

7 November 2012

Melinda L. Ocampo
President
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Pasig City 1600
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Dear Ms Ocampo

Certification of the Market Settlements Software

PA Consulting Group (PA) has been asked by the Philippine Electricity Market Corporation (PEMC) to act as an independent market auditor to perform certification testing of the market settlements software to verify its compliance with the WESM Rules. This certificate is similar to and builds on the previous certificate for the market settlements software, dated September 30, 2011.

Certification

This certification is specific to the Excel spreadsheet programs that implement the market settlements calculations based on clause 3.13 of the WESM Rules and on the mathematical equations specified in the relevant Market Manuals.

As a result of our examination of the WESM Rules, the Market Manuals, PEMC's internal procedure documentation and the market settlement spreadsheet programs, we are able to provide the following certification with respect to the MDOM software:

We certify that, when used correctly, the market settlements spreadsheet programs, as used by the PEMC in the 72nd Billing Period and provided to PA in July 2012, will perform substantially in compliance with the software specifications implied by the WESM Rules as amended by Department of Energy (DOE) Department Circulars up to and including DC2011-12-0012, together with the associated WESM Manuals with the exceptions noted below.

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

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Scope of the review and certification

The scope of the review has included, at a minimum:

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

The independent audit does not include ensuring that the computational performance of the software is in accordance with any requirements of the WESM Rules.

Nature of the tests conducted and results obtained

In performing the review and certification of the market settlements software, we have:

- Examined the WESM Rules and the Market Manuals to fully understand what functions the software is required to perform, what data it is required to use, what results the software is required to produce, and how it is to calculate them; and
- Conducted a series of tests on the software to determine whether the software properly performs these functions and correctly calculates the results required. In this respect, the software was tested for its accuracy in representing the requirements of WESM Rules and Market Manuals.

Provided the market settlements software is used in the manner intended and according to the correct manual procedures, and with data that conforms to the requirements specified in the PEMC documents or, if not explicitly discussed therein, is within the expected range of values for data pertaining to the characteristics of the Philippine electricity system, we have found that the market settlements spreadsheet programs perform all functions and correctly calculate the required results with the following exceptions:

Administered Prices Program

- *Incorrect formula in procedure manual:* The formula for the administered price for a generator in Procedure Manual BSM-STL-PRM-2011-003 "Settlement Calculations (Administered Price Cap)" is incorrect. The administered price is described in the text as being a load weighted average of ex-post energy prices, but the formula lacks the division by total load required to make it a load weighted average.
- *Missing loads in input data:* The accuracy of the program is dependent on the lists of generators and loads in input sheets being complete. If generators or loads are omitted from these lists, then their metered quantities and prices are not included in the calculations, without any error message or warning. In the version of the program supplied to PA for this audit, a number of generators and loads were missing from these lists. Consequently, the administered prices calculated were incorrect.

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Price Substitution Program

- *Lack of clarity regarding correct formulation:* The formula specified in the new manual (BSM-STL-PRM-2011.002) for the Allocation of Ex Ante Energy Trading Amount (EAETA) is materially different to what was specified in the previous manual (WESM-BSMD-008). We have been advised that the formula in the previous manual is the correct one, so the new manual needs to be updated.
- *Hard-coded Meter IDs:* Some meter IDs are hard-coded in the macro code, with the effect that their metered quantities are treated as zero in the calculations. This has a material effect on the trading amounts calculated by the program for all loads.

VAT Program

- *Hard-coded number of generators resulting in material error:* The number of generators is hard-coded in multiple locations in the macro code. The number used in the code is currently incorrect, resulting in certain input values not being loaded into the program for one generator and the GMR value being calculated incorrectly.
- *Incorrect name of generator in one location resulting in material error:* The list of generator resources is manually entered independently on a number of sheets. In the version tested, there was an inconsistency, affecting the value of the GMR.

Generation Price Index (GPI) Program

- *Input data error:* The program, supplied as used for the May-June billing period, uses TOU rates from columns labelled "January-Mar". This error would result in a material error in the settlement of MRU units.

Must Run Units (MRU) Program

- *Unhandled input data scenario results in material error:* The macro produces zero EAETA and EPETA results for the condition $EAQ = MRU$ when both EAQ and MRU are non-zero. PEMC's internal procedure manual (BSM-STL-PRM-2011.008) does not specify what EAETA and EPETA should be in this case, as it only specifies formulae for $EAQ > MRU$ and $EAQ < MRU$. However, all these formulae produce the same EAETA and EPETA values for $EAQ = MRU$ and these values would be the logically correct result. Therefore, the program is producing a materially incorrect result according to a reasonable interpretation of the manual. A similar situation also exists for the condition $MQ = MRU$ for the calculation of EPETA values.
- *Input data inconsistency results in material error:* The resource ID for a generator was inconsistent between two input files. As a result, the trading amounts calculated for this generator are incorrect when it is an MRU. This is a material error, as this generator has been an MRU during the reviewed billing period.
- *Lack of clarity regarding settlement of MRUs, and incorrect implementation:* The MRU Market Manual and PEMC's internal procedure manual on MRU settlement (BSM-STL-PRM-2011-008) are not specific enough regarding settlement amounts for MRUs, especially regarding treatment of bilateral contract quantities. In current form, they require interpretation to determine the correct settlement amount in each situation. According to our best interpretation, the formulae specified in the procedure manual and implemented in the software are incorrect, particularly in the case where a generator's MRU quantity is less than its bilateral contract quantity.

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Disclaimer of Liability

Despite the extensive testing of the software, this certification is not, and cannot be, in the form of an absolute guarantee. Error-free use and compliant results through time will increase the probability that the software is in strict accordance with the design principles.

Further, our certification is only valid if the software is used with care and for the purpose for which it was designed and tested.

In furnishing this certification, PA specifically limits its liability to the cost of repeating all and any certification evaluations, and any necessary re-certification in reliance on those evaluations. No person shall be entitled to claim against PA, any losses or damage whether direct, indirect, special or consequential, in excess of that limitation. PEMC shall ensure that all persons or parties who may rely on this certification are aware of this limitation of liability.

Yours sincerely

A handwritten signature in black ink, appearing to read "Gregg Edeson". The signature is fluid and cursive, with a long horizontal stroke at the end.

Gregg Edeson
Member of PA's Management Group