



Report on the Independent Software Audit of the Market Systems Enhancements

**Software Certification of Enhancements to the
Accounts Management System,
Central Registration and Settlement System,
Market Management System, and
Interim Tools**

DECEMBER 2022

This Report is prepared by the
Philippine Electricity Market Corporation –
Market Assessment Group for the
PEM Audit Committee

1. FOREWORD

The PEM Audit Committee (PAC) supervised the independent software certification audit of enhancements to the market systems and interim tools as follows:

Market systems:

- Accounts Management System (AMS),
- Central Registration and Settlement System (CRSS), and
- Market Management System (MMS).

Interim Tools:

- WESM Transaction Allocation Tool, and
- Regional Secondary Price Cap (SPC) Tool

The independent software certification audit was conducted to assess compliance of the market systems enhancements and interim tools with the Market Rules and Manuals, relevant circulars and issuances, and tools/systems specifications. Compliance of the above enhancements to the ICT Change Management Process (ITCMP) was likewise reviewed.

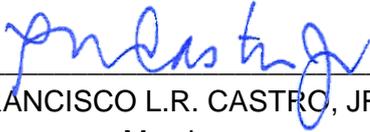
The audit was handled by the Intelligent Energy Systems Pty Ltd (IES), the independent auditor who also handled the audit of the MMS and CRSS for the enhanced WESM design and operations. Upon completion of the audit project, IES issued software certificates confirming that the market system enhancements and interim tools were implemented correctly in accordance with the Market Rules and Manuals, relevant circulars and issuances, and tools/systems specifications.

The PAC wishes to express its appreciation and gratitude to the management of the Independent Market Operator of the Philippines (IEMOP), as the Auditee, for the cooperation and support they extended to the independent auditor for the successful completion of this audit project.

For the PEM Audit Committee,



MAILA LOURDES G. DE CASTRO
Chairperson



FRANCISCO L.R. CASTRO, JR.
Member



ROSSANO C. LUGA
Member

2. ABOUT THIS REPORT

This report provides an executive summary of the results of the independent software certification audit of the market systems and interim tools.

3. EXECUTIVE SUMMARY

3.1. Background

The PEM Audit Manual Section 10 provides the requirements for the audit of the software of the Market Operator including enhancements or modifications thereto.

In reference to this, the IEMOP informed the PAC on the development and deployment of the following:

- AMS and CRSS enhancements to implement WESM bill aggregation;
- AMS and CRSS enhancements and interim tool to implement the BIR Ruling No. OT-323-2021 on taxation of WESM transactions and the DOE Circular DC2021-06-0013¹ regarding generators with expired Provisional Certificate of Approval to Connect (PCATC) for testing and commissioning that have injection to the grid, referred to as GEN-X; and
- MMS enhancements and interim tool to implement the ERC Resolution No. 7 Series of 2021² regarding the application of regional/island application of SPC.

3.1.1. Implementation of WESM bill aggregation

The CRSS was designed to calculate separate settlement amounts of trading participants by facility type, region, Value-added tax (VAT) status, and for generation companies, by feed-in tariff (FIT) eligibility. It was designed in this manner to properly account for the settlement mechanisms that require regional calculations of amounts, special settlement arrangements for FIT generators, and to further streamline the calculation processes for every 5-minute data.

The settlement amounts calculated in the CRSS are also the bases for the issuance of WESM bills implemented in the AMS. Consequently, separate WESM bills are issued for each calculated settlement amounts which results in the possibility of a trading

¹ DOE Circular DC2021-06-0013 “Adopting a General Framework Governing the Test and Commissioning of Generation Facilities for Ensuring Readiness to Deliver Energy to the Grid or Distribution Network”

² ERC Resolution No. 7 Series of 2021 “Adopting Amendments to Resolution No. 04 Series of 2017 Entitled “Amendments to the Pre-emptive Mitigation Measures in the WESM””

participant receiving multiple WESM bills. Issuance of multiple WESM bills may pose tax issues on the part of the trading participants due to the possibility that one (of the several) WESM bill may show a purchase of energy by a trading participant even if its overall WESM transaction, based on the sum of all its WESM bills, reflects only energy sales.

To address this concern, the IEMOP implemented enhancements in the CRSS (permanent solution) and AMS (interim solution) to aggregate the settlement amounts of each trading participants into a single WESM bill³.

Considering the urgency to deploy the interim solution, it was deployed in the first week of August 2021 in time for the issuance of the final settlement statements for July 2021, the first billing month under the enhanced WESM design and operations⁴.

3.1.2. Implementation of BIR ruling on taxation of WESM transactions and DOE circular on GEN-X⁵

The Bureau of Internal Revenue (BIR) issued its ruling No. OT-323-2021 dated 24 August 2021 in response to IEMOP's request and provided for directives on the proper tax treatment of the WESM transactions and of IEMOP as corporate entity⁶. The BIR Ruling resolved the long-standing questions on proper arrangements for invoicing and taxation of sales and purchase of electricity in the WESM.

To implement the BIR Ruling, IEMOP formulated guidelines and procedures in consultation with various WESM members and industry associations, and implemented the WESM allocation transaction tool and enhancements to the CRSS and AMS.

The WESM allocation transaction tool was used to calculate the WESM transaction allocation for prelim, final, adjustment and additional compensation for the following:

- (1) Stage 1 implementation of BIR Ruling on the allocation of WESM transactions based on monthly net trading amounts and provision by IEMOP to sellers with the breakdown of transactions, showing list of customers and their corresponding transactions to enable seller to issue official receipts for all sales made through the WESM to all buyers in the WESM; and
- (2) Implementation of the directive under DOE Circular No. DC2021-06-0013 Section 4.3.3. which prescribes that energy injection of generating facilities with expired

³ OP-RJN-2021-0479 IEMOP letter to PAC dated 02 August 2021

⁴ OP-RJN-2021-0500 IEMOP letter to PAC dated 12 August 2021

⁵ OP-RJN-2022-0003 IEMOP letter to PAC dated 04 January 2022; OP-RJN-22-1024 IEMOP letter to PAC dated 12 January 2022; OP-RJN-2022-0216 IEMOP letter to PAC dated 21 March 2022

⁶ BIR Ruling No. OT-323-2021 dated 24 August 2021

PCATC shall not be entitled to WESM payments for any energy injected but shall be charged for any energy withdrawn from the grid or distribution network.

The WESM allocation transaction tool and stage 1 of the enhancements (i.e., segregation of sales and purchases based on the monthly output) was implemented by IEMOP in January 2022, while the stage 2 enhancements (i.e., segregation on a per interval basis, calculation of 12% VAT and 2% Expanded Withholding Tax (EWT)) was deployed in August 2022⁷.

3.1.3. Implementation of regional/island application of secondary price cap (SPC) when HVDC/island interconnection goes on outage

The MMS was designed to apply SPC for the combined Luzon-Visayas and Mindanao regions so to comply with the directives under ERC Resolution No. 7, Series of 2021, the IEMOP implemented enhancements to the MMS for the regional/island application of SPC when HVDC/island interconnection goes on outage. The IEMOP contracted Siemens, Inc., the MMS vendor, to develop the enhancements.

However, market results since the December 2021 billing period indicated the need for the regional implementation of the SPC due to the market suspension in the Visayas region and imposition of SPC on account of the recent sustained high prices in Luzon. Further, there was no power exchange between Luzon and Visayas through the HVDC link for the period 16-23 December 2021. These cited conditions called for the implementation of regional SPC as required under the ERC resolution.

Pending completion of the MMS enhancements and completion of the testing and audit requirements, IEMOP was constrained to deploy in January 2022 the internally-developed interim tool for the application of regional SPC for the December 2021 and January 2022 billing months. Meanwhile, the MMS enhancements was completed and deployed in March 2022⁸.

Upon approval of the PEM Board to engage an independent auditor to conduct the audit, the PEMC engaged IES to handle the audit under the supervision of the PAC.

The kickoff meeting for the audit project was held on 02 June 2022 while the closing meeting was held on 09 November 2022

⁷ OP-RJN-2022-0160 IEMOP letter to PAC dated 28 February 2022

⁸ OP-RJN-2022-0187 IEMOP letter to PAC dated 08 March 2022

3.2. Objectives and Scope

The audit objectives are as follows:

- To examine the enhancements to the MMS, CRSS, AMS and interim tools to assess compliance with the Market Rules and Manuals, and directives of the ERC, DOE, or the BIR through its orders and issuances;
- To issue software certification on the enhancements to the MMS, CRSS, AMS and interim tools;
- To review whether the development of software enhancements followed the ICT Change Management Process and secure appropriate approval; and
- To make recommendations for identified issues.

For the scope, the Independent Auditor shall carry out the following:

For Software certification:

- Test to determine whether the market systems enhancements are consistent with the Market Rules and Manuals, relevant DOE, ERC or BIR orders and issuances, and systems/tools specifications;
- Identify inconsistencies and non-compliances of the market systems enhancements with the Market Rules and Manuals, relevant DOE, ERC or BIR orders and issuances, and system/tools specifications, and explanation as to how such conclusions were derived;
- Provide specific recommendations as to how the identified inconsistencies and non-compliances could be corrected; and
- Re-test and examine remediations to address preliminary findings.

For Change Management review:

- Review whether the development to deployment of the market systems enhancements followed the ICT Change Management process and secured appropriate approvals; and
- Identify relevant controls (or lack thereof) and verify the effectiveness of identified controls to prevent, detect and/or correct errors that the enhancements may bring about.

The Independent Auditor shall report and/or present the results of the audit and recommendations to the PAC and the PEM Board. Findings in the Change Management Review shall not affect the software certification.

The table below shows the in-scope areas of software certification

Functionality	Enhanced market systems or new developed tools				
	AMS	CRSS	Interim WESM Transaction Allocation Tool	MMS	Interim Tool on SPC
1 - Implementation of WESM bill aggregation	Yes	Yes			
2 - Implementation of BIR ruling on taxation of WESM transactions and DOE Circular DC2021-06-0013 (GEN-X) –	Yes	Yes	Yes		
3 - Implementation of regional/island application of secondary price cap (SPC) when HVDC/island interconnection goes on outage				Yes	Yes

3.3. Methodology

The following is an outline of the general methodology followed. Testing activities were carried out remotely and generally consistent with previous audits of the market systems for the enhanced WESM design and operations. The general methodology for software certification is presented first followed by that for ICT Change Management review.

For Software certification

1. Carry out walkthrough of changes with the relevant process owners and discuss testing requirements.
2. Develop test cases to test the full range of the cases that could occur under the rules.
3. For each test case, the Independent Auditor to independently apply the rules, calculate and determine the result. This result is then compared to the result obtained based on the

same inputs processed through IEMOP's enhanced market system or interim tool, as applicable.

4. Determine whether the changes to the MMS, CRSS and AMS components are consistent with those described in the Market Rules and Manuals, BIR, DOE or ERC issuances or orders, and software specifications.
5. In cases where the two results do not match, identify the difference between the two, and notify and discuss with PEMC and IEMOP.
6. Where the difference is determined to reflect the need for remediation, the Independent Auditor will provide specific recommendations as to how the identified inconsistencies and non-compliance to the rules could be corrected.
7. The IEMOP to remediate inconsistencies and non-compliances of the enhanced market system or interim tool and resubmit for retesting within five (5) working days of being notified.
8. The Independent Auditor to re-test the resubmitted and repeat the process from step 4.

ICT Change Management Review

The Independent Auditor reviewed the documents listed below for compliance with the PEM Audit Market Manual, IEMOP Manual of Approval (MOA) and ICT Change Management Procedure (ITCMP). The review will determine if the process was followed, approvals obtained and the extent to which controls existed to prevent, detect and/or correct errors that the enhanced market system or interim tool may bring about.

The key documents reviewed are:

- Relevant request for change (RFC)/ Change Order Forms (COF) for conformance to the ICT procedure,
- Evidence of technical assessment carried out in accordance with the ICT procedure,
- Highlights/Minutes of IT Change Advisory Committee (ITCAC) meetings and relevant presentations
- Evidence of approvals obtained (letters/memos).

Instances of potential non-conformances identified were discussed with PEMC and IEMOP, feedback considered, and outcome documented.

3.4. Findings, Conclusion and Recommendations

3.4.1. Implementation of WESM bill aggregation

The WESM Bill aggregation enhancement aggregates a participant's invoice across all transactions to show and settle the overall transaction of each registered organization and automate the aggregation process. Based on the data provided, testing of the implementation of WESM bill aggregation in the CRSS and the AMS systems confirms that the functionality correctly aggregates using the mapping inputs and is consistent with the reference.

The table below summarizes the test case findings relating to WESM bill aggregation.

System	Test Case	Result	Expected Outcome/Comments
CRSS	Participant with multiple billing ID	Pass	The settlement values for each of the billing IDs are aggregated to a single invoice ID
	Participant with single billing ID	Pass	The settlement value for the invoice is the same as the settlement values for the billing ID
AMS	Participant with multiple billing ID	Pass	The settlement values for each of the billing IDs are aggregated to a single invoice ID
	Participant with single billing ID	Pass	The settlement value for the invoice is the same as the settlement values for the billing ID
AMS	Check that the output Final Statement is consistent with the AMS/CRSS tables.	Pass	The settlement values in the Final Statement should be the same as the aggregated settlement values out of the AMS table.
CRSS/AMS	Mapping file can be updated, and aggregation reflects the latest mapping data.	Pass	If the user uploads a new mapping file, the existing mapping file will be deleted/updated with the new mapping table.

System	Test Case	Result	Expected Outcome/Comments
	Invalid mapping being uploaded	Pass	Error message displayed

The findings apply to the following version numbers and deployment dates.

Market System	Version No.	Deployment Date
WESM Bill Aggregation	CRSS	2.9.3. Release Patch 11022021
	AMS	AMS Version 1.2.20210814

3.4.2. Implementation of BIR Ruling on Taxation of WESM Transactions and DOE Circular DC2021-06-0013 (GEN-X)

Interim WESM Transaction Allocation Tool (WTAT)

The WESM Transaction Allocation Tool⁹ and GEN-X calculations were introduced to implement BIR ruling No. OT-323-2021 and DOE Circular DC2021-06-0013 in regard to tax and injection/withdrawal of generators with expired testing and commissioning certificate treatment of WESM transactions, respectively. Based on the data provided, testing shows that the WTAT and GEN-X calculations correctly perform the functions as described in the business requirements documents and are consistent with the reference documents.

The table below summarizes the test case results for the GEN-X calculations and WESM Transaction Allocation Tool.

System	Test Case	Result	Expected Outcome	Comments
Gen-X Excel Calculator	Generator with expired PCATC (Gen-X)	Pass	Gen-X are not entitled to payment for energy injections into the grid (positive amounts are set to zero) but are charged for energy withdrawal. The remaining participants receive a discount as a proportion of energy purchases.	This calculation is performed outside the WTAT.

⁹ Only Stage 2 Version 3 was tested and included in certification.

System	Test Case	Result	Expected Outcome	Comments
WESM Transaction Allocation Tool	Sales and Purchases Transaction Allocations	Pass	Sales/purchases calculated correctly using the formula	
	Vatable, Zero- rated, Ecozone Purchases and Sales	Pass	The allocated sales/purchases are labelled correctly (Vatable, zero-rated, ecozone) based on billing tags.	
	VAT	Pass	VAT is 12% and only calculated for Vatable sales/purchases. VAT on Zero-rated and zero-rated ecozone is 0%.	
	EWT	Pass	2% if seller is non-ITH or the buyer is WHT agent, else 0.	

The findings apply to the following version numbers and deployment dates.

Market System		Version No.	Deployment Date
BIR Ruling	AMS	AMS Version 4.0.20220731	31 July 2022

Central Registration and Settlement System (CRSS)

The CRSS GEN-X and Transaction Allocations with the calculation of VAT and EWT on a buyer and seller pair have been verified to be in accordance with the reference documents based on the data provided. This is consistent with BIR ruling No. OT-323-2021, BRD-2201-001-2201-001 (CRSS Enhancement: BIR Ruling) and DOE DC2021-06-0013 (GEN-X).

The table below summarizes the test case findings for the CRSS enhancements relating to Gen-X and BIR ruling. All the test cases have passed.

System	Test Case	Result	Expected Outcome
Customer Registration and Settlement System (CRSS)	Generator with expired PCATC (Gen-X)	Pass	Gen-X are not entitled to payment for energy injections into the grid (positive amounts are set to zero) but are charged for energy withdrawal. The remaining participants receive a discount as a proportion of energy purchases.
	Sales and Purchases Transaction Allocations	Pass	Sales/purchases calculated correctly using the formula
	Vatable, Zero-rated, Ecozone Purchases and Sales	Pass	The allocated sales/purchases are labelled correctly (Vatable, zero-rated, ecozone) based on billing tags.
	VAT	Pass	VAT is 12% and only calculated for Vatable sales/purchases. VAT on Zero-rated and zero-rated ecozone is 0%.
	EWT	Pass	2% if seller is non-ITH or the buyer is WHT agent, else 0.

The findings apply to the following version numbers and deployment dates.

Market System		Version No.	Deployment Date
BIR Ruling	CRSS Gen-X	2.9.3.GENX-RELEASE Patch	24 August 2022

Market System		Version No.	Deployment Date
		Prod- 2.9.3.RELEASE Patch 09302022	30 September 2022

Accounts Management System (AMS)

The AMS enhancements adjust the net ratio to exclude withholding tax, in accordance with BIR ruling NO. OT-323-2021, for the purposes of allocating collected cash. The allocated EWT amount is calculated using a new net ratio formula specifically for allocating withholding tax based on amounts included in the withholding tax certificates. The testing results show that the allocated cash amounts and allocated withholding tax amounts correctly reflect these changes which are consistent with BIR ruling NO. OT-323-2021 and the business requirements documents.

The test cases were performed for the final run in the April billing period. The AMS test cases findings are shown in the table below.

System	Test Case	Result	Expected Outcome/Comments
AMS	Allocated Cash for energy	Pass	The allocation is based off a net ratio which accounts for withholding tax but does not include VAT.
	Allocated Cash for VAT	Pass	The allocation is based off a net ratio for VAT only.
	Expanded Withholding Tax Allocation	Pass	The allocation is based off withholding tax net ratio formula. Data showing the calculation of the allocated EWT amounts were provided separately from energy and VAT, and verified by IES.

Market System		Version No.	Deployment Date
BIR Ruling	AMS	AMS Version 4.0.20220731	31 July 2022

3.4.3. Implementation of regional/island application of secondary price cap (SPC)

The MMS enhancement adopted a shorter rolling average period, down from five to three days, and implemented the SPC depending on the status of the HVDC Interconnection in interval 't' and the Cumulative Price Threshold (CPT) Breach Flag in interval 't-1'. The testing was conducted on the data received on the 36 test cases that were developed and provided to IEMOP. The outputs were in accordance with the Business Requirements Document No. BRD-2108-009.2209-005 (Regional Implementation of SPC).

Additionally, a saved case data was received for a test case for the Interim Tool that was used for the evaluating the Dispatch Interval Pricing Calculation (DIPC) value through manual intervention in the months prior to the full deployment of the enhanced MMS. The value provided by the Interim Tool corresponded to the value obtained by using the formula provided in the Price Determination Methodology (PDM) WESM Manual Issue 3.0.

The test cases allowed checking of the limited functionality of the SPC interim tool and the findings are summarised in the table below.

Test Case	Result	Expected Outcome	Comments
Customisation of CPT value and SPC value for each region	Pass	CPT and SPC value to be set to the specified value for each pricing region.	IEMOP was able to set the specified values, which were used in the subsequent testing
Breach Flag = 'Y' for each of LUZ and VIS, but 'N' for LUZ-VIS.	Pass	The DIPC value calculated by the Interim Tool should match the value IES calculated as per the PDM document	DIPC values for both, Luzon and Visayas matched the expected value

The findings apply to the following version numbers and deployment dates.

Market System		Version No.	Deployment Date
SPC	Interim tool	Version 1	31 January 2022

3.4.4. IT Change Management Review

The documents reviewed provide evidence that the PAC and PEM Board have been notified as required and the PAC provided with the required information. The final internal approvals within IEMOP and notification and approvals from PEMC were obtained in accordance with

the requirements of the reference documents. There is a process for implementing changes but some aspects – relating to processing ‘Emergency’ RFCs and appointing Third Person Reviewer, are not accurately documented in the ITCMP. IEMOP has advised it will review the existing process for Emergency RFCs with a view to reflect actual practice. It has also advised it will consider harmonizing the next version CMP Procedure with Memorandum Order 2019-004 with regards to appointing Third Person reviewers.

In one case the RFC did not kick off the change process and was raised after the matter was discussed at the ITCAC. Some RFC/COF forms did not indicate Change Category which is contrary to requirements. The process of document control can be improved to prevent the RFC form being modified in an uncontrolled manner. IEMOP has advised it will take corrective action to address these findings.

The evidence suggests a need to review the ITCMP to better reflect implemented processes. Consideration should be given to whether training is needed in some areas to improve consistent implementation and adherence to the ITCMP. IEMOP has advised that it agrees with the need to regularly refresh employees’ knowledge regarding correct implementation of filing Requests for ICT Change.

3.5. Software Certificates

Appendix A – Software Certificate for enhancements to implement WESM bill aggregation

Appendix B – Software Certificates for enhancements to implement BIR Ruling

Appendix C – Software Certificate for enhancements to implement regional secondary price cap

Appendix A – Software Certificate for enhancements to implement WESM bill aggregation

14 November 2022

Atty. Maila Lourdes G. de Castro
Chairperson, PEM Audit Committee
Philippine Electricity Market Corporation
18/F Robinsons Equitable Tower
ADB Avenue, Ortigas Center
1600 Pasig City, Philippines

Dear Atty. de Castro,

SCOPE OF THIS CERTIFICATE

The purpose of this software certificate is to confirm that the WESM Bill Aggregation function in the Central Registration and Settlement System (CRSS) and Accounts Management System (AMS) correctly aggregates the settlement values based on the input provided in the participant mapping tables. This certifies that the calculations performed in this function was in accordance with *Bills Aggregation Enhancements BRD*¹, *CRSS WESM Bill Aggregation*² and *AMS Enhancement for WESM Bill Aggregation*³ documents.

This certificate is applicable to the WESM Bill Aggregation function implemented in CRSS Version 2.9.3⁴ and AMS Version 1.2.20210814⁵.

CERTIFICATION TESTING METHODOLOGY

IEMOP provided IES with the CRSS and AMS billing tables including the invoice amounts before and after aggregation along with the corresponding participant mapping files. Using the mapping file, IES independently applied the aggregation logic, calculated the aggregated values, and compared them to aggregated outputs provided by IEMOP as the output and verified that the aggregation is consistent with the mapping table. The testing found that the amounts expressed in Philippine (PHP) matched at a minimum tolerance of two decimal places. This was performed for both the CRSS and AMS aggregations.

The test results are summarised in the following table.

System	Test Case	Result	Expected Outcome/Comments
CRSS	Participant with multiple billing ID	Pass	The settlement values for each of the billing IDs are aggregated to a single invoice ID
	Participant with single billing ID	Pass	The settlement value for the invoice is the same as the settlement values for the billing ID

¹ BRD-2109-011.2108.003, 16 August 2021

² SDSD-2109-011-2108-005

³ SDSBSA-2108-008.2108-004

⁴ Release Patch 11022021, deployment date of 2 November 2021

⁵ Deployment date of 14 August 2021



System	Test Case	Result	Expected Outcome/Comments
AMS	Participant with multiple billing ID	Pass	The settlement values for each of the billing IDs are aggregated to a single invoice ID
	Participant with single billing ID	Pass	The settlement value for the invoice is the same as the settlement values for the billing ID
AMS	Check that the output Final Statement is consistent with the AMS/CRSS tables.	Pass	The settlement values in the Final Statement should be the same as the aggregated settlement values out of the AMS table.
CRSS/AMS	Mapping file can be updated, and aggregation reflects the latest mapping data.	Pass	The aggregation result is consistent with the mapping file information.
	Invalid mapping being uploaded	Pass	Error message displayed

CERTIFICATION OF CRSS AND AMS SOFTWARE MODULES WITH RESPECT TO REFERENCE DOCUMENTATION

The WESM Bill aggregation enhancement aggregates a participant's invoice across all transactions to show and settle the overall transaction of each registered organization and automate the aggregation process. The aggregation aims to prevent taxation issues for participants who may receive more than one invoice in the absence of aggregation. Based on the data provided, testing of the implementation of WESM bill aggregation in the CRSS and the AMS systems confirms that the functionality correctly aggregates using the mapping inputs and is consistent with the reference documents.

LIMITATION OF LIABILITY

In furnishing this certification, Intelligent Energy Systems specifically limits its liability in accordance with Clause 5.08 (b) of the Contract for External Audit Services (Independent Software audit of the New Market Management System) dated 17 February 2017. No person shall be entitled to claim against Intelligent Energy Systems, any losses or damage whether indirect, special or consequential, in excess of that limitation and PEMC shall ensure that all persons or parties who may rely on this certification are aware of this limitation of liability.

Yours sincerely



Charles Hugh Bannister
Chairman and CEO

Appendix B – Software Certificates for enhancements to implement BIR Ruling

14 November 2022

Atty. Maila Lourdes G. de Castro
Chairperson, PEM Audit Committee
Philippine Electricity Market Corporation
18/F Robinsons Equitable Tower
ADB Avenue, Ortigas Center
1600 Pasig City, Philippines

Dear Atty. de Castro,

SCOPE OF THIS CERTIFICATE

The purpose of this software certificate is to confirm that the Accounts Management System (AMS), specifically the function of allocation of cash collected and withholding tax certificates, is in accordance with *BIR Ruling No. OT-323-2021*. The enhancement produces results that are consistent with the changed net ratio formula documented in System Design Document *AMS Enhancements to Implement BIR Ruling*.¹ The certification does not extend to the manual tasks and processes associated with the audited processes or to the timeliness with which the processes are carried out.

The certificate is limited to the software version that was tested, AMS Version 4.0.20220731 with deployment date 31 July 2022.

CERTIFICATION TESTING METHODOLOGY

IEMOP provided IES with test data containing the cash collected and allocated cash and the corresponding WESM transaction details. IES independently calculated the expected outputs and compared the result with the AMS calculation output values provided by IEMOP and confirmed that the values matched the independent calculations. The testing approach IES used to calculate the allocated cash amounts or withholding tax certificate amounts. Calculated the transaction detail for each buyer and seller pair for the allocation type and sum all the seller's amounts corresponding to a buyer. Allocated the appropriate amount to each seller and aggregated each of the cash collected and withholding tax for each seller to arrive at the final payment. The testing found that the output provided by IEMOP matched the independently determined amount by IES to a minimum tolerance of one decimal place for amounts expressed in Philippine (PHP).

The test results are summarised in the following table.

¹ SDSAF-2112-005.2203-002, 19 May 2022

System	Test Case	Result	Expected Outcome/Comments
AMS	Allocated Cash for energy	Pass	The allocation is based on a net ratio which accounts for withholding tax but does not include VAT.
	Allocated Cash for VAT	Pass	The allocation is based on a net ratio for VAT only.
	Expanded Withholding Tax Allocation	Pass	The allocation is based on withholding tax net ratio formula. Data showing the calculation of the allocated EWT amounts were provided separately from energy and VAT and verified by IES.

CERTIFICATION OF AMS SOFTWARE MODULE WITH RESPECT TO REFERENCE DOCUMENTATION

The AMS enhancements adjust the net ratio to exclude withholding tax, in accordance with *BIR ruling NO. OT-323-2021*, for the purposes of allocating collected cash. The allocated EWT amount is calculated using a new net ratio formula specifically for allocating withholding tax based on amounts included in the withholding tax certificates. The testing results show that the allocated cash amounts and allocated withholding tax amounts output of AMS are consistent with *BIR ruling NO. OT-323-2021* and the System Design document.

LIMITATION OF LIABILITY

In furnishing this certification, Intelligent Energy Systems specifically limits its liability in accordance with Clause 5.08 (b) of the Contract for External Audit Services (Independent Software audit of the New Market Management System) dated 17 February 2017. No person shall be entitled to claim against Intelligent Energy Systems, any losses or damage whether indirect, special or consequential, in excess of that limitation and PEMC shall ensure that all persons or parties who may rely on this certification are aware of this limitation of liability.

Yours sincerely



Charles Hugh Bannister
Chairman and CEO

14 November 2022

Atty. Maila Lourdes G. de Castro
Chairperson, PEM Audit Committee
Philippine Electricity Market Corporation
18/F Robinsons Equitable Tower
ADB Avenue, Ortigas Center
1600 Pasig City, Philippines

Dear Atty. de Castro,

SCOPE OF THIS CERTIFICATE

The purpose of this software certificate is to confirm that the calculations relating to Gen-X and WESM Transaction Allocation Tool (WTAT) with introduction of Expanded Withholding Tax (EWT) calculations implemented in the Central Registration and Settlement System (CRSS), version 2.9.3,¹ are in accordance with *BIR Ruling No. OT-323-2021* and *DOE DC2021-06-0013*. The calculations are also verified to be in accordance with the related Business Requirements Documents *CRSS Enhancement: BIR Ruling BRD*² and *CRSS Enhancement: DOE DC2021-06-0013 (Gen-X)*.³

This software certificate also verifies that the WESM Transaction Allocation Tool and associated Gen-X excel spreadsheet correctly calculates the Gen-X adjustments, Transaction Allocation and Expanded Withholding Tax in accordance with *BIR Ruling No. OT-323-2021* and *DOE DC2021-06-0013*.

The certification does not extend to the manual tasks and processes associated with the audited processes or to the timeliness with which the processes are carried out. This includes the manual transfer of data between the CRSS interface and the interim tool, as well as the manual adjustment of the Gen-X status to ensure that the negative trading amount would not be payable by customers with loads for scenarios where a Gen-X participant has a negative trading amount across the billing period.

CERTIFICATION TESTING METHODOLOGY

Gen-X generators are defined as generators with expired Provisional Certificate of Approval to Connect (PCATC) for testing and commissioning that have injection to the grid. As a result of the ruling in DOE Circular *DOE DC2021-06-0013*, Gen-X participants are no longer paid for their energy injection but still charged for energy withdrawal and enhancements were required to the CRSS system. In addition, the BIR ruling introduced the requirement for withholding taxes which are specified for each buyer and seller pair.

¹ GENX Release Patch, deployment date 30 September 2022

² BRD-2201-001-2201-001, 01 January 2022

³ BRD-2204-009-2205-002, 22 April 2022



This requirement resulted in additional modifications to the CRSS to calculate the settlement values for taxation purposes.

The same testing methodology was followed for CRSS, WTAT and the Gen-X spreadsheet where in both test cases, IEMOP provided IES with the input and output data. IES then applied the values from the CRSS outputs, and the attribute tagging and independently determined the expected outputs. In each step, IES compared the calculated results with the provided output file to verify that they match. To summarise the testing methodology followed, IES used the CRSS monthly outputs and Gen-X tags provided by IEMOP and calculated the reduction to amounts payable by customers with load. The buyer-seller matching was then performed based on the adjusted amounts and energy purchases reallocated. The Value Added Tax (VAT) and Withholding Tax (WHT) calculations were then calculated based on the categorisation of sales or purchases as vatable, zero-rated or ecozone zero-rated, depending on the corresponding participant tag. IES compared the output provided by IEMOP with the independently determined calculations and found that the amounts matched at a minimum tolerance of two decimal places for amounts expressed in Philippine (PHP).

The table below shows the test case results for the CRSS and WTAT.

System	Test Case	Result	Expected Outcome
Customer Registration and Settlement System (CRSS)	Generator with expired PCATC (Gen-X)	Pass	Gen-X are not entitled to payment for energy injections into the grid (positive amounts are set to zero) but are charged for energy withdrawal. The remaining participants receive a discount as a proportion of energy purchases.
	Sales and Purchases Transaction Allocations	Pass	Sales/purchases calculated correctly using the formula.
	Vatable, Zero-rated, Ecozone Purchases and Sales	Pass	The allocated sales/purchases are labelled correctly (Vatable, zero-rated, ecozone) based on billing tags.
	VAT	Pass	VAT is 12% and only calculated for Vatable sales/purchases. VAT on Zero-rated and zero-rated ecozone is 0%.
	EWT	Pass	2% if seller is non-ITH or the buyer is WHT agent, else 0.
Gen-X Excel Calculator	Generator with expired PCATC (Gen-X)	Pass	Gen-X are not entitled to payment for energy injections into the grid (positive amounts are set to zero) but are charged for energy withdrawal. The remaining participants receive a discount as a proportion of energy purchases.
WESM Transaction Allocation Tool	Sales and Purchases Transaction Allocations	Pass	Sales/purchases calculated correctly using the formula.
	Vatable, Zero-rated, Ecozone Purchases and Sales	Pass	The allocated sales/purchases are labelled correctly (Vatable, zero-rated, zero-rated ecozone) based on billing tags.

System	Test Case	Result	Expected Outcome
	VAT	Pass	VAT is 12% and only calculated for Vatable sales/purchases. VAT on Zero-rated and zero-rated ecozone is 0%.
	EWT	Pass	2% if seller is non-ITH or the buyer is WHT agent, else 0.

CERTIFICATION OF CRSS SOFTWARE MODULE WITH RESPECT TO REFERENCE DOCUMENTATION

The CRSS Gen-X and WESM Transaction Allocations with the calculation of VAT and EWT on a buyer and seller pair have been verified to be in accordance with the reference documents based on the data provided. The test results show that the implementation in the CRSS module produces results that are consistent with rulings *BIR ruling No. OT-323-2021* and *DOE Circular DC2021-06-0013* and *Business Requirement Documents CRSS Enhancement: BIR Ruling* and *DOE DC2021-06-0013 (Gen-X)*.

CERTIFICATION OF WESM INTERIM TOOLS WITH RESPECT TO REFERENCE DOCUMENTATION

The WESM Transaction Allocation Tool and Gen-X calculations were introduced to implement *BIR Ruling No. OT-323-2021* and *DOE Circular DC2021-06-0013* regarding tax and injection/withdrawal of generators with expired testing and commissioning certificate treatment of WESM transactions, respectively. The test results show that the WTAT and Gen-X calculations correctly perform the functions as described in the business requirements documents and are consistent with the reference documents.

LIMITATION OF LIABILITY

In furnishing this certification, Intelligent Energy Systems specifically limits its liability in accordance with Clause 5.08 (b) of the Contract for External Audit Services (Independent Software audit of the New Market Management System) dated 17 February 2017. No person shall be entitled to claim against Intelligent Energy Systems, any losses or damage whether indirect, special, or consequential, in excess of that limitation and PEMC shall ensure that all persons or parties who may rely on this certification are aware of this limitation of liability.

Yours sincerely



Charles Hugh Bannister
Chairman and CEO

Appendix C – Software Certificate for enhancements to implement regional secondary price cap

24 November 2022

Atty. Maila Lourdes G. de Castro
Chairperson, PEM Audit Committee
Philippine Electricity Market Corporation
18/F Robinsons Equitable Tower
ADB Avenue, Ortigas Center
1600 Pasig City, Philippines

Dear Atty. de Castro,

SCOPE OF THIS CERTIFICATE

The purpose of this certificate is to confirm that, subject to the qualifications and limitations stated in this certificate, the calculations resulting from enhancements, deployed on 28 February 2022, to the Market Management System (MMS) used by the Independent Electricity Market Operator of the Philippines (IEMOP) satisfy the requirements based on the following references:

- 1- Energy Regulatory Commission (ERC) Resolution No. 7 Series of 2021¹ with modified implementation as agreed during the meeting of 6 August 2021 between the ERC and IEMOP,
- 2- Modified implementation in item 1 is documented in IEMOP's Business Requirement Document BRD-2108-009.2209-005: Regional Implementation of the Secondary Price Cap (27 September 2022) Version 2, and
- 3- Calculations being consistent with the Price Determination Methodology document.²

The certificate also confirms that, subject to the qualifications and limitations stated in this certificate, the calculations implemented via the Secondary Price Cap (SPC) Interim Tool, Version 1 deployed on 31 January 2022, are in accordance with the same Price Determination Methodology WESM Manual applicable to the MMS, conditional upon correct and valid manual inputs are provided to the tool. The Interim Tool was developed internally by IEMOP, as a tool with limited functionality, and used for some billing months to implement the regional application of the SPC limited to the regions that were known to need the application of regional SPC before the deployment of the enhancements on the MMS-DIPC module on March 2022.

A primary condition is that all inputs provided to the certified functionality are valid and correct by systems and processes that are outside the scope of the audit.

¹ ERC Resolution No. 7 Series of 2021: A Resolution Adopting Amendments to Resolution No. 4 Series of 2017 Entitled "Amendments to the Pre-emptive Mitigating Measure in the Wholesale Electricity Spot Market (WESM)"

² WESM Manual – Price Determination Methodology Issue 3.0

TESTING METHODOLOGY USED FOR MMS ENHANCEMENT CERTIFICATION

IES developed an independent method and a set of test cases to test all possible scenarios that could occur for the three pricing regions of Luzon (CLUZ), Visayas (CVIS) and the combined Luzon and Visayas (CLUZ_CVIS). The application of the regional SPC is determined by five parameters. Tests were carried out across 36 test cases. Of these, 32 test cases covered all possible combinations of the five parameters, each of which can take one of two values. The other four (4) test cases were designed to test other parameters including the limiting value of breach, length of the averaging period for RAGWAP and correct application related to the MW flow condition of the HVDC link. The testing found that the amounts matched at a minimum tolerance of two decimal places for amounts expressed in Philippine Peso (PHP).

CERTIFICATION OF MMS ENHANCEMENT

The audit results show that the MMS Enhancement produces results consistent with the requirements of the three reference documents. The following table summarises the results of the testing carried out:

Test Case	Result	Expected Outcome	Comments
Test different magnitudes of CPT and SPC for each pricing region tested	Pass	CPT and SPC values to be applied correctly consistent with conditions specified and the value for each pricing region specified for the test case.	IEMOP was able to set the specified values, which were used in the subsequent cases.
Test Cases SPC_01 through to SPC_32	Pass	The application of the SPC depends on the combination of five configurable parameters in each test case. The parameters are specified earlier in the certificate.	IEMOP ran the test cases with the specified parameter settings and provided the outputs in CSV files which were all individually checked.
Testing the equality case where RAGWAP = CPT	Pass	As per the updated BRD, the SPC is applied when RAGWAP > CPT. Thus, when the calculated RAGWAP = CPT, the Breach Flag should not trigger	IEMOP ran a test case with the RAGWAP value equal to the CPT in an offline saved case scenario, and the SEC flag was not triggered.
Customization of the period (number of intervals) over which RAGWAP is calculated.	Pass	RAGWAP value calculated by IEMOP's simulation to change and be calculated correctly consistent with the number of intervals specified in the test for the RAGWAP calculation. Periods of 3 and 7 days were tested.	IEMOP provided an output file with the RAGWAP calculation intervals changed from 3 days to 7 days. The value calculated by IEMOP's simulation was checked by IES.

"The testing results for all test cases have passed and we believe that the MMS Enhancement deployed on 28 February 2022 meets the functional requirements consistent with the reference document."

TESTING METHODOLOGY USED FOR THE SPC INTERIM TOOL

The SPC Interim Tool was developed internally by IEMOP, as a tool with limited functionality to be used in restricted circumstances. The running of the Interim Tool is

not automated. The tool was run for the region and periods where IEMOP determined that the application of regional SPC is required. The functionality of the SPC Interim Tool is to set the SPC value for the generators (provided as input to the tool) and calculate the Dispatch Interval Pricing Calculation (DIPC) value for the loads in the affected region.

Given the limited functionality and application of the SPC tool, the test cases tested that the regional SPC value is set for the generation assets of the affected pricing region and the uniform price applicable to all loads of that region is determined consistent with the set price and load (MW) in the region. The testing found that the amounts matched at a minimum tolerance of two decimal places for amounts expressed in Philippine Peso (PHP).

CERTIFICATION OF THE INTERIM TOOL

The audit results show that the Interim Tool fulfils its intended functions described in this certificate in accordance with the Price Determination Methodology WESM Manual. The following table summarises the results of the testing that we have carried out:

Test Case	Result	Expected Outcome	Comments
Customization of CPT value and SPC value for each region	Pass	CPT and SPC value to be set to the specified value for each pricing region.	IEMOP was able to set the specified values, which were used in the subsequent testing
Breach Flag = 'Y' for each of LUZ and VIS, but 'N' for LUZ-VIS.	Pass	The DIPC value calculated by the Interim Tool should match the value IES calculated as per the PDM document	DIPC values for both, Luzon and Visayas matched the expected value

"The testing results for all test cases have passed and we believe that the Interim Tool, Version 1 deployed on 31 January 2022, meets the functional requirements consistent with the Price Determination Methodology WESM Manual."

LIMITATION OF LIABILITY

In furnishing this certification, Intelligent Energy Systems specifically limits its liability in accordance with Clause 5.08 (b) of the Contract for External Audit Services (Independent Software audit of the New Market Management System) dated 17 February 2017, and that no person shall be entitled to claim against Intelligent Energy Systems, any losses or damage whether indirect, special or consequential, in excess of that limitation, and PEMC shall ensure that all persons or parties who may rely on this certification are aware of this limitation of liability.

Yours sincerely



Hugh Bannister
Chairman and CEO