



**Philippine Electricity  
Market Corporation**

**Report on the  
Independent Operational Audit of the Systems  
and Procedures on Market Operations**  
for the period 26 June 2009 to 25 June 2011  
by PA Consulting Group Ltd.  
(AP 2011-01)

PEM Audit Committee

October 2011

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## Executive Summary

This report provides the objectives, scope and results of the Independent Operational Audit of the Systems and Procedures on Market Operations covering the period 26 June 2009 to 25 June 2011 (AP2011-01) conducted by PA Consulting Group Ltd. (PA) of New Zealand.

PA was chosen as the External Auditor after an open and competitive selection to conduct the audit. The quality-cost based selection process, which was approved by the PEM Board on 24 February 2011, was conducted by the PAC under the supervision of the DOE and with the assistance of the WESM Audit TWG. The selection process involved the publication of Expressions of Interest (EOI), short listing of received EOI, release of Requests for Proposals (RFP) to shortlisted firms, technical and preliminary bidding conferences, and technical and financial evaluation.

As provided in the RFP, the audit covered the settlement of the markets administered by the MO, generation scheduling, dispatch, price calculation, and any procedures and working processes used by the MO in performing these functions in the WESM. The audit also included the audit of the Market Assessment System (MAS) being administered by the Market Assessment Group (MAG).

PA reported to the PAC for the duration of the audit, which commenced on 06 May 2011. As identified by PA, the audit was conducted according to the following areas:

1. **Market Software Testing** covered the compliance and accuracy of key algorithms and calculations within the suite of market software;
2. **Operational Procedure Review** assessed whether the Market Operator and the Market Assessment manuals and procedures are aligned with WESM Rules and meet best practice standards as assessed by the PA procedure evaluation framework;
3. **Operational Process Review** assessed whether selected Market Operator and Market Assessment processes are in compliance with the WESM Rules and consistent with best practice standards defined by the PA process evaluation framework; and
4. **IT Systems Review** provided an assessment against international best practice standards with respect to software management, operations and security. It also provided software validation for selected interfaces and systems beyond those included in the Market Software Testing.

As part of the audit process, PA discussed issues relating to the market operation's conformance with the WESM Rules, WESM Manuals and applicable policies and regulations with the auditees, PA/TWG and PEMC management prior and during the finalization of the Final Audit Report. PA also presented key audit findings and recommendations to the PEM Board on 25 August 2011.

In response to PA's audit findings and recommendations, PEMC furnished PA with Responses, which were duly incorporated in PA's final audit reports.

PEMC is currently formulating a detailed Action Plan to address PA's findings and recommendations, which will be integrated with the pending items from the PEMC's Action Plan from the first market operations audit.

In accordance with its mandate under the WESM Rules, the PAC fully accepts the findings and recommendations of PA as provided in the Final Software Certificates and Final Audit Reports.

In view of the audit results, the PAC will undertake the following:

1. Oversee the monitoring of the MO's compliance to the Action Plan, in view of the PEM Board directive; and
2. Prepare and implement the following operational audits:
  - a. Market operations audit, covering the period 26 June 2011 onwards; and
  - b. Metering Arrangements Audit, as required under the WESM Rules and Manual.

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## I. About this Report

In compliance with Section 3.7.2<sup>1</sup> and 3.7.4<sup>2</sup> of the PEM Audit Market Manual ("Manual"), this report provides the objectives, scope and results of the Independent Operational Audit of the Systems and Procedures on Market Operations covering the period 26 June 2009 to 25 June 2011 (AP2011-01).

## II. Background

Under the WESM Rules, the PEM Board established the PEM Audit Committee (PAC), which is mandated, on its own or through appointment of external auditors, to conduct, coordinate and supervise audits of the operations of the spot market and of the Market Operator (MO) to reinforce Trading Participants' confidence in the transparency and adequacy of the operation of the Wholesale Electricity Spot Market (WESM).<sup>3</sup>

In line with this mandate and under the supervision of the Department of Energy (DOE), the PAC administers independent operational audits of the systems and procedures on market operations through external auditors.

The first market operations audit, for the period 26 June 2007 to 25 June 2009, was conducted in 2009 (AP2009-01) by Deloitte Touche Tohmatsu of Australia, in cooperation with the Intelligent Energy Systems (IES) and Manabat Delgado and Amper (Deloitte Philippines).

The recently concluded second market operations audit was conducted by PA Consulting Group Ltd. (PA) of New Zealand.

The audit covered the settlement of the markets administered by the MO, generation scheduling, dispatch, price calculation, and any procedures and working processes used by the MO in performing those functions in the WESM for the period 26 June 2009 to 25 June 2011.

The audit also included the audit of the Market Assessment System (MAS) being administered by the Market Assessment Group (MAG), and any procedures and working processes used in the collection, validation and processing of market monitoring data, and calculation of monitoring indices in accordance with Section 8.1 of the Manual.<sup>4</sup>

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<sup>1</sup> Within fifteen (15) days after an audit is finalized by the PEM Auditor or by a designated expert or expert team contracted to act as auditor(s), the PEM Auditor shall prepare and submit to the PEM Board an Audit Report which specifies details of the said report.

<sup>2</sup> Within five (5) business days after receiving from the PEM Board its review on the audit recommendations, the PEM Auditor shall prepare a revised Audit Report and publish it in the Market Information Website which specifies details of the publication.

<sup>3</sup> WESM Rules, Clause 1.5 and PEM Audit Market Manual, Section 3.1

<sup>4</sup> Each year or at such other regular period as may be determined by the PEM Board, the PEM Auditor shall conduct an audit of the market assessment system administered by the Market Assessment Group, and any procedures and working processes used by the Market Assessment Group in the collection, validation and processing of market monitoring data, and calculation of monitoring indices.

### III. Audit Objectives

The general objectives of the Audit Project are to<sup>5</sup>:

1. Review and assess the procedures and working processes of the MO;
2. Review and assess the usefulness and appropriateness of systems, data management and other procedures and working processes used by the MO to administer the WESM, in order to:
  - a. 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;
  - b. assess if 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; and
  - c. assess if the systems, calculations, information flows and data management protect the accuracy and quality of the data and results in generation scheduling, dispatch, prices and settlement, as well as evaluate if internal controls exist and are sufficient to guarantee security and confidentiality where appropriate; and to propose recommendations to improve the: (1) procedures to collect and process the information and, (2) controls of quality and security of data in the WESM.
3. Review and assess the usefulness and appropriateness of the interfaces and exchange of information among the MO, System Operator (SO), Metering Service Provider (MSP) and other service providers in relation to generation scheduling, constraints, dispatch, prices and settlement, and metering; and
4. Review and assess the compliance by the MO with the WESM Rules and WESM Manuals; and
5. Review and assess the effectiveness of the MAS.

### IV. Audit Scope

The Audit Project covered and reviewed the MO's compliance with its procedures and the effectiveness and appropriateness of systems utilized in the operation of the spot market, which included but were not limited to:

1. Valid audit certificates for the current versions of all numeric software;
2. The calculations and allocations performed by the metering and settlements systems;
3. Billing and information systems;
4. The scheduling and dispatch processes;
5. The processes for software management; and
6. The MO's compliance with the WESM Rules.<sup>6</sup>

The Audit Project covered the past two (2) years of the market operations and transactions, specifically from 26 June 2009 to 25 June 2011. Its coverage is shown in Figure 1.

<sup>5</sup> PEM Audit Market Manual, Section 7.2.2

<sup>6</sup> PEM Audit Market Manual, Section 5.2.6.2

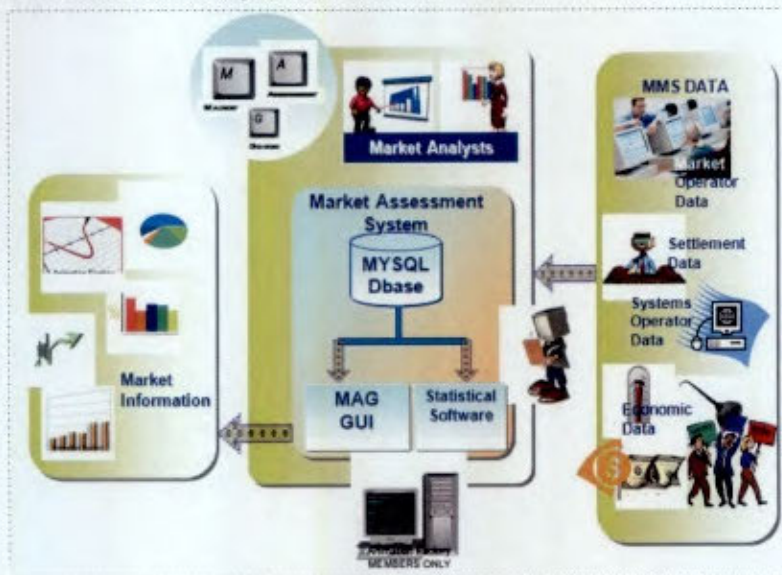
Figure 1. WESM Operations



Notes: MMS – Market Management System

In addition, the audit covered the review of the Market Assessment System (MAS) and any procedures and working processes used in the collection, validation and processing of market monitoring data, and calculation of monitoring indices, as shown in Figure 2.

Figure 2. Market Assessment System



Notes: GUI – Graphical User Interface

## V. External Auditor Selection Process

PA was chosen as the External Auditor after an open and competitive selection to conduct the audit because of its extensive experience in the audit of the electricity market of other jurisdictions and its adequate and detailed work program for the audit process.

The quality-cost based selection process, which was approved by the PEM Board on 24 February 2011, was conducted by the PAC under the supervision of the DOE and with the assistance of the WESM Audit TWG. The selection process involved the publication of Expressions of Interest (EOI), short listing of received EOI, release of Requests for Proposals (RFP) to shortlisted firms, technical and preliminary bidding conferences, and technical and financial evaluation.

PA is an international management, systems and technology consulting company operating worldwide in some 20 countries. PA has its Corporate Headquarters at 123 Buckingham Palace Road, London, SW1W 9SR, United Kingdom and has now been in business for over sixty years, having been established during World War II to optimize production of the Hurricane fighter. PA has been involved in auditing and certifying market operations and settlement software for a wide range of clients in varying geographies including the New York ISO, ISO New England, Ontario IESO, Transpower New Zealand, West Australia IMO and the California Power Exchange. PA was the certifying auditor of the WESM MMS in 2006.

A summary of the selection process activities and timeline is provided in Attachment A.

## VI. Audit Implementation

The External Auditor reported to the PAC for the duration of the audit, which commenced on 06 May 2011 with the signing of the audit service contract (Contract) by the PEMC President Melinda Ocampo and PA Director Stephen Thornton.

All audit activities were coordinated by the PAC, through the MAG which served as the linkage for PA to PEMC and other relevant parties.<sup>7</sup>

As identified by PA, the audit was conducted according to the following areas:

1. **Market Software Testing** covered the compliance and accuracy of key algorithms and calculations within the suite of market software. Software testing focused on mathematical accuracy and appropriateness, and on compliance of the implementation with the WESM Rules and Manuals.
2. **Operational Procedure Review** assessed whether the Market Operator and the Market Assessment manuals and procedures are aligned with WESM Rules and meet best practice standards as assessed by the PA procedure evaluation framework. Procedures

<sup>7</sup> The MAG provides technical and administrative support to the PAC in accordance with WESM Rule 1.4.7.1.

were reviewed and scored against six criteria (i.e. compliance, context, process, timeline, accountability and governance) and allocated a summary Red-Amber-Green (RAG) score that indicated how well each procedure performed overall (i.e. Red-will not ensure compliance; Amber-may ensure compliance; Green-should ensure compliance).

3. **Operational Process Review** assessed whether selected Market Operator and Market Assessment processes are in compliance with the WESM Rules; and consistent with best practice standards defined by the PA process evaluation framework. PA adopted a four stage approach as follows:
  - a. Short-listed the Market Operations, Settlement and Market Assessment processes to audit based on risk and materiality;
  - b. For the short-listed processes:
    - i. Identified Rules obligations to be tested for compliance based on risk and materiality; and
    - ii. Identified controls and measures to be used to determine non-compliance against the Rules.
  - c. Having developed the control measures to be used to test compliance, undertook the compliance review by analysing PEMC data and interviewing relevant teams; and
  - d. PA assessed the short-listed processes for compliance risk, by reviewing each process against process management, process scale and complexity, resourcing and the results of the compliance review.
4. **IT Systems Review** provided an assessment against international best practice standards with respect to software management, operations and security. It also provided software validation for selected interfaces and systems beyond those included in the Market Software Testing. The review included an assessment of both PEMC's policies and practices including a verification of current practice against recommendations made in the previous audit. The international best practice standards considered included ISO 27001 and ISO 27002 for IT security, TIA-942 for Data centre infrastructure), BS 25999 (for BCP/DR), and ITIL v3 (for IT Service Management).

In accordance with the Contract, PA submitted reports on schedule, as follows:

Deliverables	Target Date	Status
Inception Report	27 May 2011	Completed
1 <sup>st</sup> Progress Report	10 June 2011	Completed
2 <sup>nd</sup> Progress Report	24 June 2011	Completed
3 <sup>rd</sup> Progress Report	8 July 2011	Completed
4 <sup>th</sup> Progress Report	22 July 2011	Completed
Draft Audit Report and Software Certificates	29 July 2011	Completed
Final Audit Report and Software Certificates	26 August 2011	Completed

Further, PA discussed issues relating to the market operation's conformance with the WESM Rules, WESM Manuals and applicable policies and regulations have been discussed in multiple

meetings with the auditees, PA/TWG and PEMC management prior and during the finalization of the Final Audit Report. PA also presented key audit findings and recommendations to the PEM Board on 25 August 2011.

A summary of the audit activities and timeline is provided in Attachment B.

## **VII. Auditee Response and Actions Taken**

In response to PA's audit findings and recommendations, PEMC furnished PA with Responses, which were duly incorporated in PA's final audit reports.

In relation to the said Responses, PEMC is currently formulating a detailed Action Plan to address PA's findings and recommendations. Said Action Plan will be integrated with the pending items from the PEMC's Action Plan from the first market operations audit.

## **VIII. Conclusion**

The PAC fully accepts the findings and recommendations of PA as provided in the following documents:

A. Software Certificates submitted on 30 September 2011, as follows:

1. Certification of the Market Dispatch Optimization Model Software; and
2. Certification of the Market Settlements Software.

B. Final Audit Reports submitted on 06 October 2011, as follows:

1. Public Report;
2. Internal Reports.

## **IX. Next Steps**

In view of the Audit Project results, the PAC will undertake the following:

1. Oversee the monitoring of the MO's compliance to the Action Plan, in view of the PEM Board directive; and
2. Prepare and implement the following operational audits:
  - a. Market operations audit, covering the period 26 June 2011 onwards; and
  - b. Metering Arrangements Audit, as required under the WESM Rules and Manual.<sup>8</sup>

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<sup>8</sup> WESM Rule, Clause 4.5.5.4 and PEM Audit Market Manual, Section 11.2.2

**X. Endorsement to the PEM Board**

Prepared and Submitted By:  
**PEM AUDIT COMMITTEE**

[Redacted Signature]

**Felixberto U. Bustos, Jr.**  
Chairperson / PEM Auditor

[Redacted Signature]

**Eduardo Alejandro O. Santos**  
Member

[Redacted Signature]

**Christian M. Orias**  
Member

Certified By:  
**PAC SECRETARIAT**

[Redacted Signature]

**Chrysanthus S. Heruela**  
Vice President, Market Assessment Group

## Attachment A: External Auditor Selection Process – Timeline/Activities

Date	Activity
24-Feb-11	PEM Board approval of the Audit Project and the selection process
03 to 11 March 2011	Publication of Expressions of Interest in local newspapers of general circulation and in websites
11-Mar-11	Submission of Letters of Interest by the following firms: 1. AF Mercados - Energy Markets International S.A., Spain; 2. Deloitte Touche Tohmatsu, Australia/Philippines; 3. Intelligent Energy Systems Pty Ltd, Australia, in partnership with PricewaterhouseCoopers, Australia/Philippines; 4. International Technical Assistance Consultants SI, Spain, in partnership with Atos Origin S.A.E, Spain; 5. Lantau Group Limited, Hongkong, in partnership with Orbit Systems, New Zealand; 6. PA Consulting Group, New Zealand; and 7. Sapere Research Group Ltd., New Zealand.
14 & 18 March 2011	Evaluation of EOI's (Short Listing)
21-Mar-11	1. PAC approval of the Short Listed Firms and Request for Proposals (RFP)  2. Release of the RFP to the Short Listed Firms, as follows: 1. Deloitte Touche Tohmatsu, Australia/Philippines; 2. Intelligent Energy Systems Pty Ltd, Australia, in partnership with PricewaterhouseCoopers, Australia/Philippines; and 3. PA Consulting Group, New Zealand
7-Apr-11	Technical Conference
8-Apr-11	Preliminary Conference
18-Apr-11	Submission of Bids and Opening of Technical Proposals – Change of lead firm for IES/PWC to Isla Lipana & Co., a member firm of PWC, in partnership with IES
19 , 20 & 26 April 2011	Evaluation of Technical Proposals
26-Apr-11	Opening of Financial Proposals
27-Apr-11	Submission of the results of both the Technical and Financial Evaluation to the PEM Board for approval
28-Apr-11	PEM Board approval on the following: 1. Results of the bid evaluation; Rank 1: PA Consulting Group Ltd., New Zealand Rank 2: Deloitte Touche Tohmatsu, Australia/Philippines Rank 3: Isla Lipana (PWC), in partnership with IES (Philippines/Australia) 2. Authority of the Negotiating Team (PEMC President, PAC and WESM Audit Technical Working Group) to negotiate with the highest ranked bidder and the next-ranked bidder/s in the event of failure of

### Attachment A: External Auditor Selection Process – Timeline/Activities

Date	Activity
	negotiation/s; 3. Award of contract to the winning bidder; and 4. Authority of the PEMC President to sign, execute and implement the contract.
3-May-11	Preliminary Negotiation Meeting with the first-ranked bidder, PA Consulting Group Ltd.
6-May-11	<p>Final Negotiation Meeting and Contract Signing with PA</p> <ul style="list-style-type: none"> <li>• Final Contract Price <ul style="list-style-type: none"> <li>- USD 600,000 (USD 768,883 original bid; USD 608,223 revised bid)</li> </ul> </li> <li>• Exclusion in the audit scope of the Wholesale Billing and Settlements System (WBSS) <ul style="list-style-type: none"> <li>- WBSS is currently being run in parallel with the Excel-based settlement programs</li> <li>- WBSS Phase 3 Project completion target in November 2011 (currently, 16% completion)</li> <li>- WBSS audit by the Internal Audit Department (IAD) prior its deployment</li> <li>- WBSS independent audit to be included in the next MO audit</li> </ul> </li> </ul>

## Attachment B: Audit Implementation – Timeline/Activities

Date	Activity
13-May-11	Kick-off Meeting
25-May-11	PAC/TWG Meeting with PA on the Inception Report
27-May-11	PA submission of the draft Inception Report
2-Jun-11	PA submission of the revised draft Inception Report
7-Jun-11	PAC/TWG Meeting with PA to finalize the Inception Report
8-Jun-11	PA submission of the revised draft Inception Report
10-Jun-11	Acceptance of the Inception Report by the PAC and WESM Audit Technical Working Group (TWG)
10-Jun-11	<ul style="list-style-type: none"> <li>Approval of release of 1st Payment (USD 120,000) by President Ocampo</li> <li>Submission of 1st Progress Report by PA</li> </ul>
23-Jun-11	Acceptance of the 1st Progress Report by the PAC and WESM Audit Technical Working Group (TWG)
24-Jun	Submission of 2nd Progress Report by PA
27-Jun	PA's request for additional team member to be on-site
30-Jun	PEMC-NGCP Coordination Meeting on data and information requests of PA from NGCP-SO and NGCP-MSG
8-Jul	Submission of 3rd Progress Report by PA
11-Jul	Remittance of 1st Payment - USD 84,000 (USD 120,000 net of 30% withholding tax pending PA's tax treaty application with BIR-ITAD)
12-Jul	<ul style="list-style-type: none"> <li>Acceptance of the 2nd and 3rd Progress Reports by the PAC and TWG</li> <li>Approval of release of 2nd Payment (USD 150,000) by President Ocampo</li> </ul>
20-Jul	Remittance of 2nd Payment - USD 105,000 (USD 150,000 net of 30% withholding tax pending PA's tax treaty application with BIR-ITAD)
27-Jul	NGCP and DOE Meeting on PA's review of the Market Network Model (MNM) <ul style="list-style-type: none"> <li>PA's request for data on the System Operator's network model, i.e. PSS/E format</li> </ul>
5-Aug	Submission of Draft Audit Report by PA Transmittal of PEMC's initial comments on the key audit findings and recommendations
9-Aug	Acceptance of the 4th Progress Report by the PAC and WESM Audit Technical Working Group (TWG) Approved release of 3rd Payment (USD 150,000) by President Ocampo
10-Aug	Submission of revised audit report by PA
12-Aug	Transmittal of PEMC's comments on the draft audit report
17-Aug	PAC/TWG Decision on the MNM Review: <ul style="list-style-type: none"> <li>PA to carry out the MNM Review using available data, i.e. single line diagram</li> </ul>
23-Aug	PA meeting with PEMC and PAC/TWG to discuss the audit report
25-Aug	PA presentation of findings and recommendations to the PEM Board
26-Aug	Submission of Final Draft Audit report by PA
1-Sep	Transmittal of Final Draft Audit report and other reports to PEMC departments for comments/inputs

## Attachment B: Audit Implementation – Timeline/Activities

Date	Activity
2-Sep	Submission of Software Certificates by PA
5-Sep	Submission of Revised Software Certificates by PA
5-Sep	Remittance of 3rd Payment - USD 105,000 (USD 150,000 net of 30% withholding tax pending PA's tax treaty application with BIR-ITAD)
13-Sep	PEMC internal meeting to finalize PEMC's response to Summary Report
14-Sep	PAC/TWG Meeting re: PEMC's response to Summary Report
15-Sep	Transmittal of PAC's comments to TOD & IST
20-Sep	Transmittal of PEMC's responses to PA
23-Sep	Transmittal of PEMC's comments on the software certificates
30-Sep	Receipt of Final Audit Certificates from PA
06-Oct	Receipt of Final Audit Reports from PA by courier
	Acceptance by PAC/TWG of the Final Audit Certificates and Audit Reports