



# PHILIPPINE ELECTRICITY MARKET CORPORATION

4th Independent Operational Audit:  
Audit Summary Report

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**PA Regional Office:**  
PA Consulting Group  
Level 13, 142 Lambton Quay  
PO Box 1659  
Wellington 6011  
New Zealand  
Tel: +64 4 499 9053  
Fax: +64 4 473 1630  
**[www.paconsulting.com](http://www.paconsulting.com)**

**Prepared by:** PA Consulting Group

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# EXECUTIVE SUMMARY

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The 4th Independent Operational Audit of the Systems and Procedures on Market Operations (the Audit) covers the Philippine Electricity Market Corporation's (PEMC) systems and procedures on market operations, billing and settlement, including the interfaces with the System Operator, the Metering Services Providers (MSP), WESM Participants, the Energy Regulatory Commission (ERC) and the Department of Energy (DOE).

The Audit covers five workstreams:

- Market Software
- Process and Compliance
- Market Documentation
- IT Systems and
- Bid to Bill Analysis

## Market Software review

The Market Operator has made good progress against most of the recommendations made in the 3<sup>rd</sup> Independent Operational Audit (2012 Audit). Main findings from the Market Software review include:

- *Market clearing software:* We have noted good progress with the addition of a patch which successfully addresses PA's Audit Findings related to erratic pricing under severe congestion and TCG constraint violations.
- *Market Network Model:* We reiterate our findings from the previous two audits. Namely, given that the System Operator cannot guarantee to produce an optimal re-dispatch around the constraints in the Meralco sub-transmission system, this strongly suggests that the Meralco sub-transmission system should be included within the Market Network Model so as to guarantee an optimal dispatch<sup>1</sup>.
- *Load forecasting:* We have noted an improvement in the regional forecasts but note that the errors in the nodal forecasts are unacceptably high. We note that the poor forecast performance is largely

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<sup>1</sup> We note that PEMC is in the process of obtaining a copy of the Meralco 115 kV network model so that the materiality of its exclusion from the Market Network Model can be determined

attributable to the pro-rating methodology used to derive nodal forecasts from regional forecasts and to non-updating (bad) data retrieved from the real-time SCADA snapshot provided by the the National Grid Corporation (NGCP) in its role as System Operator. Hence, forecasting is likely to be improved once the new MMS is deployed (and the Market Operator is able to move away from the pro-rating methodology) and if the quality of the System Operator's SCADA data were more reliable. In the meantime, we note that the Market Operator has undertaken three studies aimed at improving the quality of forecasting using the pro-rating methodology, and the results of these studies are due to be implemented in 2014.

- *Settlements software:* Two programs had key errors (Administered Price Cap program and Must Run Unit (MRU)( program), in that they did not comply with their specification(s) under certain conditions. The remaining programs perform as per their specifications when used without operator error. However, all programs have a number of implementation flaws that make them prone to operator error and result in an inadequate audit trail. Note, we have seen no evidence to suggest that the errors or flaws we have found have resulted in the software producing results that are inconsistent with the WESM Rules or Market Manuals over the Audit Period<sup>2</sup>. Nevertheless, these errors and flaws have significant potential to materially impact on market outcomes in the future and should be addressed as per our recommendations.
- *Metering software:* Most of the metering programs perform as per their specifications when used without operator error (with the exception of the Daily MTR and Monthly MTR tools where we noted errors). We further note that all programs have a number of implementation flaws that make them prone to operator error and result in an inadequate audit trail. Particularly, we note that although the MTR tools generally perform as per their specifications, it is likely that when their results are used to generate MTRs (outside the programs), there is a significant risk that incorrect MTRs will be issued. Note, we have seen no evidence to suggest that the errors or flaws we have found have resulted in the software producing results that are inconsistent with the WESM Rules or Market Manuals over the Audit Period. Nevertheless, these errors and flaws have significant potential to materially impact on market outcomes in the future and should be addressed as per our recommendations.
- *TOD tools:* The TOD programs perform as per their specifications when used without operator error. However, several programs have a number of implementation flaws that make them prone to operator error and result in an inadequate audit trail. Note, we have seen no evidence to suggest that the flaws we have found have resulted in the software producing results that are inconsistent with the WESM Rules or Market Manuals over the Audit Period. Nevertheless, these flaws have significant potential to materially impact on market outcomes in the future and should be addressed as per our recommendations.
- *Market Assessment System:* The changes made to the Excel VBA pre-processing tools successfully address the majority of the 2012 findings and recommendations, and the ones that were not addressed are not of any great significance. Given that all of the recommendations were left to MAGs discretion on whether or not to implement them, this is a good result.

## Process and Compliance review

The Market Operator has made good progress against most recommendations made as part of the 2012 Audit. PA has noted improvement in the business process scores for two areas (registration and market operations).

However, there are two areas where we again reiterate opportunity for improvement:

- The first reemphasizes the findings of the Market Software workstream and relates to tools used by the settlement and metering teams to discharge their obligations under the WESM Rules and Manuals. The suite of spreadsheet tools have significant manual processing components and are

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<sup>2</sup> 26 June 2012 to 25 June 2013.

poorly documented. As such these tools have significant scope for error and pose a serious non-compliance risk.

- The second relates to the on-going non-compliance by market participants of collection and payment and Prudential Requirements obligations. With upcoming rule changes designed to lower the amount of prudential security that is required, we note that enforcing these obligations will be critical and recommend PEMC implement our proposed measures with urgency.

## Market Documentation review

With regard to the review of the Market Manuals, we note that the rate of progress with respect to addressing our 2011 recommendation is unacceptably slow; no recommendations from the 2011 Audit have as yet been implemented. However, we do note that PEMC has established a Technical Working Group to harmonize the Market Manuals with the WESM Rules. We further note that as of February 2014, the PEM Board has approved four market manuals which have been proposed by the PEMC-TWG to address the findings and recommendations during the 2011 audit.

With regard to the review of the Internal Business Procedures (IBPs), we have noted a significant improvement in the governance and quality of the Market Operator's IBPs. Overall (with the exception of those IBPs scoring red overall or red on process), we note that the Market Operator's suite of IBPs is generally of high quality and appropriately documents its obligations under WESM Rules and Manuals.

## IT Systems review

PEMC have made some limited progress against the recommendations of the previous Audit, with two satisfactorily resolved, and some progress having been made against most of the others.

New recommendations this year relate to compliance with software management procedures, and some issues noted with the PEMC website.

## Bid to Bill analysis

The Bid-to-Bill Workstream is a new workstream in the Independent Operational Audit of the Systems and Procedures on Market Operations. The Bid-to-Bill analysis tracks participants' data through PEMC's systems and processes from the initial offer/forecast to the final settlement amounts. The goal is to identify systemic discrepancies between the intent of the WESM Rules and operational realities – as opposed to reporting any one-off errors are found.

Our analysis identified a number of findings, though none are above the materiality threshold. The key finding relates to the disparity between market prices and what customers actually pay.

## Conclusions

PEMC has again demonstrated a clear commitment to addressing the findings and recommendations of previous audits. We would like to emphasise again that it is apparent that PEMC has cultivated a culture of self-improvement and cooperation. There are numerous staff members across all levels of the organisation who are highly capable and hard-working, with a desire to improve both the WESM itself and the manner in which PEMC fulfils its role as the Market Operator.

While this report describes a number of areas where PEMC can still improve its operations, good progress has been achieved and many more improvement initiatives are underway or have been planned.

Of the challenges currently faced by the Market Operator, there are three areas that stand out as critical to the successful operation of the market:

- *Calculation of settlements* – this is currently performed in spreadsheet programs and a new system will not be in place for some time. The use of Excel/VBA tools for this task is not appropriate by international best practice standards and the tools are error-prone and do not produce an adequate audit trail. This audit recommends improvements that can be made to the spreadsheet programs to mitigate the risk of errors while they continue to be used.
- *Enforcing participant compliance with collection and payments and Prudential Requirements obligations* – these continue to cause significant problems for PEMC as some trading participants fail to meet their payment obligations. While the ERC's recently issued Order allowing Electric Cooperatives (ECs) to recover the cost of posting prudential security in their tariffs should mitigate the level of non-compliance, we note that the upcoming suite of rule changes around decreasing prudential requirements implies a greater level of risk for generators who are due to be paid. In particular, if a participant defaults in a particular month and has not been compliant with responding to a margin call notice (or replenishing their security) there is a significant and non-trivial risk that generators will be short-paid. Hence, it is vitally important for Trading Participants to comply with their payment and prudential requirement obligations. Furthermore, it is important that the Market Operator act immediately if collection and payment and prudential requirements obligations have been violated. However, in order to do this, the Market Operator needs to mitigate the risk of late and non-payment as much as possible while having an effective means of enforcing compliance with collection and payment obligations and prudential requirements. As such we recommend PEMC, ERC and DOE implement our proposed measures (see Section 4.5) with urgency.
- *Review of System Operator compliance with WESM Rules and Manuals* – As noted in our findings relating to load forecasting accuracy, poor forecasting accuracy on the part of the Market Operator is often driven by poor quality SCADA data provided by the System Operator. Although we have recommended that the System Operator (i.e. NGCP) should initiate a review of their SCADA systems and the process used to update real-time information (see Section 2.5), we further recommend that the System Operator be subject to an audit/review similar to the one for the Market Operator. In addition to covering the System Operator's compliance with the WESM Rules and Manuals, such an audit/review should examine the System Operator's IT systems (including SCADA) and also their business processes. Such a scope would provide the System Operator with practical means to improve their systems and processes so as to not only better their own compliance, but positively impact on the Market Operator's compliance as well.

Findings and recommendations specific to each Audit workstream are presented in the body of this report. In presenting our key and material findings, it is worth noting that we have seen no evidence to suggest that most of these findings have had anything other than a minor or negligible impact on market outcomes over the Audit Period<sup>3</sup>. Nevertheless, most of the associated recommendations should be adopted to mitigate non-compliance risk in the future and to align PEMC's operations with international best practice.

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<sup>3</sup> In the five cases where we have found evidence of a finding financially impacting on market outcomes, we have explicitly specified this in the body of the report.

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# 1 OBJECTIVES AND SCOPE

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This 4<sup>th</sup> Independent Operational (2013) Audit covers PEMC's systems and procedures on market operations, billing and settlement, including the interfaces with the System Operator, the Metering Services Providers (MSPs), WESM Participants, the Energy Regulatory Commission (ERC) and the Department of Energy (DOE).

## 1.1 Audit Objectives

The objectives of the annual market operations audit shall be consistent with those of the 1st, 2nd and 3rd Independent Operational Audits, as follows:

1. Review and assess the procedures and working processes of the Market Operator;
2. Review and assess the usefulness and appropriateness of settlement systems, data management and other procedures and working processes used by the Market Operator to administer the WESM, in order to:
  - a. identify the appropriate steps and measures to help the Market Operator effectively and efficiently perform its responsibilities in time and form in accordance with the WESM Rules;
  - b. assess if the Market Operator 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; and to propose recommendations to improve the: (1) procedures to collect and process the information and, (2) controls of quality of data in the WESM.
3. Review and assess the usefulness and appropriateness of the interfaces and exchange of information among the Market Operator, System Operator, Metering Service Provider (MSP) and other service providers in relation to generation scheduling, constraints, dispatch, prices and settlement, and metering;
4. Review and assess the compliance by the Market Operator with the WESM Rules and Market Manuals;
5. Review and assess the effectiveness of the Market Assessment System (MAS); and

6. Certify that the following are adequate and in full compliance with the Market Rules: any new software or associated systems, or modified existing software or their associated systems for generation, scheduling, dispatch or settlement or price calculation relevant to the WESM.

## 1.2 Scope

This section briefly describes the items that are considered to be in scope for this audit.

- The Market Software Testing workstream:
  - The market clearing and pricing software (MDOM)
  - The market network model
  - The load forecasting software
  - The settlements software
  - The metering software tools (as appropriate)
  - The TOD software tools (as appropriate)
  - The market assessment software
- The Bid-to-Bill workstream has been added to the scope of this year's Audit and will track participant's data through PEMC's systems and processes from the initial offer/forecast to the final settlement amounts.
- The Process and Compliance workstream covers high risk and high materiality processes selected using the review of historical information and examining procedural gaps.
- The Market Documentation workstream covers Market Manuals and Internal Business Procedures (IBPs) related to Market Operations and Market Assessment System.
- The IT Systems workstream covers:
  - The processes and procedures for the management of software
  - Selected system interfaces including the BCQ declaration tool (a module of the Wholesale Billing and Settlement System (WBSS))
  - The validation of selected systems and sub-systems over and above those included in the Market Software Testing workstream

Note that in practice the 2013 Audit focussed on:

- Responses to the findings and recommendations from previous audits
- Areas that are new or have changed since the previous audit and
- Areas where the previous audit indicated that additional review is merited.

### 1.2.1 Out of scope

The following items are considered to be out of scope for this audit:

- Actions, processes and procedures the WESM Rules require be undertaken by the PEM Board
- Actions, processes and procedures required by the WESM Rules to be undertaken by the Enforcement and Compliance Office (ECO) on behalf of the PEM Board
- Actions, process and procedures required by the WESM Rules to be undertaken by WESM Participants, the System Operator, the ERC and the DOE
- Actions, processes and procedures undertaken by PEMC staff to operate the company; for example Human Resources, Finance, etc. which are not related to the operation of the WESM

## 1.3 Materiality

The Materiality Threshold has been set at 0.25% of the estimated annual market value of energy traded in the WESM. This is approximately Php 120 million.

The Materiality Threshold is a guideline only, and includes both quantitative and qualitative aspects of an issue or risk. It represents either the actual impact during the entire Audit Period, or the potential for impact during any future 12 month period of market operations, whichever is more appropriate.

Obviously this is a high threshold, well above the level that any one participant would be concerned by, and therefore we will exercise a degree of discretion in designating a finding to be *Material*. By way of example, a finding that does not meet the Materiality Threshold may still be designated as Material in the following circumstances:

- The impact is on one or a small number of participants such that the sum of impacts does not meet the threshold but the impact on the affected participants is large.
- The finding is potentially due to negligence or misconduct.
- The finding is persistent and there are no steps being taken to remedy the situation in the near future.

## 2 MARKET SOFTWARE TESTING WORKSTREAM

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The Market Software Testing workstream covers PA's assessment of the market software employed in the WESM. The assessment evaluates the calculations within the software against the WESM Rules and Manuals, and compares the software systems with international best practices.

### 2.1 Scope

Market Software Testing covers the compliance and accuracy of the key algorithms and calculations contained within the suite of market software. Specifically, the purpose of the work stream is to evaluate whether:

- The market clearing software, known as Security Constrained Economic Dispatch (SCED), is compliant with the WESM Rules and Market Manuals
- The Market Network Model (MNM) fairly represents the transmission network under the control of the System Operator
- The Similar Day Load Forecast (SDLF) and Load Predictor (LDP) software and related processes result in suitably accurate and unbiased load forecasts
- The Settlements software is compliant with the WESM Rules and Market Manuals and calculations are performed reliably and accurately
- The metering software tools are compliant with their specifications
- The Trading and Operations Department (TOD) software tools are compliant with their specifications and
- The Market Assessment System (MAS) software and related tools calculate output variables such as market monitoring indices correctly.

### 2.2 Approach

While our approach differs for each of the five software areas, the focus in each case is on mathematical accuracy and appropriateness, and on compliance of the implementation with the WESM Rules and Market Manuals and/or software specification.

### 2.3 Progress against 2012 recommendations

Table 1 summarizes PEMC's progress against the 2012 Audit recommendations made with respect to the Market Software Testing stream.

**Table 1: Progress against 2012 Market Software recommendations**

Market software	Progress against 2012 Audit recommendations
Market clearing software (SCED)	PEMC have made good progress to address previous audit recommendations, including implementing a software patch that addresses two findings.
Market Network Model	<p>In response to our 2011 Audit recommendations, PEMC undertook studies that showed that the inclusion of Meralco sub-transmission assets could have a significant impact on dispatch and market prices. To this end, in the 2012 Audit, we recommended that PEMC should:</p> <ul style="list-style-type: none"> <li>• Undertake further Meralco studies using a number of relevant generation and load scenarios</li> <li>• Determine whether the other cases where distribution utilities are able to link Market Trading Nodes are able to influence the market dispatch and pricing and</li> <li>• Determine appropriate pricing mitigation measures to be used under these circumstances and test the outcome of these as a part of the above studies.</li> </ul> <p>In response to our recommendations, we note that PEMC are in discussions with Meralco with a view to obtaining a more accurate version of Meralco's 115 kV network to use in the study recommended in the first bullet point above.</p> <p>We understand that no progress has been made with respect to the remaining two recommendations.</p>
Load Forecasting	<p>PEMC staff have completed three studies to address 2012 Audit findings, namely:</p> <ul style="list-style-type: none"> <li>• <i>Assessment on Regional Forecasts</i> – completed March 2012</li> <li>• <i>Benchmarking Demand Forecasts in the Philippine Wholesale Electricity Spot Market (WESM)</i> – completed December 2012</li> <li>• <i>Nodal Forecasting in the Philippine Wholesale Electricity Spot Market (WESM)</i> – completed December 2012</li> </ul> <p>Additionally, PEMC has already taken actions to investigate the mitigation of nodal forecast errors using the current methodology of pro-rating including:</p> <ul style="list-style-type: none"> <li>• Discussion on the use of state-estimation with NGCP-SCADA</li> <li>• Proposed enhancement on translation of EMS Snapshot Data to MMS Snapshot Data so as to capture unaccounted (or unmonitored) consumption in the system..</li> </ul>
Settlements	PEMC have undertaken a project to improve the settlements spreadsheets in line with our 2012 recommendations. However, this project has not been completed within this audit period, so these issues with the spreadsheets are still present in the programs that we tested this year.
Market Assessment System	In the previous Audit we recommended a number of improvements to the Excel VBA tools that MAG uses to pre-process certain input data ready to be loaded into the MAS database. There were no material or key findings and therefore the recommendations were to be implemented at MAG's discretion. MAG responded quickly to our recommendations and made improvements to the spreadsheet tools that were completed in December 2012.

## 2.4 Results

Table 2 summarizes the main results from the various programs tested.

**Table 2: Summary of market software testing results**

Market Software area	Program/tool	Key results
Market clearing	SCED	There was one patch to the MMS implemented during the Audit Period. The patch was created to address PA's Audit Findings related to erratic pricing

Market Software area	Program/tool	Key results
software (SCED)		<p>under severe congestion and TCG constraint violations.</p> <p>All of the tests from 2011 were rerun and the results were as expected with the previous findings that were related to the new MMS patch now fixed.</p> <p>Since patch MA 1.5.13 was implemented in November 2012 the MDOM has not had a valid independent audit certificate.</p>
Market Network Model	MNM	<ul style="list-style-type: none"> <li>Representation of common assets: The portion of the Market Network Model which is also a part of the System Network Model is appropriate for its intended use</li> <li>Representation of additional market assets: The modelling of the additional assets is appropriate for their intended use</li> <li>Representation of additional system assets: Embedded generation was added at three locations during the Audit Period (Gamu (19 MW), Bacnotan (21 MW) and Quezon (4 x 60 MW)). These three assets are appropriately modelled in the MNM and will not have adverse impacts on nodal prices and dispatch.</li> </ul>
Load Forecasting	SDLF/LDP/other	<ul style="list-style-type: none"> <li>Regional forecasts: <ul style="list-style-type: none"> <li>Forecasting accuracy has improved since 2012 for both Day Ahead projection (DAP) and Real Time Dispatch (RTD) forecasts as evidenced by the Maximum Absolute Percentage Error (MAPE) and Forecasting Accuracy Rate (FAR) statistics.</li> <li>The shapes of the error distributions (of DAP and RTD forecast) are largely unchanged since 2012.</li> <li>We note that the DAP error distribution is slightly negatively skewed (with the skewness more pronounced for Visayas) indicating a tendency for DAP forecasts to result in an overestimate of actual demand.</li> </ul> </li> <li>Nodal forecasts: <ul style="list-style-type: none"> <li>The nodal load forecasts have unacceptably high errors, with a significant proportion of nodal forecasts having absolute percentage errors outside the 3%, 10% and even 50% tolerance bands.</li> <li>The nodal load forecasts for both Luzon and Visayas are significantly negatively skewed, indicating that there is systemic overestimation of nodal loads.</li> </ul> <p>We note that the above results are unsurprising given the pro-rating methodology employed by the Market Operator. However, as noted above, the Market Operator has initiated actions required to mitigate the forecasting error attributable to the pro-rating methodology. We further note that the extreme errors typically occur on smaller sized loads.</p> </li> </ul>
Settlements	Settlement Engine	The program is capable of complying with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	Line Rental Program	The program is capable of complying with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	Administered Price Cap Program	The program does not comply with its specifications under certain conditions. In addition, aspects of its implementation make it prone to operator error.
	Market Fees Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	VAT Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	PSM Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.

Market Software area	Program/tool	Key results
	NSS Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	GPI Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	MRU Program	The program does not comply with its specifications under certain conditions. In addition, aspects of its implementation make it prone to operator error.
	Prelim Program	The program complies with its specification(s) when used without error.
	BCQ Programs: From HTML-Upload to WESM Bilat Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	BCQ Programs: BCQ Redeclaration Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	Settlement and Meter Report	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
Metering software tools	Daily MTR Programs	<ul style="list-style-type: none"> <li>• With the exception of 5 SEINs the program correctly categorizes metering points into their “trouble” categories.</li> <li>• The program incorrectly summarizes the metering points which have meter trouble in the MTR summary sheet of the MTR_YYYY-MM-DD_(ALL DATA1) and MTR_YYYY-MM-DD_(1st issue) output files. The latter is used to issue MTRs (using the Auto Email program). Therefore we conclude that the program will lead to the MSP not receiving MTRs for particular “trouble” metering points. not receiving an</li> </ul>
	Monthly MTR Program	<ul style="list-style-type: none"> <li>• The program correctly identifies metering points where there is a difference between the daily (POMAX) value and the monthly (CD MSG) value in any given interval for any given hour on any given day (on the Dxx sheets)</li> <li>• The program correctly derives daily and monthly totals for each metering point for both POMAX and CD MSG data (on the SUMMARY sheet).</li> <li>• If the MSP fails to issue a CD_MSG file for a particular metering point, then the program does not pick this metering point up, and hence an MTR will not be issued for such missing data.</li> </ul>
	SSLA Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	Metering Conversion Program	The program complies with its specification(s) when used without error
	Auto Email Program	The program complies with its specification(s) when used without error
TOD tools	Marginal Tool	The outputs of this program are consistent with the input data from the database.
	MRR Summary Program	The outputs of this program are consistent with the input data from the database.
	Monthly Billing	The program complies with its specification(s) when used without error.



Market Software area	Program/tool	Key results
	Macro	However, aspects of its implementation make it prone to operator error.
	PSM Congestion	The outputs of this program are consistent with the application of the Market Manual. The outputs are also consistent with the application of the functional specifications excepting where these contradict the Market Manual, or sensitivity limits have not been updated
	Reference Input Program	The outputs of this program are consistent with the input data from the database.
	PEN Report program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
	MCP Generate Program	The program complies with its specification(s) when used without error. However, aspects of its implementation make it prone to operator error.
Market Assessment System	MAS	<ul style="list-style-type: none"> <li>• We found that the changes made to the Excel VBA pre-processing tools successfully address the majority of the 2012 findings and recommendations, and the ones that were not addressed are not of any great significance.</li> <li>• We also noted that, during the Audit Period, MAG identified, reported and fixed three errors in the Excel VBA pre-processing tools which were related to changes made to the tools in that time</li> </ul>

## 2.5 Findings and Recommendations

Table 3 below provides a short summary of our findings and recommendations for each software area.

**Table 3: Overview of findings and recommendations**

Software area	Type of finding	Findings	Recommendations
Market Clearing software (SCED)	Key	<p>The MDOM has not had a valid audit certificate since the deployment of patch MA 1.5.13 on November 16, 2012. This is not in line with international best practice standards and undermines the value of having software certificates which is to provide confidence to market participants by demonstrating that the market clearing software in use at all times has been independently verified by experts in the field.</p> <p>It is worth noting, however, that our post-audit testing indicated that changes made to MDOM during the Audit Period were implemented correctly and did not have any adverse impact on the existing functionality of the MDOM.</p>	<ul style="list-style-type: none"> <li>• Before implementing any future MMS patches, a new independent software certificate should be obtained for the new MDOM version. For major changes this will require retesting of the MDOM, while minor changes may only require the independent certifier to review the change documentation and reissue the software certificate with the new version number</li> <li>• In determining the functional specifications for the new MMS, carefully consider all aspects of the MDOM formulation, particularly those aspects related to software limitations in the existing MMS, and make the most of the opportunity presented by the need for a new system</li> </ul>
Market Network Model	Key	<p>Based on PEMC studies undertaken in response to PA's 2011 recommendations, we conclude that the impact of the inclusion of the Meralco sub-transmission system can have a significant impact on dispatch and market prices. Given that the System Operator cannot guarantee to produce an optimal re-dispatch around the constraints in the Meralco sub-transmission system, this strongly suggests that the Meralco sub-transmission system should be included within the Market Network Model so as to guarantee an optimal dispatch</p>	<ul style="list-style-type: none"> <li>• Continue to seek cooperation from Meralco in providing relevant information and data in order to carry out any additional scenarios required, particularly the provision of accurate load data.</li> <li>• Report to the DOE and the ERC on the issues that need to be resolved in order to add Meralco assets to the MNM. Request that the matters be decided upon promptly to enable PEMC to implement the MNM additions by the end of 2014. We note that PEMC plans to present to the ERC and DOE on this topic before the end of the second quarter of 2014.</li> <li>• Determine whether the other cases where distribution utilities are able to link Market Trading Nodes are able to influence the market dispatch and pricing, given that ownership and operation of the 115 kV facilities has been transferred from NGCP to</li> </ul>

Software area	Type of finding	Findings	Recommendations
			the distribution utilities
Load forecasting	Key	<p>Nodal forecasts have performed poorly over the Audit Period with a significant proportion of nodal forecasts having absolute percentage errors outside the 3%, 10% and even 50% tolerance bands (even after stratifying for load). Additionally, the nodal load forecasts for both Luzon and Visayas are significantly negatively skewed, indicating that there is systemic overestimation of nodal loads. We note, however, that the above deficiencies are due to a number of factors including:</p> <ul style="list-style-type: none"> <li>• The pro-rating methodology used to derive nodal forecasts from regional forecasts. However, as noted in Section 4.2 the Market Operator has initiated actions required to mitigate the forecasting error attributable to the pro-rating methodology.</li> <li>• Non-updating (bad) data retrieved from the real-time SCADA snapshot provided by the System Operator (NGCP). The accuracy of the Market Operator's load forecasts depends on the integrity of the real-time SCADA data, since this is a key input to the real-time forecasts. If there are errors in the SCADA snapshots (e.g. due to incorrect updating of information), then the resultant forecasts will obviously be erroneous</li> <li>• Nodal load variations being high compared with regional load variations, which dilute any sudden change in demand.</li> </ul>	<p>We recommend:</p> <ul style="list-style-type: none"> <li>• Until the new MMS is implemented, TOD should continue their efforts to investigate means of mitigating the errors caused by the pro-rating methodology.</li> <li>• NGCP should initiate a review of their SCADA system and the process used to update real-time information with a view to investigating how the accuracy of their real-time data can be improved</li> <li>• In relation to above recommendation, the System Operator should be subject to an audit/review similar to the one for the Market Operator. In addition to covering the System Operator's compliance with the WESM Rules and Manuals, such an audit/review should examine the System Operator's IT systems (including SCADA) and also their business processes. Such a scope would provide the System Operator with practical means to improve their systems and processes so as to not only better their own compliance, but positively impact on the Market Operator's compliance.</li> </ul>
Settlements software	Key	<ul style="list-style-type: none"> <li>• The Administered Price Cap and MRU programs produce incorrect results under certain conditions</li> <li>• Settlement programs have a lack of audit trail</li> <li>• Settlement programs have a lack of error checking</li> <li>• Settlement programs use hard-coded input data</li> <li>• Settlement programs use unnecessary and redundant input data</li> <li>• Settlement programs have unnecessary potential for user error</li> <li>• Settlement programs have poorly labelled inputs</li> </ul> <p>We have seen no evidence to suggest that our findings above have resulted in the software producing results that are inconsistent with the WESM Rules or Market Manuals</p>	<p>We recommend BSMD:</p> <ul style="list-style-type: none"> <li>• Clarify what the correct results should be and amend the Administered Price Cap program for the situations that result in zero administered prices.</li> <li>• Investigate and fix the problem in which the requirements of sections 4.2.5.2 and 4.2.5.3 of the WESM Administered Prices manual are not being implemented.</li> <li>• Investigate and fix the problem with the MRU</li> </ul>

Software area	Type of finding	Findings	Recommendations
		during the Audit Period. Nevertheless they have significant potential to materially impact on market outcomes in the future.	<p>program that incorrectly results in zero trading amounts under certain conditions.</p> <ul style="list-style-type: none"> <li>• Ensure that the results of the existing project to resolve the issues found with the settlements programs in the previous audit are implemented as soon as possible</li> </ul>
Metering software	Key	<ul style="list-style-type: none"> <li>• Error in Daily MTR program may lead to incorrect MTRs being issued</li> <li>• Monthly MTR program may not report all missing data</li> <li>• Monthly MTR program relies on accuracy of daily metering data</li> <li>• Metering programs use unnecessary and redundant input data</li> <li>• Metering program has poor Email data security</li> <li>• Metering programs have poor error handling</li> </ul> <p>We have seen no evidence to suggest that our findings above have resulted in the software producing results that are inconsistent with the WESM Rules or Market Manuals during the Audit Period. Nevertheless they have significant potential to materially impact on market outcomes in the future</p>	<p>We recommend BSMD:</p> <ul style="list-style-type: none"> <li>• Fix the MTR summary error in the daily MTR program</li> <li>• Implement a change to the monthly MTR program to pick up metering points with missing CD data</li> <li>• Introduce enhanced error-checking capability into the monthly MTR program</li> </ul>
TOD software	Key	<ul style="list-style-type: none"> <li>• TOD tools have potential for significant error</li> <li>• The PSM functional specifications documentation<sup>4</sup> is not aligned with the Market Manual on pricing errors and price substitution<sup>5</sup> definition of the price threshold for network congestion where the market clearing price is zero.</li> </ul> <p>We have seen no evidence to suggest that our findings above have resulted in the software producing results that are inconsistent with the WESM Rules or Market Manuals during the Audit Period. Nevertheless they have significant potential to materially impact on market outcomes in the future</p>	<p>We recommend TOD:</p> <ul style="list-style-type: none"> <li>• Implement changes to the Monthly Billing macro to avoid incorrect results when an autofilter has been applied to the input file</li> <li>• Align PSM functional specifications to Market Manual definition.</li> </ul>
Market Assessment System	N/A	No findings	No recommendations

<sup>4</sup> Price Substitution Methodology Executable Application Software Functional Specifications version 1.0 (MO-PSM-001).

<sup>5</sup> Market Manual on The Methodology for Determining Pricing Errors and Price Substitution Due to Congestions for Energy Transactions in the WESM (Issue 3.0)

# 3 BID TO BILL WORKSTREAM

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The Bid-to-Bill Workstream is a new workstream in the Independent Operational Audit of the Systems and Procedures on Market Operations. It tracks participants' data through PEMC's systems and processes from the initial offers and forecasts to the final settlement amounts.

## 3.1 Scope

The new Bid-to-Bill Workstream takes a different approach and perspective to the other Audit Workstreams. It can be seen as a complement to the other reviews conducted in the Audit. It employs a "vertical" data-focussed approach, as opposed to the more "horizontal" approach seen in other workstreams. The Bid-to-Bill Analysis tracks participants' data through PEMC's systems and processes from the initial offer/forecast to the final settlement amounts.

The purpose of the Bid-to-Bill Analysis is to assess compliance and risks at a system and process level. In doing so, the Bid-to-Bill Analysis focuses on a single Trading Interval at a time, and covers a small number of intervals that include both common and unusual market situations. Example scenarios considered as part of this workstream include (but are not limited to):

- Summer peak, tight supply conditions
- Off-peak, low demand
- Large changes in demand
- Disparate ex-ante and ex-post prices

The analysis takes a rules perspective, comparing data flows through Market Operator processes as defined in the WESM Rules and Market Manuals to PEMC's actual operational processes. The goal is to identify systemic discrepancies between the intent of the WESM Rules and operational realities – as opposed to reporting any one-off errors are found.

## 3.2 Approach

There are four key areas in the Bid-to-Bill Analysis. They are:

- The identification of scenarios of interest and selection of intervals for analysis
- The identification of data flows
- The development of tools for data analysis
- The investigation of issues revealed by the tools.

In consultation with MAG and TOD staff, 30 Trading Intervals were identified that covered specific scenarios of interest for analysis. Data for these intervals was provided and the intervals were further reduced to a set of eight intervals for full analysis.

Spreadsheet tools were developed to track the participant data through market calculations as described in the WESM Rules and Market Manuals, from “bid” (offer/forecast) to “bill” (settlement amounts). Two tools were developed:

- One from the perspective of a Customer Trading Participant (with the analysis starting at the nodal Real Time Dispatch (RTD) load forecast)
- One from the perspective of a Generator Trading Participant (starting with the Generators’ offers and follows the data through to the energy settlement amounts)

This analysis informs the findings and recommendations for the Bid-to-Bill Workstream. Flowcharts were developed to represent the Bid-to-Bill process developed in the spreadsheet tools.

### 3.3 Progress against 2012 recommendations

The Bid-to-Bill Analysis is a new workstream in 2013, so there are no recommendations to report on.

### 3.4 Findings and Recommendations

#### 3.4.1 Findings

None of the Audit Findings from the Bid-to-Bill Analysis meet the Materiality Threshold. There is one Key Finding and two General Findings.

##### Key Findings

##### ***Effective prices paid by customers vary from market prices***

The combination of ex-ante and ex-post pricing in the WESM can at times result in effective energy prices that have little relation to market prices. The contributing factors include:

- Trading Intervals in which there is a large difference between ex-ante and ex-post prices
- Ex-ante quantities are based on Market Operator forecasts that can differ markedly from Metered Quantities
- Line Rental Trading Amounts (LRTAs) calculated on ex-ante prices combined with BCQs that can exceed ex-ante quantities

When these factors combine, the effective energy price for a Customer at a particular node in a particular Trading Interval can be significantly different from either the ex-ante or the ex-post price at that node.

We note that the recent Market Design Study has made recommendations that are under consideration which involve shortening of the Trading Interval and corresponding changes to the pricing principles. Such changes to the market would remove this issue.

##### General Findings

##### ***Net Settlement Surplus occurring without congestion is not well documented***

Various disconnections between settlement energy quantities and instantaneous RTD and Ex-Post Dispatch (RTX) results are some significant causes of Net Settlement Surplus (NSS). These are not sufficiently identified and communicated to participants and the ERC.

##### ***Variations in rounding of numbers can cause discrepancies***

The variety of tools and manual processes used to calculate, query and transfer data through the many stages of market calculations have varying degrees of data precision that could potentially result in small differences in final settlement amounts. While the amounts involved are unlikely to be

significant to trading participants, it is best practice to ensure sufficient data precision at every intermediate calculation step.

### **3.4.2 Recommendations**

#### ***Improve the consistency and transparency of market pricing***

Take account of the effective energy costs paid by customers when considering the Market Design Study's recommendations on interval length and market pricing principles.

#### ***Communicate quantity disconnects as causes of NSS***

Improve the identification and communication to participants and the ERC concerning how disconnects between settlement energy quantities and instantaneous RTD and RTX results can be significant causes of NSS.

#### ***Retain sufficient and consistent data accuracy through intermediate calculation steps***

In the short term this could possibly be improved by taking additional care to preserve data precision in database queries, Excel calculations and manual operations. In the longer term, the Centralised Registration and Settlement System (CRSS) can easily address this by retaining appropriate data precision at each intermediate step.

## 4 PROCESS AND COMPLIANCE WORKSTREAM

The Process and Compliance workstream of the Audit assesses whether:

- The Market Operator has been compliant with selected obligations of the WESM Rules and Manuals and
- The Market Operator's business processes (to discharge their obligations under the WESM Rules and Manuals) are consistent with best practice standards defined in our process evaluation framework.

### 4.1 Scope

Table 4 summarises the processes that are in scope for this audit. Since the 2011 Audit we have undertaken full reviews of all of the Market Operator's market-facing business processes. Hence, this year all process reviews shall be incremental in nature as indicated in Table 4 below.

**Table 4: In-scope processes for the 2013 review of process and compliance**

Process	Scope of process review
Market fees and budget	<ul style="list-style-type: none"> <li>• Incremental review: follow-up of issues noted in last audit</li> </ul>
Trading and Operations	<ul style="list-style-type: none"> <li>• Incremental review: Follow-up of issues noted in last audit</li> <li>• Compliance testing of WESM Rules that were breached last year (e.g. PEN issuance) and high volume high materiality obligations (e.g. compliance with timetable in Dispatch Protocol)</li> </ul>
Settlements (including Collection and Payments and Prudential Requirements)	<ul style="list-style-type: none"> <li>• Incremental review: Follow-up of issues noted in last audit</li> <li>• Compliance testing of WESM Rules that were breached last year and high volume high materiality obligations (e.g. timeliness of settlement statements)</li> </ul>
Market Assessment	<ul style="list-style-type: none"> <li>• Incremental review: follow-up of issues noted in last audit</li> </ul>
Registration	<ul style="list-style-type: none"> <li>• Incremental review: Follow-up of issues noted in last audit</li> <li>• Compliance testing of all high materiality Registration obligations</li> </ul>

### 4.2 Approach

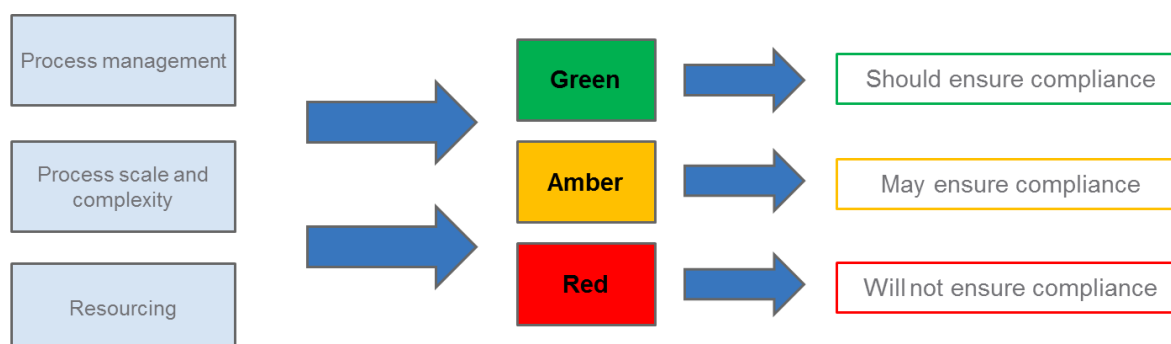
The process review methodology is set out in Table 5.



**Table 5: Process review methodology**

Stage	Description
Stage 1: Identification of primary and sub-processes	This involved definition of logical groups of activities, including the breakdown of those activities, to enable examination and analysis. In some cases this identification of logical groups aligned to procedures, on other occasions multiple procedures may support a process.
Stage 2: Assessment of processes against the PA framework	<p>This involved interviewing the relevant staff (i.e. those who undertake the processes) and reviewing supporting documentation where relevant (e.g. records of complaints, process checklists used, etc.). The purpose of the interviews was to review the processes against our analysis framework in three main areas, specifically:</p> <ul style="list-style-type: none"> <li>• Process management</li> <li>• Process scale and complexity</li> <li>• People and Skills</li> </ul>
Stage 3: Determination of RAG score	<p>This provides an assessment of process performance and risk. It includes observed and identified breaches and risks, along with corresponding mitigations and performance improvement opportunities. The process performance is summarised as a Red-Amber-Green (RAG) score where the colours correspond to the status of the process:</p> <ul style="list-style-type: none"> <li>• Red equals a poorly performing process, with either high risk of non-compliance or substantial re-work required. The process requires immediate attention.</li> <li>• Amber equals a process with potential for substantial improvement. For example, there may be a risk of non-compliance or difficulties subject to certain conditions such as a new starter. The process requires attention to bring it up to best possible standard.</li> <li>• Green equals a process that works well and is supported by staff with a clear idea of how to undertake the process. The process does not require remedial action.</li> </ul>

**Figure 1: Revised process assessment framework**



## 4.3 Progress against PA recommendations

PEMC has made good progress against PA's recommendations as highlighted in Table 6.

**Table 6: Progress against process recommendations from the 2012 Audit**

PA recommendations	PEMC actions
<ul style="list-style-type: none"> <li>PEMC should continue with its plans to study the market design issues identified in the 2011 and 2012 audits.</li> </ul>	<ul style="list-style-type: none"> <li>As directed by the PEM Board, the Rule Change Committee has reduced the level of Prudential Requirements (PR) from the current 63 days to 35 days and revise the basis of assessment for the maximum exposure (ME) and actual exposure (AE) on the Prudential Requirements</li> <li>PEMC has engaged an external consultant to undertake a review of the <math>P_{Min}</math> issue and of the Constraint Violation Coefficients (CVCs)</li> <li>TOD has begun the process of reviewing the Procedures covering Pricing Errors</li> <li>The recommended review of Must-Run Units is planned</li> <li>No action has been taken on developing effective enforcement options to address participant non-compliance with collection and payments and Prudential Requirements obligations.</li> </ul>
<ul style="list-style-type: none"> <li>PEMC should continue to enhance their compliance monitoring and reporting processes.</li> </ul>	<ul style="list-style-type: none"> <li>PEMC has developed and approved an internal compliance monitoring program that will be owned by the Office of the President. The program includes semi-annual monitoring of Market Operator teams against process-specific checklists that will include pertinent WESM Rules and Manuals obligations. Additionally, the program will include self-reporting of incidents and breaches through a “compliance gap reporting” mechanism.</li> <li>The compliance checklists to be used for the semi-annual monitoring are due to be issued to PEMC teams before the end of 2013. The first monitoring period will cover March 26 2013 to September 25 2013.</li> </ul>
<ul style="list-style-type: none"> <li>PEMC should continue to enhance their suite of Procedures.</li> </ul>	<ul style="list-style-type: none"> <li>PEMC has engaged an external consultant to refine and align all their Internal Business Procedures (IBPs)</li> <li>The outcome of this process and the subsequent internal review by PEMC is covered as part of the Market Documentation review (see Chapter 5).</li> </ul>

## 4.4 Results

In this section we summarise the breaches that have been noted as part of this audit

Note our classification of audit breaches and findings has been revised for this audit. Breaches and audit findings are classified as material, key or general findings:

- Material breaches or findings are those that meet the materiality criteria/threshold set out in Section 1.3.
- Key breaches or findings don’t meet the materiality threshold but are important to the functioning and credibility of the market.
- General breaches or findings are issues that are not of major significance to the functioning and credibility of the market.

Table 7 summarises the number of provisions of the WESM Rules or Manuals that were breached in the Audit Period (26/6/2012 -25/6/2013) by materiality and process area.

In previous audits our breaches were classified as “material” and “non-material” breaches of the WESM Market Rules. Material breaches from previous audits are broadly comparable with material and key breaches in this audit, and non-material breaches are comparable with general breaches.

Note, the area of Prudential Requirements still accounts for the majority of non-compliances. The Market Operator’s breaches in this area are attributable to their inability to enforce obligations relating to Prudential Requirements. As noted in earlier audits, this is a regulatory artefact and not a result of the Market Operator’s business processes. As such, the large number of breaches in the prudential

requirements area emphasizes further the need for Trading Participants to comply with their prudential requirement obligations.





**Table 7: Number of provisions breached by process area 2013**



PEMC division	Material	Key	General	Total
IR-PS Registration	0	1	0	1
TOD - Market Operations	0	0	6	6
TOD - Planning	0	0	0	0
BSMD - Settlement & Reconciliation	0	2	1	3
BSMD - Metering	1	0	1	2
Finance, Accounting and Planning	0	0	0	0
AMU – Collection & Payments and Prudential Requirements	4	0	2	6
MAG – Market Monitoring Unit	0	0	0	0
<b>Total</b>	<b>5</b>	<b>3</b>	<b>7</b>	<b>18</b>

## 4.5 Findings and recommendations


Table 8 summarizes the process-specific findings and corresponding recommendations.

**Table 8: Summary of Audit Findings and Recommendations for Process and Compliance workload**

Process team	Score	Findings	Type of finding	Recommendations
IR-PS - Registration		IR-PS continues to breach Rule 2.5.3.1 see Table 10) and has failed to inform applicants of additional information required to process their registration applications within the required time frame of five working days.	Key	IR-PS should continue to review and refine the registration processes around timely processing of registration applications so that MR 2.5.3.1 is not breached in the future.  We note that PEMC has plans to document a process for managing timing risks in their Internal Business Process for registration.
TOD – Market Operations		No findings	N/A	No recommendations
TOD – Market Analysis and Planning		No findings	N/A	No recommendations
BSMD – Settlement		There are no documented procedures in place to ensure manually submitted BCQs are incorporated into the settlement process. This is a key finding as one of the breaches of Rule 3.14.4.4 that occurred due to the manual emailing of BCQ declarations could have been avoided by conducting a check to see whether any participants had emailed their BCQ declarations.  This finding had a market impact as it caused an error in preliminary statement calculations that were not discovered until after the final statement was sent out.	Key	BSMD (Settlement and Reconciliation) should revise settlement procedures to ensure any manually submitted (i.e. emailed) BCQ declarations are picked up during the settlement process.  Note, we would expect to see such procedures documented in BSMD's (Settlement and Reconciliation) IBPs.
BSMD – Metering		Metering tools are still poorly documented and there is still a lack of distinction between IBP manuals (in which the process is documented) and tool documentation (which serves as a user manual).	General	BSMD (Metering) should develop separate documentation for all their metering tools as soon as possible.
		There are no procedures to address the updating of	Material	BSMD (Metering) should

Process team	Score	Findings	Type of finding	Recommendations
		<p>metering tools to pick up changes in the metering masterfile. This is a material finding as:</p> <ul style="list-style-type: none"> <li>There was one material breach during the Audit Period (where a participant was billed for a non-existent load) which had a financial market impact and can be attributed to the lack of such procedures</li> <li>The absence of such procedures has the potential to significantly financially impact market participants in the future.</li> </ul>		<ul style="list-style-type: none"> <li>Refine their suite of IBPs or tool documentation (as appropriate) to include input data checks that should be conducted across all meter data tools. At a minimum we would expect to see a documented check to ensure metering points are updated to reflect the latest masterfile included.</li> <li>Continue with their plans to revise the WESM Metering Manual to clearly outline MSP and trading participant obligations in the deregistering and decommissioning of metering points.</li> </ul>
		The manner in which the end-to-end testing process is carried out by the metering team when new metering installations are being registered is not compliant with Section 5 of the Metering Manual.	General	BSMD (Metering) should revise the Metering Manual end-to-end metering test process to reflect how the process is actually carried out in practice. This is a low priority task and can be deferred until the next time the Metering Manual is updated.
Finance Accounting and Planning		No findings	N/A	No recommendations
Accounts Management Unit		<p>The Market Operator is in breach of the last part of the Clause 3.14.7 and with Section 3.3.2 of the Billing and Settlement Manual due to a misalignment between Clause 3.14.7 of the Market Rules and the Billing and Settlement Manual in two respects:</p> <ul style="list-style-type: none"> <li>First, Clause 3.14.7 only requires the Market Operator to pay out what it has received from Trading Participants. However, Section 3.3.2 requires the Market Operator to pay Trading Participants in full (irrespective of whether there has been a default).</li> <li>Second, the Rules state any shortfall in payment <i>“shall be paid upon collection from the defaulting WESM Member but not later than the date in the</i></li> </ul>	General	<p>MAG, AMU, the Rule Change Committee (RCC) and other relevant teams should align the Billing and Settlement Manual with the Rules and with operational practice.</p> <p>See Section 5 for further details on this recommendation.</p>

Process team	Score	Findings	Type of finding	Recommendations
		<p><i>billing and settlement time table". However, the Billing and Settlement Manual does not specifically state the date by which a default must be remedied, and ambiguously implies (in Section 2.3.2, Step 8) that the date is "no later than 3pm on the next business day following the day on which the Market Operator is due to be paid under Clause 3.14.6".</i></p>		
		<ul style="list-style-type: none"> <li>The majority of breaches in the area of Prudential Requirements in previous audits continue to recur and participants continue to breach payment obligations as the Market Operator does not have any effective means of enforcement.</li> <li>We note this as a material finding because participant non-compliance with collection and payments and prudential obligations has historically financially impacted multiple participants (e.g. where defaults or inadequate prudential security has led to generators being paid late).</li> </ul> <p>This finding continues to have a financial impact on the market and as such our associated recommendations should be adopted with urgency.</p>	Material	<p>Before the suite of Prudential Requirements rule changes are promulgated:</p> <ul style="list-style-type: none"> <li>PEMC should, in collaboration with the ERC, the DOE, the National Electrification Authority (NEA) and any other relevant organizations review policies to facilitate the immediate disconnection of participants who have been non-compliant with collection and payment obligations or prudential requirements</li> <li>AMU (in collaboration with relevant PEMC teams) should enforce the use of real-time Electronic Fund Transfer (EFT) facilities.</li> <li>AMU should, as soon as the Centralised Registration and Settlement System (CRSS) is implemented, monitor exposure on a weekly basis (as opposed to monthly).</li> </ul>
		<ul style="list-style-type: none"> <li>AMU continues to use error-prone spreadsheets due to the delay in the launch of the WBSS Account Management Module.</li> <li>We note this as a material finding as errors in these spreadsheets can have significant financial impact on market participants</li> </ul> <p>However, with the exception of one incident in which Value Added Tax calculations were done incorrectly (which did have a financial impact on the market), we have noted no evidence to suggest that AMU's spreadsheets produced results that were inconsistent with the WESM Rules and Market</p>	Material	<p>AMU, ISTD and any other relevant PEMC teams should:</p> <ul style="list-style-type: none"> <li>Continue with their plan to automate collection and payment and related processes as soon as possible. The current suite of spreadsheets have significant potential to materially impact on market outcomes and should be migrated to the WBSS as soon as possible.</li> <li>If the above automation is delayed (e.g. due to issues uncovered during the parallel runs) then more robust interim spreadsheets with automated functionality should be developed.</li> </ul>

Process team	Score	Findings	Type of finding	Recommendations
		Manuals over the Audit Period. .		
		<p>An on-going withholding tax issue means that some participants are regularly withholding 2.5% to 3% of their WESM bill. As noted previously, 65 out of the 191 default incidents in the 2013 audit year were attributable to this issue. It appears that the tax regulation is misaligned with the WESM Rules. However, we note that PEMC has made an application to the Bureau of Internal Revenue (BIR) to act as the withholding agent when making payments to generators.</p> <p>This finding also has a financial impact on the market as participants are not paying the full amount required under the WESM Rules.</p>	Key	We recommend that the Market Operator in conjunction with the relevant governmental organizations such as the Bureau for Internal Revenue and the Department of Energy resolve the withholding tax issues so that trading participants are able to remit the full settlement amount to the Market Operator as required under the WESM Rules.
Market Monitoring Unit		No findings	N/A	No recommendations

# 5 MARKET DOCUMENTATION WORKSTREAM

The Market Documentation workstream assesses whether the Market Manuals and PEMC's Internal Business Process manuals (IBPs) are compliant with the WESM Rules and consistent with best practice standards defined in PA's procedure evaluation framework.

## 5.1 Scope

### 5.1.1 Market Manuals in scope

As in the 3rd Audit, an incremental approach has been taken to reviewing the Market Manuals. So while the full list of Market Manuals included in the scope of the Audit, the documents reviewed this year are only those for which amendments have taken effect during the Audit Period, and those that have been introduced for the first time during the Audit Period. These are listed below in Table 9.

**Table 9: Market Manuals reviewed in the 4th Audit**

Market Manual	Type of review
Metering Standards and Procedures	<ul style="list-style-type: none"> <li>Incremental review of changes made in the Audit Period</li> </ul>
Dispatch Protocol Manual	<ul style="list-style-type: none"> <li>Incremental review of changes made in the Audit Period</li> </ul>
Registration, Suspension and De-Registration Criteria and Procedures	<ul style="list-style-type: none"> <li>Full review of new Market Manual</li> </ul>

### 5.1.2 IBPs in scope

The IBPs reviewed are summarised below.

- Corporate Planning and Communications (CPC) IBPs covering registration and participant support processes
- Market Assessment Group (MAG) IBPs covering market monitoring processes
- Billing, Settlement and Metering IBPs covering processes relating to meter validation, settlement and reconciliation
- Account Management Unit (AMU) IBPs covering collection and payment and prudential requirements processes

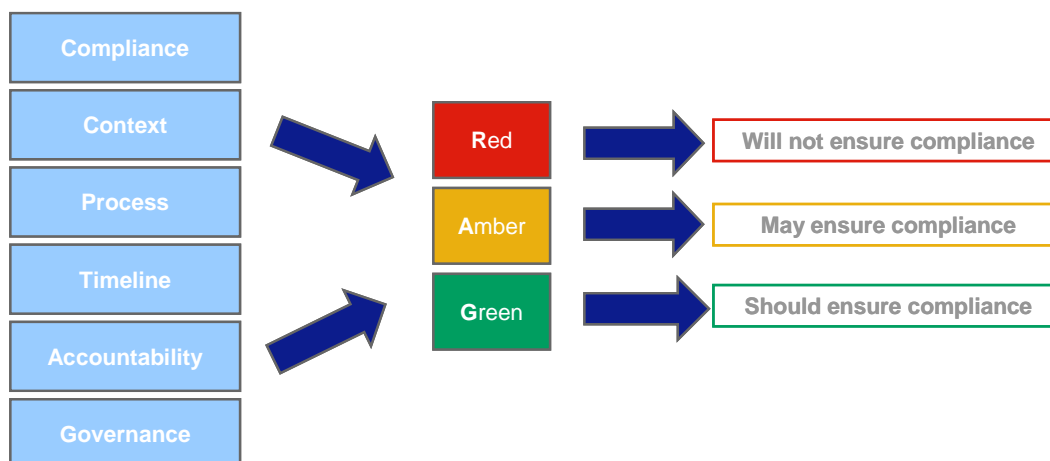


- Finance Planning and Accounting (FPA) IBPs covering market fees and budget processes.
- Trading and Operations Department (TOD) IBPs covering processes relating to scheduling, pricing and dispatch (including the market network model).

## 5.2 Approach

Market Manuals and IBPs were reviewed and scored against six criteria and allocated a summary Red-Amber-Green (RAG) score that indicated how well each manual and IBP performed overall. The Procedure Evaluation Framework is illustrated in Figure 2 below.

**Figure 2: Procedure Evaluation Framework.**



### Compliance scoring

To determine the compliance score in Figure 2 above, we employed an obligation mapping approach, which mapped all Market Rules obligations against existing Market Manuals and IBPs with a view to determining which obligations were not addressed by the manuals being reviewed.

## 5.3 Progress against 2012 recommendations

All previous Audit Findings related to Market Manuals remain valid as none have been addressed during the Audit Period. However, we note that as of February 2014, the PEM Board has approved four market manuals which have been proposed by the PEMC-TWG to address the findings and recommendations during the 2011 audit.




PEMC has recently restructured and revamped its entire suite of IBPs in response to our previous audit recommendations.

## 5.4 Results

- The Market Manuals reviewed in 2013 resulted in no new Audit Findings and no changes in RAG scores.
  - The manuals that underwent incremental reviews retained their scores from the 2011 Audit:
    - The Metering Standards and Procedures Manual retained its Red score
    - The Dispatch Protocol Manual retained its Amber score
  - The Registration Manual was reviewed for the first time in 2013 and achieved a Green score.
  - The Process and Compliance workstream has resulted in two findings related to the Billing and Settlement Manual and the Dispatch Protocol.
- We have noted a significant improvement in the governance and quality of the Market Operator's IBPs (see Table 10 for summary results of our IBP review). Overall (with the exception of those

IBPs scoring red overall or red on process), we note that the Market Operator's suite of IBPs is generally of high quality and appropriately documents its obligations under WESM Rules and Manuals. Additionally, the majority of amber scoring IBPs requires minor to moderate remedial work to bring them to green standard.

**Table 10: Summary of IBP scores across PEMC teams (% IBPs receiving RAG score indicated in parentheses).**

Team				Total IBPs
Corporate Planning & Communication – Institutional Relations and Participant Support (CPC IR-PS)	0 (0%)	9 (60%)	6 (40%)	15
Market Assessment Group (MAG)	0 (0%)	0 (0%)	1 (100%)	1
Billing Settlement and Metering - Metering (BSM – Metering)	3 (75%)	1 (25%)	0 (0%)	4
Billing Settlement and Metering - Settlement (BSM – STL)	1 (20%)	2 (40%)	2 (40%)	5
Finance Division– Account Management Unit (AMU)	3 (30%)	3 (30%)	4 (40%)	10
Finance Division – Finance, Planning & Accounting (FPA)	0 (0%)	2 (100%)	0 (0%)	2
Trading and Operations Department – Operations (TOD – Operations)	1 (3%)	20 (61%)	12 (36%)	33
Trading and Operations Department – (TOD MAP)	0 (0%)	8 (62%)	5 (38%)	13
<b>Total</b>	<b>10 (12%)</b>	<b>44 (53%)</b>	<b>29 (35%)</b>	<b>83</b>

## 5.5 Findings and Recommendations

The 2013 Audit Findings and Recommendations are summarized below,

**Table 11: Summary of Audit Findings and Recommendations for Market Documentation workflow**

Audit Finding	Type of Finding	Recommendation
All Key Findings from the 2nd and 3rd Audits remain valid. This is demonstrated by the fact that none of the Market Manuals that failed to achieve a Green score in the 2nd Audit (2011) have been improved to that standard in the intervening 2 years.	Key	<p>The Technical Working Group (TWG) has been established to harmonize the Market Manuals with the WESM Rules should also be tasked with addressing PA's current and previous Audit Findings and Recommendations:</p> <ul style="list-style-type: none"> <li>The TWG, in collaboration with the relevant PEMC teams, revise all Market Manuals that currently have a Red score so that they achieve the Green standard in the 5th Audit, to be conducted in 2014<sup>6</sup>. Priority should be given to the Metering Manual and the Billing and Settlement Manual<sup>7</sup>.</li> </ul>

<sup>6</sup> Note that this will require the Market Manuals to be in effect by June 25, 2014.

Audit Finding	Type of Finding	Recommendation
However, we note that as of February 2014, the PEM Board has approved four market manuals which have been proposed by the PEMC-TWG to address the findings and recommendations during the 2011 audit.		<ul style="list-style-type: none"> <li>The TWG, in collaboration with the relevant PEMC teams, revise all Market Manuals that currently have an Amber score so that they achieve the Green standard in the 6th Audit, to be conducted in 2015<sup>8</sup>.</li> </ul>
There is a misalignment between Clause 3.14.7 of the Market Rules and the Billing and Settlement Manual.	General	<p>The following changes should be made to the Billing and Settlement Manual and WESM Rules:</p> <ul style="list-style-type: none"> <li>Section 3.3.2 of the Billing and Settlement Manual should be revised so the wording is consistent with Clause 3.14.7 of the WESM Rules.</li> <li>The glossary of the WESM Rules should be updated to include “<i>Billing and Settlement Timetable</i>” as a defined term. The definition should reference the Billing and Settlement Manual.</li> <li>Section 2.3.2 of the Billing and Settlement Manual should be revised so that: <ul style="list-style-type: none"> <li>It is explicitly referenced as the Billing and Settlement timetable referenced in the glossary of the WESM Rules</li> <li>The timeline for the Market Operator to remit default payments to market participants is defined.</li> </ul> </li> </ul>
The Dispatch Protocol timeline for web publication of day-ahead projections and real time data (RTD and RTX) is unrealistic and is not aligned with the Market Operator’s business practice.	General	<p>In order to address the misalignment between the web publication timelines and Market Operator practice, the following changes should be made to the Dispatch Protocol:</p> <ul style="list-style-type: none"> <li>The timetables in Sections 5.2, 5.3 and 5.4 of the Dispatch Protocol should be revised so that the web publication timeline for DAP, RTD and RTX results aligns with the Market Operator’s business practice of publishing results at the end of the trading day.</li> <li>The timetables in Sections 5.2, 5.3 and 5.4 of the Dispatch Protocol should be revised so that publication of DAP, RTD and RTX results to the MPI (which occurs at the end of the relevant hour) is clearly distinguished from web publication (which occurs at the end of the trading day).</li> </ul>

<sup>7</sup> These two manuals scored poorly in the 2011 Audit. Both the Billing and Settlement Manual is missing a large number of material obligations from the WESM Rules. Furthermore, the Metering Manual is very difficult to follow in general and if a market participant were to follow the pertinent chapters in this manual, it is likely that they would be non-compliant with the relevant WESM Rules provisions due to the confusing manner in which the Manual is structured and written.

<sup>8</sup> Note that this will require the Market Manuals to be in effect by June 25, 2015.

# 6 IT SYSTEMS WORKSTREAM

The IT Systems Workstream provides an assessment of how PEMC fares against international best practice standards.

## 6.1 Scope

The IT Systems Workstream consists of the following:

- Software management review
- Interface review
- Software validation

Information security and general IT controls are no longer in scope of this annual market operational audit, as they are reviewed separately.

## 6.2 Approach

Our approach to each area of the IT Systems review is summarized in Table 12 below.

**Table 12: IT Systems review methodology**

Review area	Methodology
Software Management	<ul style="list-style-type: none"> <li>• Obtain the current versions of the applicable internal procedure documents, and review them for changes since the versions that were current at the time of the previous Audit</li> <li>• Review any changes in the procedures against recommendations from the previous Audit and best practice</li> <li>• Request and review evidence that operational practice matches the documented procedure changes.</li> <li>• Obtain the latest MMS availability and performance report, and review this against PEMC performance standards</li> <li>• Review progress against the recommendations identified in the previous Audit</li> </ul>
Interfaces	<ul style="list-style-type: none"> <li>• Review the list of software changes implemented during the Audit period for changes to any of the interfaces</li> <li>• Where significant changes have occurred, design and carry out tests to ensure the data integrity of the altered interface.</li> <li>• Review progress against the recommendations identified in the previous Audit</li> </ul>
Software Validation	<ul style="list-style-type: none"> <li>• Review the list of software changes implemented during the Audit period for changes to any of the above applications</li> </ul>

Review area	Methodology
	<ul style="list-style-type: none"> <li>Where significant changes have been implemented, review against the criteria and findings identified in the previous two audits</li> <li>Review progress against the recommendations identified in the previous Audit</li> </ul>

## 6.3 Progress against 2012 recommendations

Of the 12 previous recommendations that we reviewed for progress, 2 have been satisfactorily resolved (Dates are no longer being altered on RFICFs, the new PEMC website does not allow SQL injection). Resolution of the remaining observations is either still in progress, requires further work, or had not been started at the time of the Audit.

## 6.4 Findings and Recommendations

There are no findings or recommendations to report for the IT review.

# A GLOSSARY

- 
- **AE:** Actual Exposure
  - **AMU:** Account Management Unit
  - **BCQ:** Bilateral Contract Quantity
  - **BSMD:** Billing Settlement and Metering Department
  - **CPC:** Corporate Planning and Communications
  - **CRSS:** Centralised Registration and Settlement System
  - **CVC:** Constraint Violation Coefficient
  - **DAP:** Day Ahead Projection
  - **DOE:** Department of Energy
  - **EC:** Electric Cooperative
  - **ECO:** Enforcement and Compliance Office
  - **EFT:** Electronic Fund Transfer
  - **ERC:** Energy Regulatory Commission
  - **FAR:** Forecasting Accuracy Rate
  - **FPA:** Finance Planning and Accounting
  - **GPI:** Generation Price Index
  - **IBP:** Internal Business Procedure
  - **IR-PS:** Institutional Relations and Participant Support
  - **LDP:** Load Predictor
  - **LRTA:** Line Rental Trading Amount
  - **MAG:** Market Assessment Group
  - **MAPE:** Maximum Absolute Percentage Error
  - **MAS:** Market Assessment System
  - **MCP:** Market Clearing Price
  - **MDOM:** Market Dispatch Optimization Engine
  - **ME:** Maximum Exposure
  - **MMS:** Market Management System
  - **MMU:** Market Monitoring Unit
  - **MNM:** Market Network Model
  - **MRR:** Market Rerun

- **MRU:** Must Run Unit
- **MSP:** Metering Services Provider
- **MTR:** Meter Trouble Report
- **NEA:** National Electrification Authority
- **NGCP:** National Grid Corporation of Philippines
- **NSS:** Net Settlement Surplus
- **PEMC:** Philippine Electricity Market Corporation
- **PEN:** Pricing Error Notice
- **PSM:** Price Substitution Mechanism
- **RCC:** Rule Change Committee
- **RFICF:** Request for Information Change Form
- **RTD:** Real time (ex-ante) Dispatch
- **RTX:** Real time (ex-post) dispatch
- **SCADA:** Supervisory Control and Data Acquisition
- **SCED:** Security Constrained Energy Dispatch
- **SDLF:** Similar Day Load Forecast
- **SSLA:** Site Specific Loss Adjustment
- **TCG:** Transmission Constraint Group
- **TOD:** Trading and Operations Department
- **VAT:** Value Added Tax
- **WBSS:** Wholesale Billing and Settlement Systems
- **WESM:** Wholesale Electricity Spot Market

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

**[paconsulting.com](http://paconsulting.com)**

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