



Report on the Independent Software Audit of the Philippine Renewable Energy Market System (PREMS)

Software Certification and Vulnerability Assessment and Penetration Test (VAPT)

DECEMBER 2021

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 and Vulnerability Assessment and Penetration Test (VAPT) of the Philippine Renewable Energy Market System (PREMS). This audit is in compliance with the requirement under Clause 6.2.2 of the Renewable Energy (RE) Market Rules or REM Rules which provides that the REM software shall be certified to have correctly implemented the intent of the REM Rules.

The software certification audit of the PREMS was conducted to review and assess the compliance of the system with relevant laws, issuances, and Market Rules and Manuals, and provide recommendations for improvement of the system. Meanwhile, the VAPT was conducted to ensure security of the system against vulnerabilities and threats to avoid accidental and unlawful data loss, alteration of data and intentional/unintentional disclosure of confidential information.

The software certification audit and VAPT was handled by the Reyes Tacandong & Co. in partnership with Pointwest Technologies Corporation. Upon completion of the audit project, Reyes Tacandong & Co issued the software certificates confirming that the PREMS was implemented correctly in accordance with the REM Rules.

The PAC wishes to acknowledge the effort and contribution of the former members of the Committee namely, Prof. Felixberto U. Bustos, Jr., Mr. Eduardo Alejandro O. Santos and Mr. Christian M. Orias, who supervised this audit project, from the preparatory audit activities, conduct of audit proper, and ensuring the audit project completion. Their expertise and many years of dedication, loyalty, and service to Philippine Electricity Market Corporation (PEMC) and the WESM as part of the Committee are unparalleled and will always be an important part of the continued success and development of PEMC and the WESM.

The PAC likewise wishes to express its appreciation and gratitude to the management of the PEMC, as the Auditee, for the cooperation and support they extended to the external auditor for the successful completion of this audit project.

For the PEM Audit Committee,

(signed)

MAILA LOURDES G. DE CASTRO
Chairperson

(signed)

FRANCISCO L.R. CASTRO, JR.
Member

(signed)

ROSSANO C. LUGA
Member

2. ABOUT THIS REPORT

This report provides an executive summary of the results of the PREMS independent software certification audit and VAPT.

3. EXECUTIVE SUMMARY

3.1. Background

The REM Rules requires the certification of the REM software to have correctly implemented the intent of the REM Rules by an independent reviewer¹. Further, the REM Rules provides that qualified independent reviewers or technical experts may be engaged for the conduct of the audit².

The Philippine Renewable Energy Market System or shortly known as PREMS, is an enterprise-grade system that will run the functions of the RE Registrar, and participating RE organizations. The PREMS was developed by Exist Software Labs through the Development for Renewal Energy Applications Mainstreaming and Market Sustainability (DREAMS) Project through a joint effort with the United Nations Development Programme UNDP, and Global Environment Facility (GEF) and Department of Energy (DOE). PEMC, as the RE Registrar and in collaboration with DOE and UNDP, participated in the development and acceptance of the PREMS.

The PREMS will be the main system for the implementation of the REM and it will handle registration and contract management, RE Certificate (REC) transactions and allocation, Renewable Portfolio Standards (RPS) compliance, and reports management.

The PEM Board approved the conduct of the PREMS independent software certification audit and VAPT as part of the market readiness criteria for the REM in accordance with the REM Rules.

Thereafter, PEMC engaged Reyes Tacandong & Co. in partnership with Pointwest Technologies Corporation to conduct the PREMS independent software certification audit and VAPT under the supervision of the PAC.

The objectives of the audit project are split into two main tasks, as follows:

Task 1: Software certification audit

¹ REM Rules Clause 6.2.2.1

² REM Rules Clause 6.2.1.3

- Review and assess the compliance of the system with the RE Law, Rules and Regulations, REM Rules, RPS Rules, DOE issuances related to the implementation of the RE Law, and other relevant Market Rules and Manuals;
- Provide recommendations for improvement of the system.

Task 2: VAPT

- Ensure that the PREMS is secure against vulnerabilities and threat to avoid accidental and unlawful data loss, alteration of data and intentional/unintentional disclosure of confidential information.

The kickoff meeting for the audit project was held on 04 February 2021. The Inception Report for Task 1: Software certification audit was submitted on 24 February 2021 while the Inception Report for Task 2: VAPT was earlier submitted on 19 February 2021.

Consequently, Task 2: VAPT was earlier completed in July 2021 with the executive summary report submitted on 29 July 2021. The final PREMS VAPT technical report was submitted on 10 August 2021.

On the other hand, Task 1: Software certification audit was completed in October 2021 with the final report and software certificate finalized and accepted on 06 December 2021.

3.2. Scope/Objectives

3.2.1. Task 1: Software certification audit

The software certification audit covers the following five (5) PREMS components:

- Registration and Contract Management
- Allocation of Renewable Energy Certificate (REC)
- REC Transactions
- Management of RPS
- Data Interface

The components on System Administration and Data Publication and Reporting are not included in the scope of audit.

The specific software certification audit objectives are as follows:

Component	Component Description	Audit Objective
Registration and Contract Management	<p>This module facilitates the creation and build-up of all market participant registration information, classification of membership, company information, and all other requirements in the REM.</p> <p>This module also facilitates enrollment of contracts from participants and the monitoring, updating and approval of such contract.</p>	Check the accuracy of information contained in the registration and contract database/ Masterfile, among others.
Allocation of REC	This module covers the import of various input data for calculation of REC entitlement, creation of RECs, calculation of participants' REC entitlement, and issuance of allocation reports.	Check the accuracy of calculation and reporting of results for REC entitlement of each REM participant-member and that allocation entered is posted to the specific account of the participant.
REC Transactions	This module facilitates the management of REM participant activities including banking, transfer and retirement of RECs, creation, acceptance and cancellation of REC orders, and bulletin board management.	Validate if the activities of the REM participants are managed and reported accurately.
Management of RPS	This module facilitates the import of various input data for calculation of compliance volumes, issuance of notices (via dashboard notifications, e-mail and generation of letters), calculation of REM participants' compliance volumes and generation of compliance reports.	Verify the accuracy of the calculation results of REM participants' RPS volume compliance based on the imported input data for the calculation of compliance volumes, issuance of notices (via dashboard notifications, e-mail and generation of letters).

Data Interface	This module enables the PREMS automatic or manual import of data from related Market Operator Market Systems, including the Central Registration and Settlement System (CRSS), Electricity Market Database (EMDB), and other data sources including but not limited to the system/s of TransCo, System Operator, and On-grid and Off-grid Metering Service Providers (MSP) including the National Power Corporation (NPC).	Check the accuracy and seamless data exchange of the automatic or manual import or export of data between and among the related market systems, subject to availability of access in and acceptable datasets in identified systems.
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3.2.2. Task 2: VAPT

Assets assessed for VAPT include the PREMS production and Disaster Recovery (DR) environment web applications.

Specifically, the VAPT has the following objectives:

- Assess the external security of the PREMS web application to identify vulnerabilities and control gaps that may allow an external attacker to:
 - Access/steal or corrupt sensitive information contained by the PREMS web application
 - Hinder the PREMS web application's ability to provide the necessary services
- Perform a Black Box Web VAPT on the PREMS web applications
 - Vulnerability Assessment (VA) without Digital Certificate (DC) and credentials
 - Penetration Testing (PT) on identified high risk/high impact VA results without DC
- Perform dynamic analysis within its target environments to identify existing technical vulnerabilities in PREMS web application
- Conduct automated and manual penetration tests to investigate the possibility of compromising the PREMS systems

- Produce a report detailing the issues identified, risk rating and the recommendations to mitigate the exposure or vulnerability
- Provide support in the form of consultation to PEMC resources during remediation efforts
- Perform a validation scan to determine if remediation efforts are effective
- Produce the final report

3.3. Approach and Testing

The over overall audit methodology for Task 1: Software certification audit and Task 2: VAPT was a combination of key audit activities (i.e., Initiation, Planning, Execution, and Reporting) with structured approach to Project Management and Quality Assurance.

Initiation

Conduct of kick-off meeting with the PAC and Auditee, the PEMC RE Market Project Team, to discuss the following:

- Audit organization structure (PEMC/RE Registrar and RT&Co.)
- Audit objective, scope, and approach
- Audit timeline
- Key audit resources (Designated Point Person, Initial Document Requests, Remote Auditing)
- Risk rating
- VAPT rules of engagement
- Report template (Inception, Progress Report and Final Report)
- Communication and escalation protocols
- PEMC health and safety protocols

Planning

1. Understanding of the REM Rules, RPS Rules and walked the business processes, system and data flows.
2. Preparation and submission of Inception Report to the PAC, which presented the following:
 - Audit objective and scope of work based on the process and system understanding
 - Risk assessment and risk rating considering the likelihood and impact of the identified risk

- Detailed audit approach and project delivery
- Audit test and sampling
- Audit timeline
- Audit deliverables

Execution

1. Conduct of detailed walkthrough of the business processes, system and data flows.
2. Review of related business requirements documentation and identified key system functionalities including the embedded application controls that ensured the integrity of the system processing.
3. For Task 1: i) development of test cases in consultation with PEMC RE Market Project Team to assess the various five components of the PREMS; and ii) execution of the test cases to evaluate system functionality.
4. For Task 2: i) black box testing; and ii) revalidation/rescan.
5. Documentation of observations.
6. Conduct of series of confirmation meetings and wash-up discussions with PEMC RE Market Project Team on initial observations noted.
7. Validation of noted observations as well as the management actions to close-out any non-conformance and observations noted.

Reporting

1. Issuance of Progress Reports every two weeks indicating the status of audit activities and all issues encountered and issued weekly status updates via e-mail.
2. Conduct of wash-up meeting to present the Preliminary Audit Report and obtain additional comments and management actions to remediate the identified gaps.
3. Issuance of Audit Accomplishment Report to document the overall status of the audit and milestone for each of the audit area.
4. Issuance of the Final Reports (Task 1 and Task 2) and the software certificates for each PREMS component to PAC at the conclusion of audit.

3.4. Findings

3.4.1. Task 1: Software Certification Audit

PREMS Component	Audit Assessment
Registration and Contract Management	Satisfactory with qualifications
Allocation of Renewable Energy Certificate (REC)	Satisfactory
REC Transactions	Satisfactory
Management of RPS	Satisfactory
Data Interface	Satisfactory

The Registration and Contract Management component generally met the defined system functional requirements and the related Market Rules, except for the facility code numbering in the system, the particulars of which were not specified in the business requirements definition (BRD) documentation. This necessitates further manual steps including security control steps that preclude ease of use on the part of the RE Registrar. While this is the case, the proposed enhancement has been endorsed to the Department of Energy, the system owner, for approval and implementation.

A Satisfactory rating for other PREMS component indicates that the PREMS component is consistent with the requirements of the REM Rules, RPS Rules, and the related REM business processes.

3.4.2. Task 2: VAPT

Vulnerabilities	Previous Severity	Severity	Instances	Status
Insecure Direct Object Reference	Medium	Medium	1	Active
Detailed Error Messages Revealed	Medium	Medium	1	Active
Contact Form – Arbitrary Data Submission	Medium	Low	1	Active
Redirection from HTTP to HTTPS	Medium		2	Mitigated

The tester has verified that one (1) vulnerability has been fully mitigated and one (1) penetration test findings has been reduced from Medium to Low severity due to the implementation of security controls.

- The redirection to a HTTPS URL is transmitted over the insecure HTTP protocol. This makes the redirection itself vulnerable against Man-in-the-Middle attacks. After trying to access the HTTP site of the application, the server responded with

Request Time Out. As such, the vulnerability “Redirection from HTTP to HTTPS” has been marked mitigated.

- The vulnerability “Contact Form – Arbitrary Data Submission” has been reduced from Medium severity to Low severity. The CAPTCHA system implemented in the application could prevent automated attacks leveraging the contact form..

On the other hand, the tester identified vulnerabilities that are not part of the penetration testing activity as they cannot be exploited, but still are recommended to be fixed as attackers may develop new techniques/strategies to exploit each vulnerability present.

3.5. Conclusion and Recommendations

There are **no significant findings** for both Task 1: Software Certification Audit and Task 2: VAPT.

The PREMS components are consistent with the requirements of the REM Rules, RPS Rules and the REM business processes, but the system’s facility code numbering is inconsistent with prevailing market practice and absent from the design specifications. This requires manual revision and control by the RE Registrar. Meanwhile, the use of client digital certificates as a first layer defense is very effective, ensuring that only individuals in possession of a digital certificate can access the websites.

While the remaining vulnerabilities found currently have no known active exploits, from a forward-thinking perspective and as an opportunity for future improvement, it is recommended that these vulnerabilities be monitored, and the risk reassessed regularly as attackers may develop exploits in the future or attempt to exploit these vulnerabilities from a different entry point.

In line with vulnerabilities still present in the web application, the following proposed actions are recommended:

- Continuously strengthen security posture by creating multiple layers of defense:
 - Server and Application Layer: Implement a repeatable hardening and patch management process
 - Application Layer: Implement input sanitation of fields in all forms
 - Application Layer: Ensure all test data is removed as part of deployment to production
- Perform regular internal vulnerability scans to re-assess the exploitability of identified vulnerabilities and to detect new vulnerabilities as they become known.

APPENDIX A – PREMS SOFTWARE CERTIFICATES



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October 29, 2021

PROF. FELIXBERTO U. BUSTOS, JR.

Chairperson, PEM Audit Committee
18th Floor, Robinsons Equitable Tower
ADB Avenue, Ortigas Center
1600 Pasig City, Philippines

Dear **Prof. Bustos**,

SCOPE OF THIS CERTIFICATE

The purpose of this software certification is to confirm that the **Registration and Contract Management** component of Philippine Renewable Energy Market System (PREMS) is consistent with requirements of Renewable Energy Market (REM) Rules and REM business requirements.

The areas of PREMS' functionality under Registration and Contract Management component that were tested are as follows:

1. Registration and updating of participant information
2. Cessation, deregistration, activation, suspension and lifting of registration information privileges
3. Registration and updating of facility for Mandated, Generating, and GEOP participants
4. Uploading, updating, and viewing of Power Supply Agreement (PSA)
5. Registration/creation and maintenance of data providers
6. Registration/creation and maintenance of technology type
7. Notification to the participant regarding the registration status through dashboard and email

CERTIFICATION TESTING METHODOLOGY

The general approach we adopted for testing the component were as follows:

- We sought to understand the REM Rules and walked the business processes, system and data flows pertinent to registration and contract management.
- We reviewed the related business requirements documentation and identified key system functionalities including the embedded application controls that ensured the integrity of the system records of RE participants, facilities, PSA and other required information for registration and contract management.

- We reviewed the production master records to identify invalid data format, blank fields, duplicate values, limit check, and drop-down list, among others.
- We developed test cases in consultation with RE Project Team to assess the various aspects of the Registration and Contract Management, as indicated in the Scope of this Certificate.
- We ran the test cases to evaluate system functionality.

CERTIFICATION OF THE PREMS COMPONENT WITH RESPECT TO REFERENCE DOCUMENTATION

This is to certify that the **Registration and Contract Management** component is consistent with the following:

a. REM Rules – Chapter 2: Membership and Registration

2.1 Participation in the REM

- 2.1.1 Mandatory REM Trading Participants
- 2.1.2 Mandatory REM Generators
- 2.1.3 Voluntary REM Generators
- 2.1.4 Registration of REM members

2.2 REM Member Categories

- 2.2.2 REM Trading Participants
- 2.2.2 REM Generators
- 2.2.3 Data Providers

2.3 Qualifications of REM

2.4 Members

- 2.4.1 General Qualifications
- 2.4.2 Qualifications of Trading Participants
- 2.4.3 Eligible REM Generators and their Classification

2.5 Responsibilities of REM Members

2.6 Application and Registration of REM members

- 2.6.1 Registration Process
- 2.6.2 Assessment
- 2.6.3 Approval or disapproval of application

2.7 Cessation, Deregistration, Suspension, Transfer of Ownership Category and Non-Payment of Transaction Fees

- 2.7.1 Cessation of Registration
- 2.7.2 Deregistration of REM Members
- 2.7.3 Suspension of REM Members
- 2.7.4 Transfer of Membership Category
- 2.7.5 Non-Payment of Transaction Fees

b. PREMS Business Requirements Definition (BRD) – Section 2. Registration and Contract Management (Manage Market Standing Data)

2.1 Create and Maintain Participant

- 2.1.1 New participant
- 2.1.2 Update participant
- 2.1.3 Suspend or deregister participant
- 2.2 Create and Maintain RE Generator
 - 2.2.1 New REM Generator
 - 2.2.2 New Hybrid Generator
 - 2.2.3 Update Generator
 - 2.2.4 Power Supply Agreement
 - 2.2.5 Registration Transaction Notification
- 2.3 Create and Maintain supporting data
 - 2.3.1 Create and maintain data providers
 - 2.3.2 View and Maintain Technology Types
 - 2.3.3 View and Maintain Policy Settings

- c. Except for the facility code numbering in the system, the particulars of which were not specified in the BRD necessitating further manual steps including security control steps that preclude ease of use on the part of the RE Registrar; the proposed enhancement has been endorsed to the Department of Energy, the system owner, for approval and implementation.

Very truly yours,



Caesar Parlade
Partner, Digital Transformation Services

For and on behalf of Reyes Tacandong & Co.



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October 29, 2021

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Chairperson, PEM Audit Committee
18th Floor, Robinsons Equitable Tower
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1600 Pasig City, Philippines

Dear **Prof. Bustos**,

SCOPE OF THIS CERTIFICATE

The purpose of this software certification is to confirm that the **Allocation of RECs** component of Philippine Renewable Energy Market System (PREMS) is consistent with requirements of Renewable Energy Market (REM) Rules and REM business requirements.

The areas of PREMS' functionality under Allocation of RECs component that were tested are as follows:

1. Import of the data required for REC allocation
 - Bilateral Contract Quantity (BCQ)
 - Meter Data
 - FiT All Data
 - RE Generator MQ
2. Calculation, allocation, and issuance of Renewable Energy Certificates

REC Transaction Method	REC Owner
Feed-in-tariff (FiT)	Allocated among the RPS Mandated Participants
WESM (Non-FiT)	Generator
Power Supply Agreement (PSA) with non- DCC (DU, EC, RES, etc.)	Non-DCC/ Load counterparty
Power Supply Agreement (PSA) with DCC	Generator counterparty/ Generating Participant
Self-generation/ Non-WESM/ embedded/GEOP/Net-metering	Host Distribution Utility

3. Viewing of RECs Summary
4. Viewing of Transaction Movements (Transaction Logs)

CERTIFICATION TESTING METHODOLOGY

The general approach we adopted for testing the component were as follows:

- We sought to understand the REM Rules and walked the business processes, system and data flows pertinent to REC calculation, allocation, and issuance.
- We reviewed the related business requirements documentation and identified key system functionalities including the embedded application controls that ensured the accuracy of REC calculation, allocation, and issuance.
- We developed test cases in consultation with RE Project Team to assess the various aspects of the Allocation of RECs, as indicated in the Scope of this Certificate.
- We ran the test cases to evaluate system functionality.

CERTIFICATION OF THE PREMS COMPONENT WITH RESPECT TO REFERENCE DOCUMENTATION

This is to certify that the **Allocation of RECs** component is consistent with the following:

a. REM Rules – Chapter 3: Market Operations

3.1 Certificate Creation

3.1.1 Issuance

3.1.2 Information to be included on a REC

3.1.3 REC Issuance Timetable

3.1.4 REC calculations for Renewable Electricity generated from WESM RE Generators that are not Multi-Fuel Hybrid Systems

3.1.5 REC calculations for Renewable Electricity generated from WESM RE Generators that are Multi-Fuel Hybrid Systems

3.1.6 REC issuance for Renewable Electricity generated from WESM RE Generators

3.1.7 Adjustments to RECs issued in respect of Renewable Electricity generated from WESM RE Generators

3.1.8 REC calculations for Renewable Electricity generated from REM Generators that are not WESM RE Generators

3.1.9 REC issuance for Renewable Electricity generated from REM Generators that are not WESM RE Generators

3.1.10 Adjustments to RECs issued in respect of Renewable Electricity generated from REM Generators that are not WESM RE Generators

3.2 Allocation of Renewable Electricity Generation from FiT Eligible Facilities

3.2.1 Provision of data to enable FiT Allocation

3.2.2 Allocation of FiT generation to Mandated Participants

3.2.3 Adjustment for errors

3.2.4 Disputes related to FiT allocations

b. PREMS Business Requirements Definition (BRD) – Section 3. Allocate RECs

3.1 Import Data

3.1.1 Import meter data

3.1.2 Import fuel data

3.1.3 Manual data override

3.2 Calculate Entitlements

3.2.1 Calculate Generator Entitlements

3.2.2 Calculate Generator Upgrade

3.2.3 Calculate Hybrid Generator Entitlements

3.2.4 Calculate Mandated Entity Entitlements

3.3 Create RECs

3.4 Allocate FiT RECs

Very truly yours,



Caesar Parlade

Partner, Digital Transformation Services

For and on behalf of Reyes Tacandong & Co.



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October 29, 2021

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Chairperson, PEM Audit Committee
18th Floor, Robinsons Equitable Tower
ADB Avenue, Ortigas Center
1600 Pasig City, Philippines

Dear **Prof. Bustos**,

SCOPE OF THIS CERTIFICATE

The purpose of this software certification is to confirm that the **REC Transactions (Management of Participant Activity)** component of Philippine Renewable Energy Market System (PREMS) is consistent with requirements of Renewable Energy Market (REM) Rules and REM business requirements.

The areas of PREMS' functionality under REC Transactions component that were tested are as follows:

1. Manage participant account activity
 - a. Retirement - Checked through RPS Compliance Reports
 - b. Expiration
 - c. Banking
 - d. Surrender
2. Transact REC Transfers (One Time Transfer and Standing Order)
 - a. Lodge transfer/ standing order
 - b. Update transfer/ standing order
 - c. Accept or reject transfer/ standing orders
 - d. Cancel transfer/ standing orders
3. Manage Bulletin Board
 - a. View all postings of "For Sale" and "Want to Purchase" RECs
 - b. Create and update "For Sale" entry
 - c. Create and update "Want to Purchase" entry
 - d. Cancel Bulletin Board Entry
4. Notification of participant activities through dashboard and email

CERTIFICATION TESTING METHODOLOGY

The general approach we adopted for testing the component were as follows:

- We sought to understand the REM Rules and walked the business processes, system and data flows pertinent to REC calculation, allocation, and issuance.
- We reviewed the related business requirements documentation and identified key system functionalities including the embedded application controls that ensured the integrity of REC transactions processing.
- We developed test cases in consultation with RE Project Team to assess the various aspects REC Transactions processing, as indicated in the Scope of this Certificate.
- We ran the test cases to evaluate system functionality.

CERTIFICATION OF REC TRANSACTIONS WITH RESPECT TO REFERENCE DOCUMENTATION

This is to certify that the **REC Transactions (Management of Participant Activity)** component is consistent with:

a. REM Rules – Chapter 3: Market Operations

3.3 Certificate Transactions

3.3.1 Certificate Transfers

3.3.2 Banking of RECs

3.3.3 Surrendering of RECs for RPS compliance

3.3.4 Retirement of RECs

3.3.5 Pricing of RECs

3.6 REM Bulletin Board

b. PREMS Business Requirements Definition (BRD) – Section 4. REC Transactions (Manage Participant Activities)

4.1 Manage Participant Activity

4.1.1 Retire RECs

4.1.2 Bank RECs

4.2 Manage inter-participant transfers

4.2.1 Lodge Transfer

4.2.2 Accept Transfer

4.2.3 Cancel Transfer

4.3 Manage Standing Order

4.3.1 Create Standing Order

4.3.2 Accept Standing Order

4.3.3 Cancel Standing Order

4.4 Bulletin Board

4.4.1 Create “for sale” entry

4.4.2 Create “want to purchase” entry

4.4.3 Cancel Bulletin Board entry

c. PREMS Business Requirements Definition (BRD) – Section 6 Data Publication and Reporting

6.2 Participant Data and Reports

6.2.1 View Account Balances

6.2.2 View Transactions

6.2.4 View Expiring RECs

6.2.5 View Standing Order

Very truly yours,



Caesar Parlade

Partner, Digital Transformation Services

For and on behalf of Reyes Tacandong & Co.



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Dear **Prof. Bustos**,

SCOPE OF THIS CERTIFICATE

The purpose of this software certification is to confirm that the **Management of RPS Compliance** component of Philippine Renewable Energy Market System (PREMS) is consistent with requirements of Renewable Energy Market (REM) Rules, DOE Circulars on RPS Rules and REM business requirements.

The areas of PREMS' functionality under Management of RPS Compliance component that were tested are as follows:

1. Import of data for calculation (i.e., Annual Gross and Net Electricity Sales)
2. Calculation of Compliance Volume with respect to the RPS Compliance Period (i.e., Annual RPS Obligation, Preliminary Surrendered RECs)
3. Generation and issuance of Compliance Notices and Reports (i.e., Preliminary REC Statement, Final REC Statement, REC Report) which includes the following:
 - a. RPS Percentage and RPS Obligation for the year
 - b. Number of Active RECs
 - c. Number of Surrendered RECs
 - d. Number of RECs in retirement sub account
 - e. Shortfall/excess amount
 - f. List of REC Transactions for the year

CERTIFICATION TESTING METHODOLOGY

The general approach we adopted for testing the component were as follows:

- We sought to understand the REM Rules and DOE Circulars on RPS Rules and walked the business process, system and data flows required for RPS compliance of RE Trading Participants.
- We reviewed the related business requirements documentation including the required computation of the compliance volume with respect to the RPS compliance period (i.e., Annual RPS Obligation, Preliminary Surrendered RECs)
- We developed test cases in consultation with the RE Project team to assess the Management of RPS, as indicated in the Scope of this Certificate.
- We ran the test cases to evaluate system functionality.

CERTIFICATION OF THE PREMS COMPONENT WITH RESPECT TO REFERENCE DOCUMENTATION

This is to certify that the **Management of RPS Compliance** component is consistent with:

- a. REM Rules – Chapter 4: RPS Compliance and Reporting for On-Grid Mandated Participant
 - 4.1 Definition and Responsibilities
 - 4.1.1 Annual RPS Obligation
 - 4.1.2 RPS Compliance Timelines
 - 4.1.3 RPS Compliance Mechanism
 - 4.2 Calculation of Shortfall Amounts
 - 4.2.1 Quantities to be included in the Preliminary REC Statement
 - 4.2.2 Calculation of Shortfall Amounts for the RPS Compliance Period
 - 4.3 Disputes
 - 4.3.1 Disputes related to compliance levels
 - 4.3.2 Impact of Dispute on RPS compliance requirements
 - 4.4 Annual REC Report
- b. DOE Circular No. DC2017-12-0015 Promulgating the Rules and Guidelines Governing the Establishment of the Renewable Portfolio Standards for On-Grid Areas
- c. DOE Circular No. DC2018-08-0024 Promulgating the Rules and Guidelines Governing the Establishment of the Renewable Portfolio Standards for Off-Grid Areas

d. PREMS Business Requirements Definition (BRD) – Section 5. Manage RPS Compliance

5.1 Import Data and RPS Target Determination

5.1.1 Import RPS obligation

5.1.2 RPS Percentage

5.2 Calculate Compliance Volumes

5.3 Issue Notices

5.3.1 Issue compliance notices

Very truly yours,



Caesar Parlade

Partner, Digital Transformation Services

For and on behalf of Reyes Tacandong & Co.



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1600 Pasig City, Philippines

Dear **Prof. Bustos**,

SCOPE OF THIS CERTIFICATE

The purpose of this software certification is to confirm that the **Data Interface** component of Philippine Renewable Energy Market System (PREMS) is consistent with requirements of Renewable Energy Market (REM) Rules and REM business requirements.

The areas of PREMS' functionality under Data Interface component that were tested are as follows:

1. Manual data import between to IEMOP's WESM Central Registration & Settlement System ("CRSS") and WESM Electricity Market Database ("EMDB")
2. Manual batch upload of participant and facility information to PREMS
3. Monitoring of import process through recording of logs for each transaction activity to indicate success, warning and errors as well as number of records updated, inserted, deleted, and the start time and end time of each transaction made

CERTIFICATION TESTING METHODOLOGY

The general approach we adopted for testing the component were as follows:

- We sought to understand the REM Rules and walked the business process and data exchange/ flows from Market Operator systems to PREMS.
- We reviewed the related business requirements documentation and identified the key system functionality and embedded application controls to ensure integrity and existence of the data transfer.
- We developed test cases in consultation with the RE Project Team to assess various aspects of the Data Interface, as indicated in the Scope of this Certificate.
- We ran the test cases to evaluate system functionality.

CERTIFICATION OF THE PREMS COMPONENT WITH RESPECT TO REFERENCE DOCUMENTATION

This is to certify that the **Data Interface** component is consistent with:

a. REM Rules – Chapter 3: Market Operations

3.1.4 REC calculations for Renewable Electricity generated from WESM RE Generators that are not Multi-Fuel Hybrid Systems

3.1.5 REC calculations for Renewable Electricity generated from WESM RE Generators that are Multi-Fuel Hybrid Systems

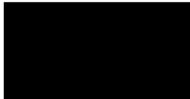
3.1.8 REC calculations for Renewable Electricity generated from REM Generators that are not WESM RE Generators

b. PREMS Business Requirements Definition (BRD) – Section 7. Data Interfaces

7.2 Data Overriding/ Manual Import

7.3 Monitoring of Import Process

Very truly yours,



Caesar Parlade

Partner, Digital Transformation Services

For and on behalf of Reyes Tacandong & Co.