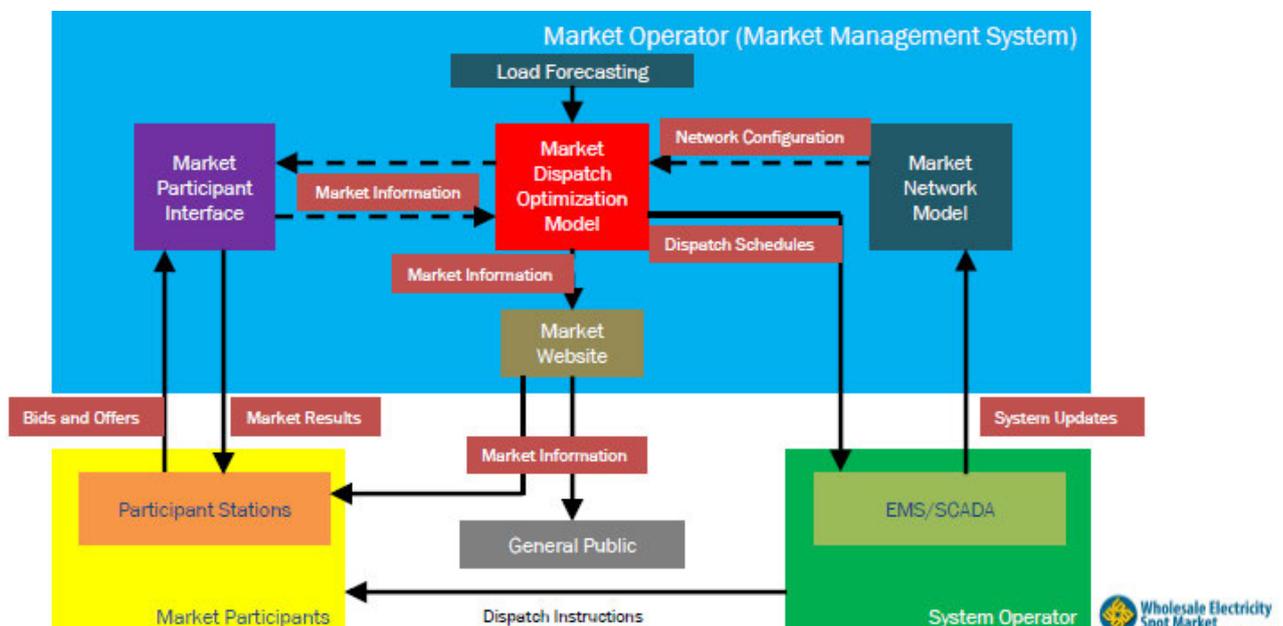
MDOM is a collection of software that calculates the optimal dispatch schedule and nodal prices considering the different inputs from the MO and SO and trading bids as depicted in the diagram below:

#### Market Management System ("MMS")

The MMS is part of the MDOM Program. The MMS is a set of interconnected information and communication technology elements used by the Trading Operations Department ("TOD") to facilitate the operation of WESM. MMS is also connected to the SO to monitor, control, and optimise the performance of the generation and transmission system. The interface used by Trading Participants is the Market Participant Interface ("MPI").

#### Market Assessment System ("MAS")

The MAS is an in-house database developed to collect market data and calculate the Market Monitoring Indices that are used by the MAG to generate market monitoring reports.



# The RSM Bird Cameron Market Audit Approach

## Scope

Our audit and review was conducted in accordance with International Auditing Standards and ISAE 3000 *Assurance Engagements Other than Audits and Reviews of Financial Information*, and accordingly included such tests and procedures as we considered necessary in the circumstances. These procedures were undertaken to form a conclusion as to whether in all material respects, anything has come to our attention to indicate the control procedures for the WESM were not adequately designed and operated effectively based on the relevant rules or procedures.

We reviewed PEMC's systems, processes and procedures against a set of benchmark criteria and industry best practice. The criteria upon which the review was conducted is set out below.

Note that only those obligations of the MO (as distinct from obligations of the SO and other parties) within the Rules, Manuals and IBPs below form part of our review criteria.

## Scope Exclusions and Assumptions

Areas excluded from the scope of the 5th Market Operations included:

- Activities of PEMC in relation to its compliance with ISO 9001:2008 and ISO 27001:2013 (although general IT controls considered critical were within our scope to the extent necessary to enable us to conclude on the effectiveness of controls for compliance with the review criteria);
- Market Governance process;
- Legal process;
- System and program design and development;
- Budgeting and planning;
- Review of metering arrangements as required under Retail Rules Clause 4.8 including metering tools and programs; and
- The Central Registration and Settlement System ("CRSS") is the system to be used for RCOA. This system is expected to become operational during 2015 and was therefore excluded from the scope of this review.

## Tasks

The scope of this audit, and work conducted in forming our conclusion has included the following:

### *Task 1: Market Software and Systems Review*

Review of systems, tools and programs changed or introduced during the covered period, and review of the billing and settlement programs and tools, without limitation.

### *Task 2: Information Security and Technology Review*

- a) Review and check the adequacy of the process for software change management;
- b) Review of market-related systems and network performance;
- c) Review of market-related back-up and restoration processes;
- d) Review of WESM Website's security; and
- e) Vulnerability assessment.

### *Task 3: Process and Compliance Review*

- a) Review the MO's compliance with its obligations in the WESM and Retail Rules and Market and Retail Manuals;
- b) Validate the Market Operator Performance Standards ("MOPS") Report approved during the audit period; and
- c) Propose enhancements in processes and MOPS to achieve best international practices.

### *Task 4: Bid-to-Bill Analysis*

Conduct of chronological testing of the market processes from the market participants' registration, submission of offers up to invoicing and payment by the Market Operator. The number of sample trading intervals has been agreed upon by PEMC and RSM Bird Cameron

### *Task 5: Review of Rules and Manuals*

To ensure the harmonization and consistency of relevant market documentations, this task includes the following activities:

- a) Review of the WESM Rules vis-a-vis the WESM Manuals; and
- b) Review of the Retail Rules vis-a-vis the Retail Manuals.

## The RSM Bird Cameron Market Audit Approach (Cont.)

### Review Criteria

#### Rules

The current WESM Rules published online encompasses the DOE Circulars relating to the **WESM** and **Retail Rules** in operation during the audit. These have been detailed in the table below:

DOE Circulars	
DOE DC2014-03-0008	DOE DC2013-07-0016
DOE DC2014-03-0007	DOE DC2013-07-0017
DOE DC2013-10-25	DOE DC2013-07-0018
DOE DC2013-01-0002 (Retail Rules)	

#### WESM Manuals, Retail Manuals and PEMC's IBPs

The WESM Manuals, Retail Manuals and PEMC's IBPs covered by this review are detailed in the table below:

WESM Manuals	
Procedure on Start-up and shutdown of Generating Unit Issue 1.0 (recently obsolete, now incorporated in the recently approved Dispatch Protocol Manual)	WESM Manual on Registration, Suspension and Deregistration Criteria and Procedures Issue 2.0 (new issue)
System Security and Reliability Guidelines Issue 0.0	WESM Manual on the Management of Net Settlement Surplus Issue 2.0 (new issue)
WESM Consultation Guidelines Issue 1.0	WESM Manual on Metering Standards and Procedures Issue 10.0 (new issue)
Procedure for Determining Ex-Post Nodal Energy Prices Issue 2.0	Methodology for Determining Pricing Errors and Price Substitution Due to Congestion for Energy Transactions in the WESM Issue 4.0 (new issue)
Pricing and Cost Recovery Mechanism for Reserves in the Philippines Revision No. 4.0	Billing and Settlement Manual Issue 3.0 (new issue)
Pricing Error Issuance and Market Re-run Procedure Revision No. 4.0	Retail Manuals
Market Operation Information Disclosure and Confidentiality Manual Issue 3.0 (new issue)	Registration Manual
Manual of Procedures for Changes to the WESM Rules Issue 2.0 (new issue)	Metering Manual
Guidelines on Significant Variations In and Between Trading Intervals Issue 0.00	Market Transactions Manual
Emergency Procedures Issue 2.0	Disclosure and Confidentiality of Contestable Customer Information Manual
Dispute Resolution Market Manual Issue 4.0 (new issue)	PEMC IBPs
Criteria and Guidelines for the Issuance of Pricing Error Notices and Conduct of Market Re-Run (Issue 1.0)	All TOD IBPs
Ancillary Services Monitoring Manual (Issue 0.0)	All BSMD IBPs
Market Surveillance, Compliance and Enforcement Market Manual Issue 3.0	Finance - Accounts Management Unit IBPs

## The RSM Bird Cameron Market Audit Approach (Cont.)

### Review Criteria (Cont.)

*WESM Manuals, Retail Manuals and PEMC's IBPs*

WESM Manuals	PEMC IBPs
Financial Penalty Manual Issue 1.0 (new issue)	CPC Institutional Relations – Participant Support IBPs
Technical Committee Market Manual Issue 1.0 (new issue)	MAG MOPS IBPs
Segregation of Line Rental Trading Amounts Issue 1.0 (new issue)	Office of the President – WCO and Change Management IBPs
Market Network Model Development and Maintenance – Criteria and Procedures Issue 3.0 (new issue)	IST IBPs
WESM Manual on Load Forecasting Methodology 2.0 (new issue)	

### Levels of Assurance

As indicated throughout this report, we have provided **reasonable assurance** for Task 1 and **limited assurance** for Tasks 2 to 5, in accordance with ISAE 3000.

In conducting the reasonable assurance engagement, we are required to gather sufficient appropriate evidence to conclude that the subject matter conforms in all material respects with identified suitable criteria, and give a report in the form of a positive assurance.

The reasonable assurance opinion shows that the auditor is very confident about making this statement because the evidence collected and the work done have been extensive, covering all material areas of compliance.

For a limited assurance engagement on the other hand, we are required to gather sufficient appropriate evidence to conclude that the subject matter is plausible in the circumstances, and give a report in the form of a negative assurance.

ISAE 3000 states that the level of assurance given by a reasonable assurance engagement is **high**, whereas a limited assurance engagement gives a **moderate** level of assurance. It is not possible to give an absolute level of assurance for several reasons.

## The RSM Bird Cameron Market Audit Approach (Cont.)

### Materiality

Materiality for purposes of this engagement was considered in the context of materiality as defined in International Standards on Assurance Engagements (ISAE) 3000. In particular, we considered materiality when:

- a) Planning and performing the engagement, including determination of the nature, timing and extent of procedures we will perform; and
- b) Evaluating whether the PEMC has complied with the audit criteria (being the Rules, Manuals and procedures).

Instances of non-compliance or control weakness are considered to be material if they, individually or in the aggregate, could reasonably be expected to influence relevant decisions of users of our reports (including PEMC and WESM members), taken on the basis of the PEMC's compliance with the audit criteria. Our consideration of materiality is a matter of professional judgement, and takes into account the common information needs of intended users as a group. In this context, we assume that the users of our reports, including PEMC and WESM members:

- a) Have a reasonable knowledge of the market and PEMC's compliance obligations;
- b) Understand that compliance and assured to appropriate levels of materiality, and have an understanding of any materiality concepts included in the Rules, Manual and procedures;
- c) Understand any inherent uncertainties involved in the measuring or evaluating compliance; and
- d) Make reasonable decisions on the basis of PEMC's operations taken as a whole.

Materiality is considered in the context of qualitative factors and, when applicable, quantitative factors. The relative importance of qualitative factors and quantitative factors when considering materiality in a particular engagement is a matter for the assurance practitioner's professional judgement.

### Inherent Limitations

As part of our work, we are not required to search specifically for irregularities, including fraud and other illegal acts, and our audit should not be relied upon to disclose them. However, if we had found any, we will have reported them to PEMC.

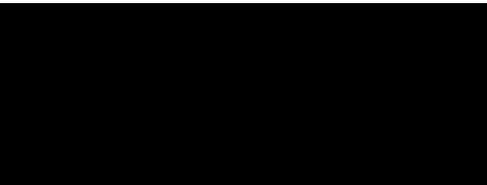
Because of the inherent limitations of any internal control structure it is possible that fraud, error, or non-compliance with laws and regulations may occur and may not be detected. Further, the internal control structure, within which the control procedures that we are reviewing operate, will not be reviewed and no opinion will be expressed as to its effectiveness.

A review is not designed to detect all weaknesses in control procedures as it is not performed continuously throughout the period and the tests performed are on a sample basis.

### Acknowledgement

The matters raised in this report have been discussed with PEMC management and the PEM Audit Committee, and comments have been provided where appropriate. We would like to take this opportunity to thank PEMC staff for their assistance and cooperation during the course of the review.

### RSM BIRD CAMERON



**J M IMBERT**

Director  
Melbourne  
20 August 2015



Independent Certification Reports  
by

RSM Bird Cameron  
(the 'Market Auditor')

to the Board of the  
Philippine Electricity Market  
Corporation

- » Certification of the MDOM Software
- » Certification of the Settlement and  
Billing Software

for the period 26 June 2013  
to 25 December 2014

# Independent Certification – Market Dispatch Optimisation Model (MDOM)

## Board of Directors of the Philippine Electricity Market Corporation

### Introduction

RSM Bird Cameron has been engaged by the Philippines Electricity Market Corporation (“PEMC”) to certify the compliance of the within scope MDOM software operated by PEMC during the audit period of 26 June 2013 to 25 December 2015 relative to the Wholesale Electricity Spot Market (“WESM”) Rules and associated WESM Manuals.

Our approach to certifying the MDOM has been based on assessing changes implemented since the prior audit which we have been informed of and assuming that all pre-existing functionality was in compliance to the extent recognised by prior audits.

### Scope

The scope of this review was to assess the compliance of the Security Constrained Economic Dispatch (“SCED”) component of the Market Applications (“MA”) subsystem of the Market Management System (“MMS”) against the applicable WESM and Retail Market Rules.

The SCED is the software that implements the MDOM based on clause 3.6 of the WESM Rules and on the mathematical formulation specified in the Price Determination Methodology (“PDM”) WESM Manual.

The changes to be reviewed in this certification were:

1. The introduction of two new joint energy / reserve constraints to replace existing constraints limiting the scheduling of reserve.
2. Removing a limit on the value on a tolerance that could be set by an operator in setting revised reserve requirements for the purpose of price setting when reserve requirements are violated.
3. Implementation of distributed swing buses for the purpose of determining system losses.
4. Changes in operator parameters for controlling the convergence of the SCED process.
5. Changed constraint violation variable coefficients for influencing the priority with which constraints are violated when there would otherwise be no feasible solution.

The scope of this certification has included, at a minimum:

- Examination of the algorithms used in the MDOM Software to determine if the algorithms are mathematically equivalent to the prescriptions in the WESM Rules and associated Market Manuals;
- Tests to determine whether the outputs of the MDOM Software are consistent with those which result from the application of the prescriptions in the WESM Rules and associated Market Manuals; and
- Identification of inconsistencies and non-compliance of the MDOM Software with the WESM Rules and associated Market Manuals.

### Methodology

Our methodology comprised a mixture of software testing to test the first three items within scope. The final two items in the scope were assessed through PEMC providing evidence that the changes had been made.

Testing was limited to within scope changes. Features that were understood to have not changed were assumed to be compliant based on prior audits.

Tests were developed based on our understanding of changes based on the available documentation and discussions with PEMC. A reference dispatch solution was developed with PEMC to define an initial set of input data for MDOM. We developed tests that modified this data to test features and provided those changes to PEMC to allow them to run the tests. PEMC results were then compared against our predicted results.

We have examined WESM Rules and associated WESM Manuals to fully understand what functions the software is required to perform, what data it is required to use, what results the software is required to produce, and how it is to calculate them

## Limitations of Certificate

The Price Determination Manual which defines the scheduling and pricing methodology has not been updated to reflect the within scope changes. Consequently there was no single definitive documentation of the current functionality of the MDOM software being tested. We therefore had to make use of PEMC documentation limited to describing changes and testing of changes, combined with discussions with PEMC, to establish our understanding of the functionality to be tested. We have documented our understanding in separate reports.

The nature of testing, with PEMC performing tests based on data and instructions provided by RSM Bird Cameron, combined with the availability of environments, limited the number of cases which could be run to a set adequate to verify the impact of changes but not to perform more expansive testing that might, though is not guaranteed to, detect features of the software not known to us or software errors that only become apparent for some sets of input data but not for others.

Testing was conducted on a copy of the MDOM software in an off-line environment that was assumed functionally identical to the production environment for the WESM. Additionally, PEMC has been responsible for running tests provided by RSM Bird Cameron with their copy of the MDOM software. The solutions used to assess the performance of the software were described in data provided by PEMC to RSM Bird Cameron.

MDOM will only produce appropriate results if supplied with data that strictly conforms to the descriptions provided in, or implied by, the WESM Rules and associated Manuals. Our testing excluded systems and processes which determined input data to the within scope features of MDOM or which process output data from the within scope features of MDOM. Consequently any errors in systems or processes external to the software reviewed which result in incorrect data provided to that software or in incorrect data being released to participants are not covered by this certificate.

The software tested is relatively complex, involving a significant number of individual features, and there are a very great number of ways in which those features can be combined, and a similarly large number of situations that could occur in practice. It is impractical to test every possible combination. The testing program involves detailed tests of each feature in isolation and this forms the basis of this audit certificate.

The scale of testing that could be performed was limited by the approach.

It was assumed for this audit that the previous certifications were accurate and complete negating the need for further testing of those features if unchanged. No responsibility can be accepted for any current issues with the within scope features of the MDOM that existed in prior MDOM audits which were not identified in those audits and which were not addressed by the within scope changes to MDOM for this audit.

The computational performance of the MDOM software is not within the scope of this review.

No method of certification can provide an absolute guarantee that the software is error free or in compliance.

## Certification of the MDOM Software

The following is our certification of the extent to which the SCED component of the MA subsystem of the MMS software used during the audit period complies with the WESM and Retail Rules and Manuals during that period.

Although we have observed and reported some issues remaining from prior audits and a number of potential new issues provided that the MDOM software is used in the manner intended and is provided with correct input data we certify that the MDOM software used by PEMC will perform substantially in compliance with WESM Rules as amended by Department of Energy ("DOE") Department Circulars up to and including DC2014-03-0008 and RCOA Rules, together with the associated WESM and Retail Manuals.

This certification relates solely to the calculations that are performed within the MDOM software and makes no comment on the general suitability of the programs in performing the required tasks. It covers only the automated processes within the programs and assumes that all associated manual tasks are performed as required and without error.

## **RSM BIRD CAMERON**



**J M IMBERT**

Director

Melbourne

20 August 2015

# Independent Certification – Settlement and Billing

## Board of Directors of the Philippine Electricity Market Corporation

### Introduction

RSM Bird Cameron has been engaged by the Philippines Electricity Market Corporation (“PEMC”) to certify the compliance of the Billing, Settlement and Metering System (“BSM”) operated by PEMC during the audit period of 26 June 2013 to 25 December 2015 relative to the Wholesale Electricity Spot Market (“WESM”) Rules, Retail Competition and Open Access (“RCOA”) Rules, and associated WESM and RCOA Manuals.

Our approach to certifying the BSM has been based on assessing changes implemented since the prior audit which we have been informed of and assuming that all pre-existing functionality was in compliance to the extent recognised by prior audits.

### Scope

The scope of this review was to assess the compliance of the BSM against the applicable WESM and Retail Market Rules.

The changes to be reviewed in this certification were:

- Revisions to the Wholesale Market Settlement spreadsheets implementing the following functions to improve non-calculation functions such as audit trails and addressing other factors to reduce the risk of errors being made. These revisions should not have impacted the settlement calculation results.
  1. Marginal Tool
  2. MRR Summary Program
  3. Monthly Billing Macro
  4. PEN Report Program
  5. Reference Input Program
  6. MCP Generate Program
- Review of spreadsheets used to generate retail market data as input to the Wholesale Market Settlement spreadsheets. These implemented the following functions:
  1. Substitute OPD Price to WESM Price (Regional)

### Methodology

We were provided with old and the updated versions of spreadsheets used to settlement wholesale market. We were not provided with input data for these spreadsheets so the review was limited to assessing the changes between the old spreadsheets which were review in 4<sup>th</sup> Market Operations Audit and the current spreadsheets. We were also provided with old and new spreadsheets for generating retail market data.

The review focused on comparing changes in the spreadsheets, including to macros and visual basic code, with the aim of identifying that features that should not have changed had not and that features that should have changed had.

The changes implemented in this audit period have not been described in detail. Rather the changes have been described as addressing issues raised in prior audits. Consequently the approach taken was simply to compare the extent to which issues found in prior audits have been addressed and to verify the compliance and materiality of the features changed and to report features not addressed.

We have examined Wholesale Electricity System Market (“WESM”) Rules, Retail Competition and Open Access (“RCOA”) Rules, and associated WESM and RCOA Manuals to fully understand what functions the software is required to perform, what data it is required to use, what results the software is required to produce, and how it is to calculate them

### Limitations of Certificate

A review of software coding can identify isolated issues but limits the ability to identify issues which reflect interactions between different components of the code. A preferable method for identifying such issues is to run the software with input data and to test output data against expectations. No input data files were available for use in this way.

Our review excluded systems and processes which determined input data to the BSM or which process output data from the BSM. Consequently any errors in systems or processes external to the software reviewed which result in incorrect data provided to that software or in incorrect billing and settlement data being released to participants are not covered by this certificate.

It is assumed that the prior certification was accurate and complete. No responsibility can be accepted for any current issues with the BSM that existed in prior BSM audits which were not identified in those audits.

The computational performance of the BSM is not within the scope of this review.

No method of certification can provide an absolute guarantee that the software is error free or in compliance.

### **Certification of the Settlement and Billing Software**

The following is our certification of the extent to which the Settlement and Billing System software used during the audit period complies with the WESM and Retail Rules and Manuals during that period.

Although we have observed and reported some issues remaining from prior audits and a number of potential issues which create a risk of an operator introducing errors, provided that the Settlement and Billing Software is used in the manner intended and is provided with correct input data we certify that the BSM software used by PEMC and as provided to RSM Bird Cameron will perform substantially in compliance with WESM Rules as amended by Department of Energy (“DOE”) Department Circulars up to and including DC2014-03-0008 and RCOA Rules, together with the associated WESM and Retail Manuals.

This certification relates solely to the calculations that are performed within the BSM software and makes no comment on the general suitability of the programs in performing the required tasks. It covers only the automated processes within the programs and assumes that all associated manual tasks are performed as required and without error.

### **RSM BIRD CAMERON**



**J M IMBERT**

Director

Melbourne

20 August 2015



Independent Limited Assurance  
Report by

RSM Bird Cameron  
(the 'Market Auditor')

to the Board of the  
Philippine Electricity Market  
Corporation

for the period 26 June 2013 to  
25 December 2014



**RSM Bird Cameron**

# Independent Limited Assurance Report

## Board of Directors of the Philippine Electricity Market Corporation

### Scope

We have undertaken a limited assurance engagement on the design and the operating effectiveness of controls within Philippine Electricity Market Corporation (“PEMC”) Wholesale Electricity Spot Market (“WESM”) systems (the controls), comprising the systems required to operate the WESM, throughout the period 26 June 2013 to 25 December 2014 relevant to compliance with the WESM Rules and Manuals.

The scope of this audit, and work conducted in forming our conclusion has included the following

#### **Task 2: Information Security and Technology Review**

- a) Review and check the adequacy of the process for software change management;
- b) Review of market-related systems and network performance;
- c) Review of market-related back-up and restoration processes;
- d) Review of WESM Website's security; and
- e) Vulnerability assessment

#### **Task 3: Process and Compliance Review**

- a) Review the Market Operator's (“MO”) compliance with its obligations in the WESM and Retail Rules and Market and Retail Manuals;
- b) Validate the MO Performance Standards (“MOPS”) Report approved during the period; and

Propose enhancements in processes and MOPS to achieve best international practices

#### **Task 4: Bid-to-Bill Analysis**

Conduct of chronological testing of the market processes from the market participants' registration, submission of offers up to invoicing and payment by the Market Operator. The number of sample trading intervals has been agreed upon by PEMC and RSM Bird Cameron

#### **Task 5: Review of Rules and Manuals**

To ensure the harmonization and consistency of relevant market documentations. This task includes the following activities:

- a) Review of the WESM Rules vis-a-vis the WESM Manuals; and
- b) Review of the Retail Rules vis-a-vis the Retail Manuals

### PEMC's Responsibilities

PEMC is responsible for:

- a) the operations of the WESM and the WESM systems;
- b) identifying the control objectives;
- c) identifying the risks that threaten achievement of the control objectives;
- d) designing controls to mitigate those risks, so that those risks will not prevent achievement of the identified control objectives; and
- e) operating effectively the controls as designed throughout the period.

### Our Independence and Quality Control

We have complied with the relevant ethical requirements relating to assurance engagements, which include independence and other requirements founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

In accordance with Auditing Standard ISQC 1 *Quality Control for Firms that Perform Audits and Reviews of Financial Reports and Other Financial Information, and Other Assurance Engagements*, RSM Bird Cameron maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

### Our Responsibilities

Our responsibility is to express a limited assurance conclusion on the suitability of the design to achieve the control objectives and operating effectiveness of PEMC's controls within WESM systems, based on our procedures. We conducted our engagement in accordance with Standard on Assurance Engagements ISAE 3000 *Assurance Engagements Other than Audits or Reviews of Historical Financial Information* issued by the International Federation of Accountants.

## Our Responsibilities (Cont.)

That standard requires that we comply with relevant ethical requirements and plan and perform our procedures to obtain limited assurance about whether, in all material respects, anything has come to our attention to indicate that the controls were not suitably designed to achieve the control objectives and the controls operated effectively throughout the period.

An assurance engagement to report on the design and operating effectiveness of controls involves performing procedures to obtain evidence about the suitability of the design of controls to achieve the control objectives and the operating effectiveness of controls throughout the period.

In a limited assurance engagement, the assurance practitioner performs procedures, primarily consisting of making enquiries of management and others within the entity, as appropriate, and examination of design specifications or documentation, and evaluates the evidence obtained. The procedures selected depend on our judgement, including the assessment of the risks that the controls are not suitably designed and that the description is not fairly presented. An assurance engagement of this type also includes evaluating the overall presentation of the description and the suitability of the control objectives.

Given the circumstances of the engagement, in performing the tasks listed above we have:

- through enquiries, obtained an understanding of PEMC's control environment and information systems relevant to operation of the WESM; and
- through enquiries and inspection, obtained an understanding of how the controls were designed to operate and evaluated whether those controls would be sufficient to achieve each compliance with control objective.

The procedures performed in a limited assurance engagement vary in nature and timing from, and are less in extent than for, a reasonable assurance engagement and consequently the level of assurance obtained in a limited assurance engagement is substantially lower than the assurance that would have been obtained had a reasonable assurance engagement been performed. Accordingly, we do not express a reasonable assurance opinion on the controls.

## Our Responsibilities (Cont.)

We believe that the evidence we have obtained is sufficient and appropriate to provide a basis for our conclusion.

### Limitations of Controls

Because of the inherent limitations of any internal control structure it is possible that, even if the controls are suitably designed and operating effectively, the control objectives may not be achieved and so fraud, error, or non-compliance with laws and regulations may occur and not be detected. Further, the internal control structure, within which the controls that we have assured operate, has not been assured and no opinion is expressed as to its design or operating effectiveness.

A limited assurance engagement on operating effectiveness of controls is not designed to detect all instances of controls operating ineffectively as it is not performed continuously throughout the period and the tests performed are on a sample basis. Any projection of the outcome of the evaluation of controls to future periods is subject to the risk that the controls may become inadequate because of changes in conditions, or that the degree of compliance with them may deteriorate.

### Basis for Qualified Limited Assurance Conclusion

Based on the procedures performed and evidence obtained, we have identified:

- One **high risk level one** non-compliance issue;
- Two **low risk level one** non-compliance issues; and
- other issues ranging from **high risk** to **low risk** where internal controls in relation to the operation of the WESM can be improved.

Additionally, a scope limitation existed with respect to procedures that were intended to be performed on critical IT controls, which resulted in the inability to obtain appropriate evidence.

Further, we have identified two **high risk** issues from a previous audit period which remains outstanding.

## Basis for Qualified Limited Assurance Conclusion (Cont.)

As a result, our limited assurance conclusion has been modified to reflect the overall exposure to the WESM. In particular, the main reasons for RSM Bird Cameron in issuing a qualified review conclusion are as set below:

### *WESM members trading while suspended* (High risk level one non-compliance issue)

We noted four WESM members that were suspended during the audit period continued to trade within the WESM. The members included SORECO 1, SORECO II, BATELEC II and CASURECO II. We were advised that the PEM Board was made aware of each of the matters on a regular basis, and also the impact on the WESM, if PEMC were to proceed with the issuance of disconnection notices given the circumstances.

However, this is a non-compliance with the WESM Rules Clause 2.7.2.

### *ISO 9001:2008 and ISO 27001:2013 Accreditation* (Scope limitation)

Activities of PEMC in relation to its compliance with ISO 9001:2008 and ISO 27001:2013 were excluded from the scope of our audit. However, general IT controls considered critical were within our scope to the extent necessary to enable us to conclude on the effectiveness of controls for compliance with the review criteria. Our approach was to review external and internal audits conducted, such as ISO 27001 certification which is conducted annually, with a view to determine the level of reliance we could place on other auditors or quality assurance processes in place. On this basis we intended to limit the testing of general IT controls to those areas considered key risks to PEMC's compliance with the review criteria. As we were unable to obtain access to the workpapers of the ISO 27001:2013 auditor, we were unable to perform this assessment.

### *Breaches in the area of Prudential Requirements and Load Forecasting*

(High risk issues from previous audit period)

From our follow up of previous audit issues, we have assessed two outstanding issues as being **high** risk, and this has been considered in forming our conclusion. These issues were in relation to:

- breaches in the area of Prudential Requirements for which PEMC does not have any effective means of enforcement; and
- accuracy of nodal load forecasting.

## Qualified Limited Assurance Conclusion

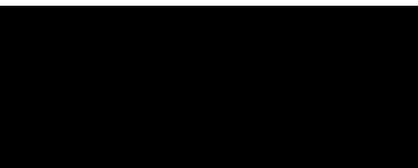
Based on the procedures we have performed and the evidence we have obtained, other than the matters noted in the Basis for Qualified Limited Assurance Conclusion section above, nothing has come to our attention that causes us to believe that, in all material respects:

- a) the controls within the WESM systems were not suitably designed to achieve compliance with the WESM Rules and Manuals; and
- b) the controls were not operated effectively as designed throughout the period from 26 June 2013 to 25 December 2014.

## Restricted Use

This report has been prepared for use by PEMC for the purpose of review by management and the PEM Audit Committee. We disclaim any assumption of responsibility for any reliance on this report to any person other than PEMC, or for any other purpose other than that for which it was prepared.

## RSM BIRD CAMERON



**J M IMBERT**

Director  
Melbourne  
20 August 2015



“Our one-firm structure enables us to provide strong connections and a focus on client relationships. Clients can readily connect to our national and international expertise and networks, our extensive understanding of Australian business and to our senior advisors. With RSM Bird Cameron you really are...**Connected for Success**”

**Assurance - Business Advisory - Corporate Finance  
Financial Services - Risk Advisory - Tax - Turnaround & Insolvency**

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