FINAL VERIFICATION REPORT

"210 MW MUSI HYDRO POWER PLANT, BENGKULU"

Document Prepared By RINA Services S.p.A. (RINA)

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Out By	

Summary:

RINA Services S.p.A. (RINA), commissioned by South Pole Carbon Asset Management Ltd., verified the greenhouse gas emission reductions reported for the project activity "210 MW Musi Hydro Power Plant, Bengkulu" in Indonesia, VCS Registration Reference N° 487, for the period 01/04/2013 to 31/07/2016 with regard to the relevant requirements for VCS activities.

The objective of the verification is to have an independent review ex post determination of the monitored reductions in GHG emission reductions, Verification was conducted using RINA procedures in line with the requirements specified in the VCS Version 3.7 Requirements, CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques. The verification consisted of desk review, on-site assessment and the resolution of outstanding issues and the issuance of the final verification report and certification

The verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable VCS / CDM requirements in order to be certified.

The project was validated by RINA (validation report N° 2009 IQ ME 132 of 16/11/2009) and it was registered under the VCS registration reference N° 487.

The GHG emission reductions were calculated on the basis of the approved methodology ACM0002 'Consolidated methodology for grid-connected electricity generation from renewable resources' version 10 of 28/05/2009 and the monitoring plan included in the registered Project Design Document, version 3 of 09/11/2009.

During the verification process 1 Corrective Action Request (CAR) was identified related to the monitoring, implementation or operations of the proposed VCS project activity in relation to all relevant VCS requirements for the project activity and the applied baseline and monitoring methodology; The same has been successfully closed and described in this report.

In conclusion, it is RINA's opinion that the project activity " 210 MW Musi Hydro Power Plant, Bengkulu" in Indonesia, VCS project ID 487, meets all relevant requirements for VCS standard and guidelines and correctly applies the baseline and monitoring methodology ACM0002 'Consolidated methodology for grid-connected electricity generation from renewable resources' version 10 of 28/05/2009. The monitoring system is in place and the emission reductions are calculated without material misstatement. Hence, RINA is able to certify that the emission reductions from the project during the monitoring period 01/04/2013 to 31/07/2016 amount to 1,776,009 tCO_2e.

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1 INTRODUCTION

1.1 Objective

RINA has been commissioned by "South Pole Carbon Asset Management Ltd." to perform an independent verification of its VCS project, "210 MW Musi Hydro Power Plant, Bengkulu", already registered under VCS with Project ID. 487 for the reported GHG emission reductions for the given monitoring period 01/04/2013 up to 31/07/2016. The VCS projects must undergo independent third party verification and certification of emission reductions as the basis for issuance of Voluntary Emission Reductions (VERs/VCUs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the project description (PD) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.
- To confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs)without any double counting, and

To establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The verification scope is:

- to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan;
- to evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement;
- to verify that reported GHG emission data is sufficiently supported by evidence.

The project is assessed against the requirements of VCS version 3.7 and related rules and guidance. RINA has, based on the recommendations in the latest version of CDM Validation and Verification Standard, and employed a rule-based approach (as criteria) in the verification, focusing on the identification of significant reporting rules and the reliability of project monitoring.

Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

1.3 Level of Assurance

All the revisions of the verification report before being submitted to the client were subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent RINA instructions, with reasonable level of assurance.

The technical review was performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme for VCS and CDM validation and verification.

The verification team and the technical reviewers consist of the following personnel.

Role	Last Name	First Name	Country
Team Leader, verifeir & Technical Expert (TA 1.2)	BURAGOHAIN	Champok	India
Technical reviewer	LIU	Huifeng	China

1.4 Summary Description of the Project

The project is a 210 MW capacity, grid connected, run off river type hydroelectric power generating unit. It is located in Bengkulu Province about 30 km northeast of Bengkulu city, the capital of the Province. It involves the inter-basin transfer of water from the Musi river in Rejang Lebong Regency to the Simpangaur river in North Bengkulu Regency through a 7.5 km long waterway and has an underground powerhouse.

The project activity involves generation of electricity by harnessing the hydrological resources of the Musi river and supply it to the Sumatra grid through the Pekalongan PLN main station, with a 150 kV transmission line. This in turn reduces the power supplied to the grid using fossil fuels that results in GHG emission to the atmosphere. Hence this project activity reduces the GHG emissions. The project has three units with 70 MW capacity each. Start date of the project is 19 July 2006 as per the commissioning certificate of all three units /**15**/. The electricity exported to grid is continuously monitored in three dedicated energy meters based on which the emission reduction is calculated.

As per the registered VCS PD (VCS Ref. No: 487) of the VCS project, baseline emissions are calculated as the product of net electricity export and grid emission factor which is in line with the applied methodology. Project emissions are calculated as the fugitive methane emissions from the project activity, the fossil fuel (diesel) consumption in generators for emergency power supply in the project activity. The emission reduction is calculated as the difference of baseline emissions and the project emissions as the leakage emissions are considered to be negligible for the project activity as per the applied methodologies.

The total emission reduction for this 3rd verification period from 01/04/2013 to 31/07/2016 is 1,776,009 tCO_{2e}. The emission reductions are calculated conservatively as per the applied methodologies.

Main components of the project activity include three turbines and its generators, transmission lines, grid interconnection points and DG sets.

The main information of the project activity is summarized in the table below:

Project Participant(s)	PT. PLN (Persero) South Pole Carbon Asset Management Ltd.		
Project Title	210 MW Musi Hydro Power Plant, Bengkulu		
Location of the project	The project area of the Musi Hydroelectric Power Plant is situated in Bengkulu Province about 30 km northeast of Bengkulu city, the capital of the Province. It involves the inter-basin transfer of water from the Musi river in Rejang Lebong Regency to the Simpangaur river in North Bengkulu Regency through a 7.5 km long waterway and an underground powerhouse. The geographical coordinate of Musi Hydroelectric Power Plant is located on 3.618497 South Latitude and 102.457186 East Longitude.		
Methodology(ies)	ACM0002 'Consolidated methodology for grid-connected electricity generation from renewable resources' version 10 of 28/05/2009		
Sectoral Scope(s)	01	RINA's Technical Area(s)	1.2
Registered PDD	Version 3 of 09/11/2009		
Starting date of the crediting period	19/07/2006		
Project's crediting period	01/08/2006 – 31/07/2016		
Current monitoring period	01/04/2013 to 31/07/2016		
Project documentation link	http://www.vcsprojectdatabase.org/#/project_details/487		

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification was conducted using RINA procedures in line with the requirements specified in the VCS Requirements, i.e. VCS Program Guide, VCS Version 3 (v3.7) and VCS Standard, VCS Version 3 (v3.7). The GHG emission reductions are on the basis of the approved Baseline and monitoring methodology ACM0002 'Consolidated methodology for grid-connected electricity generation from renewable resources' version 10 of 28/05/2009.

The verification consisted of the following three phases

- Document review;
- On-site assessment including Interviews and Site Inspections;
- Resolution of Any Material Discrepancy and the issuance of the final verification report and certification.

The following sections outline each step in more detail.

2.2 Document Review

The monitoring report (MR) version 01 of 12/12/2017 and version 02 of 30/01/2018 /**01**/, the emission reduction calculations spreadsheet (171211_Musi_ER Calculation_2013-2016 v1.0_lsa.xlsx) version 01 of 12/12/2017 /**03**/, were assessed as part of the verification. In addition the registered Project Design Document (VCS-PD) /**02**/ in particular the baseline estimations and the monitoring plan for the project were reviewed.

The following table lists the documentation that was reviewed during the verification

/01/	South Pole Carbon Asset Management Ltd.: VCS monitoring report for the project activity "210 MW Musi Hydro Power Plant, Bengkulu", version 1.0 of 12/12/2017 and version 02 of 30/01/2018
/02/	South Pole Carbon Asset Management Ltd.: VCS project description for project activity "210 MW Musi Hydro Power Plant, Bengkulu" in Indonesia, version 3 of 09/11/2009
/03/	South Pole Carbon Asset Management Ltd.: Emission Reduction spread sheet titled "171211_Musi_ER Calculation_2013-2016 v1.0_lsa.xlsx" version 01 of 12/12/2017
/04/	VCS: VCS Program Guide, VCS Version 3 (v3.7), Requirements Document of 21/06/2017
/05/	VCS: VCS Standard, VCS Version 3 (v3.7), Requirements Document of 21/06/2017
/06/	CDM Executive Board: ACM0002 'Consolidated methodology for grid-connected electricity generation from renewable resources' version 10 of 28/05/2009
/07/	Laboratorium Kalibrasi PT. PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan: Calibration certificates for energy meters
/08/	VCS: Monitoring report form (MONITORING REPORT: VCS Version 3) , version 03.4 dated 19/10/2016
/09/	RINA: Validation report (validation report N° 2009 IQ ME 132 of 16/11/2009) for the project activity "210 MW Musi Hydro Power Plant, Bengkulu"
/10/	VCS: 210 MW Musi Hydro Power Plant, Bengkulu (ID: 487) http://www.vcsprojectdatabase.org/#/project_details/487
/11/	TUV Rheinland: Verification report for the project activity '210 MW Musi Hydro Power Plant, Bengkulu' covering the monitoring period 01/04/2010 to 31/03/2013
/12/	PT PLN (Persero): Data transfer Energy PT. PLN (PERSERO) KITSBS SEKTOR BENGKULU DAN PT. PLN (PERSERO) P3BS UPT BENGKULU from 01/04/2013 to 31/07/2016
/13/	Bengkulu Province Tax Office (local government): Monthly water tax receipts for the power generation from Musi Hydro Power from April 2013 to July 2016
/14/	PT PLN (Persero): DG set running hours at MCH, intake and reregulating dam: reporting log books for the period 01/04/2013 to 31/07/2016
15/	Department of Energy: Copy of Commissioning certificates for all the three units dated 19/07/2006

/16/	Governor of Bengkulu: Environmental worthiness certificate for 210 MW Musi Hydro Power Project dated 25/08/2004

2.3 Interviews

The key personnel interviewed and the main topics of the interviews are summarized in the table below*:*

	Date	Name and Role	Organization	Topic
/a/	20/12/2017	Leonardo Sidabalok- Project Manager	South Pole Carbon Asset Management Ltd.	Monitoring report, emission reduction calculations, records of monitoring parameters, VCS rules, application of methodology etc.
/b/	20/12/2017	Pirwan- Assistant Manager	PT. PLN (Persero)	Technical aspects of the project activity. Operational life, environmental aspects etc.
/c/	20/12/2017	Akhmad Juari – SPV operation and planning control		
/d/	20/12/2017	Iwan Rosario S.- Supervisor of Environmental safety of electricity (LK2)	PT. PLN (Persero)	Operational details of the project, management structure, legal compliance, health, safety and environmental aspects, data monitoring and recording procedure, safety practices, production controls, internal audits etc.
/e/	20/12/2017	Restian Rahman- Health safety & environment		
/f/	20/12/2017	Syaifa Laila Sany- Inventory Control		

2.4 Site Inspections

On 20/12/2017, RINA visited the project site. During the on-site assessment of the project, there were no hindrance and all the equipment's and the systems were accessible. RINA assessed the implementation and operation of the proposed project activity, reviewed the information flows for generating, aggregating and reporting the monitoring parameters, interviewed key personnel of the plant to confirm the operational and data collection procedures, cross-checked between information provided in the monitoring report and data plant, checked the monitoring equipment, reviewed calculations and assumptions made in determining the GHG data and emission reductions, checked the quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

The objective of this phase of the verification is to resolve any outstanding issues which need to be clarified for RINA's positive conclusion on the project description. To guarantee transparency a verification protocol has been customized for the project. The protocol shows in a transparent manner the requirements, means of verification and the results from verifying the identified criteria. The verification protocol consists of three tables. The completed verification protocol is enclosed in Appendix B to this report.

A corrective action request (CAR) is raised if one of the following occurs:

- Non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;

- Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impair the estimate of emission reductions;

- Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

A clarification request (CR) is raised if information is insufficient or not clear enough to determine whether the applicable VCS requirements, which refer to CDM rules, have been met.

CARs, CRs and FARs identified are included in the verification protocol in Appendix B of this report.
In summary, during the verification process, 1 CAR was identified which has been successfully closed.

2.5.1 Forward Action Requests

Based on the review of the validation report /**09**/, one FAR found raised which was closed during first verification. And from the review of last verification report /11/, no FAR found raised which needs to be addressed during this verification.

2.6 Eligibility for Validation Activities

The project activity is registered under VCS registration reference Number 487 /**10**/, hence this section is not applicable.

3 VALIDATION FINDINGS

The project was validated by RINA (*validation report N° 2009 IQ ME 132 of 16/11/2009*) and it was registered under the VCS registration reference No-487. This is the 3rd verification assessment for the monitoring period 01/04/2013 to 31/07/2016 by RINA.

3.1 Participation under Other GHG Programs

N/A.

3.2 Methodology Deviations

N/A.

3.3 Project Description Deviations

During this monitoring period, PP has gone for the following two deviations in the monitoring plan of the registered PD /02/. The assessment is given below:

Sl. No.	Original text in PD	Deviation	Assessment by verification team
1.	a) The QA/QC will be conducted through cross-checking with sales electricity receipts b) Data measured by meters will be cross--checked by electricity sales receipts c) The meter (s) will either: • be read frequently and jointly by the generation unit and transmission unit, • be read by the project proponent and the data will then be double checked with the electricity sales receipts	*a) The QA/QC will be conducted through cross--checking the main meter reading report (Monthly Electricity Protocol report) at the transaction point with the Water Tax payment receipt issued by Bengkulu Province Tax Office (local government)*	a) The deviation is accepted as there is no sales receipt available. Project owner (PT PLN) is the Indonesian government owned corporation which is both responsible for generation and distribution of electricity. Therefore, there is no sales receipt available.

	using comparison meter • only be read by the grid company (transmission department).	*b) The sentence is removed* *c) The main meter at the transaction point will be read regularly and jointly by the person in charge from PLN Musi HEPP Generation unit and PLN Transmission unit*	To cross check electricity generation PP has referred Water Tax payment receipt issued by Bengkulu Province Tax Office (local government). Since, the water tax receipt mention the electricity generation, the same is accepted. b) Accepted as above deviation cover the requirement. c) PP has maintained the monitoring and recording frequency as per registered plan and only deviation is the responsible entities which are further clarified. Hence, accepted.

2.	Fuel consumption will be recorded monthly, specifically for each fuel (currently only diesel consumption is available). Fuel consumption will be calculated from static graduated level gauges on the fuel injection tanks by using emergency diesel genset, resulted in liters then converted to tonnes using fuel specific density or scientifically proven fuel densities	Diesel oil usage based on DG Set Operational Hours (in Litre). Fuel consumption will be calculated from the monitored running hours on monthly operation report of the diesel generators, converted to liters using the default diesel oil consumption per hour, from engine manufacturer datasheet on 100% load. Then, liters shall be converted to tonnes using fuel specific density or scientifically proven fuel densities. Fuel consumption will be recorded monthly, specifically for each fuel (currently only diesel consumption is available).	The diesel consumption is calculated based on operational hours and specific diesel consumption of DG set as per technical specification. The deviation is accepted as the deviated calculation is a standard practice to estimate diesel consumption and default technical specifications are applied. Hence, accepted by the verification team.

3.4 Grouped Project

This project is not a grouped project. Hence, this section is not applicable.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

On the basis of the on-site visit and the reviewed project documentation, the verification team confirms that the project was implemented as described in the registered VCS PD. All the physical components and project boundary are in conformity with the description in registered VCS PD. The project activity was commissioned in July 2006 and in operation since then. Based on the VCS PD and the available information at VCS database it is confirmed that the project's crediting period is from 01/08/2006 to 31/07/2016. While the 1st verification covered the period from 01/04/2009 to 31/03/2010, the 2nd verification covers the period from 01/04/2010 to 31/03/2013. Bothe first and second verification completed successfully.

Based on document review and onsite verification, it is confirmed that all the emission sources within the boundary have been considered appropriately. Monitoring of all parameters during the monitoring period is followed as per registered monitoring plan except the deviations described in section 3.3 above.

Data parameters fixed ex-ante and available at validation are given below:

DATA/	Source of	Reported	Assessment/Observation

PARAMETER Unit	data	value for the project period	
Grid Emission Factor of Sumatra ($EF_{grid,CM,y}$) in tCO_2e/MWh	Data based on registered PD /02/ and validation report /09/	0.743	The value is ex-ante fixed for the crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool **/02/, /09/**.
Net calorific value of diesel fuel ($NCV_{i,y}$); GJ/kg	Data based on registered PD /02/ and validation report /09/	0.043	The value is ex-ante fixed for the crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool **/02/, /09/**.
Density of diesel fuel (ρ_i); kg/m^3	Data based on registered PD /02/ and validation report /09/	815	The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool **/02/, /09/**.
Weighted average CO_2 emission factor of diesel fuel in year 'y' ($EF_{CO2,i,y}$); tCO_2/GJ	Data based on registered PD /02/ and validation report /09/	0.074	The value is ex-ante fixed for the entire crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool **/02/, /09/**.

RINA is able to confirm that the Data and parameters fixed ex ante have been implemented in full compliance with the registered monitoring plan.

Data parameters monitored:

Data/Parameter	Assessment
Data Unit	$EG_{PJ,y}$; kWh
Description	Net electricity supplied to the grid by the project activity during the year 'y'
Source of data to be used	Measured by main electricity meter (Actaris type SL 7000) at the project activity site(the switch yard) . Electricity Generation (EG) data used for monitoring is the monthly electricity generation delivered to grid summarized in Electricity Transfer Protocol Report signed by both parties of Generation department and Transmission department.
Value of monitored parameter for the monitoring period	2,390,757 MWh (Net export calculated as the difference of gross export and import from three generation units and difference of own consumption from grid monitored separately) The values mentioned in the monitoring report and ER sheet have been verified from monthly generation reports **/12/**. Further, the reported monthly values are cross checked from

<table>
<tr><td></td><td>water tax receipts and found to be correct /13/.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td colspan="5">Energy meter</td></tr>
<tr><td></td><td>Unit 1</td><td>Unit 2</td><td>Unit 3</td><td>Import meter</td></tr>
<tr><td>Sl. No.</td><td>36027156</td><td>36027159</td><td>36027158</td><td>35008966</td></tr>
<tr><td>Model</td><td>Actaris</td><td>Actaris</td><td>Actaris</td><td>Actaris</td></tr>
<tr><td>Accuracy</td><td>0.2s</td><td>0.2s</td><td>0.2s</td><td>0.2s</td></tr>
</table>
</td></tr>
<tr><td>Accuracy of the monitoring equipment</td><td>As per the registered VCS PD version 3 dated 09/11/2009, the accuracy class of energy meters installed at plant is of accuracy class 0.2s. Verification team has checked the same during the site visit and confirmed that the accuracy class of main meters are of 0.2s.</td></tr>
<tr><td>Measuring/Reading/Recording frequency</td><td>Continuous monitoring and monthly recording. The practice found to be followed during site visit and consistent with registered monitoring plan.</td></tr>
<tr><td>Calcualtion method (if applicable)</td><td>N/A.</td></tr>
<tr><td colspan="2">Calibration</td></tr>
<tr><td>Calibration frequency/interval
Is the calibration interval in line with the monitoring plan of the PD?</td><td>Once in five years as per National Regulation from the Energy and Mineral Resources Ministry Number 37 in 2008. Therefore, the deviation adopted from first verifications on calibration frequency from annual to five yearly is accepted.</td></tr>
<tr><td>Does the calibration cover the monitoring period?
Has the calibration frequency been respected?</td><td>The monitoring period is from 01/04/2013 to 31/07/2016. Calibration details of energy meters are given below:
<table>
<tr><td>Sl. No.:</td><td>Date of calibration</td><td>Validity</td></tr>
<tr><td>36027156</td><td>06/07/2012</td><td>06/07/2017</td></tr>
<tr><td>36027159</td><td>06/07/2012</td><td>06/07/2017</td></tr>
<tr><td>36027158</td><td>08/07/2012</td><td>08/07/2017</td></tr>
<tr><td>35008966</td><td>06/07/2012</td><td>06/07/2017</td></tr>
</table>
Therefore, the calibration of energy meter covers the monitoring period. The calibration frequency of the meter has been checked with calibrations records and found that the calibration frequency has been respected.</td></tr>
<tr><td>Calibration certificates</td><td>
<table>
<tr><td>Meter no.</td><td>Calibration details</td></tr>
<tr><td>36027156</td><td>Calibrated by Laboratorium Kalibrasi PT. PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan on 06/07/2012 /07/</td></tr>
<tr><td>36027159</td><td>Calibrated by Laboratorium Kalibrasi PT.</td></tr>
</table>
</td></tr>
</table>

		PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan on 06/07/2012 /**07**/
	36027158	Calibrated by Laboratorium Kalibrasi PT. PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan on 08/07/2012 /**07**/
	35008966	Calibrated by Laboratorium Kalibrasi PT. PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan on 08/07/2012 /**07**/
Does the calibration of metershave be done by an accredited person or institution?	Laboratorium Kalibrasi PT. PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan has been accredited by the National Accreditation Committee (Komite Akreditasi Nasional / KAN) with certificate number of LK--007--IDN for Laboratory of Calibration /**07**/	

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

GHG emissions reductions for the project and the baseline scenario were correctly calculated using the formulae described in the applied methodology for this project. The verification team has reviewed the emission reduction (ER) spread sheet and checked all the formulae and found they are correct and in line with the monitoring plan of the registered PD and the applied monitoring methodology.

The emission reductions are estimated by measuring the required parameters using appropriate monitoring equipment and using the formulae described in the methodologies; ACM0002, version 10 and the VCS PD except the deviations described in the above section 3.3. All the ex-ante parameters which are used in the calculation of emission reduction are presented in section 4.1 of this report. It is confirmed that all the ex-ante parameters have been correctly used in the emission reduction calculation. According to the applied methodologies, the conservativeness of the achieved emission reduction was checked and the calculation has been transparently provided in the ER sheet.

Baseline Emissions:

Baseline emissions is calculated as below:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$

Where,

$EG_{PJ,y}$: Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/yr)

$EF_{grid,CM,y}$: Combined margin CO_2 emission factor for grid connected power generation in year y (tCO_2/MWh)

The representatives of both Musi HEPP and transmission unit record the main meter readings on a monthly basis and a report is prepared based on this readings. This report is named as the monthly electricity transfer protocol report and is signed by the representatives of Musi HEPP and the transmission department /**12**/. The value of $EG_{PJ,y}$ is taken from this report and amounts to 2,390,757 MWh for the period from 01/04/2013 to 31/07/2016. The verification team has checked the monthly electricity transfer protocol reports for each month of the said period and confirmed that the value mentioned above is in line with the monthly electricity transfer protocol reports /**12**/. Further, the reported values are cross checked from monthly water tax receipts and confirm to be correct /**13**/.

The combined margin emission factor was fixed ex ante and was calculated based on “tool to calculate emission factor for an electricity system”. The value fixed ex ante is 0.743 (tCO_2/MWh) /**02**/.

Therefore, **BE_y** for the monitoring period from 01/04/2013 to 31/07/2016 is 1,**776,330 tCO_{2e}**

Project Emissions:

The only applicable Project emissions related to fossil fuel (diesel) consumption in DG sets are calculated as below:

$PEy = PE_{FF,y} = \Sigma FC_{i,j,y} \times COEF_{i,y}$

Where,

$FC_{i,j,y}$: Quantity of fuel type i combusted in process j during the year y (ton/y)

$COEF_{i,y}$: CO_2 emission coefficient of fossil fuel type i in year y (tCO_2/ton)

i : Fuel types combusted in process j during year

As per the registered PD, version 3 dated 09/11/2009, the fuel consumption in DG sets has to be calculated based on the installed static graduated level gauges and the fuel injection tanks. However, during onsite visit it was noted that no such instruments were installed in the DG sets. In consistent with previous verifications, PP has applied a deviation in monitoring plan of the registered PD and the running hours of the DG sets have been monitored and recorded which would be considered to calculate the diesel consumption based on the following equation.

FC diesel fuel (ton) = running hours (hours/month) * specific fuel consumption (lit/hour) * fuel density (ton/litre)

There are three DG sets which runs on emergency situations and for each DG set specific fuel consumption is taken as per technology supplier details. Noted that three DG sets are in operation located at MCH, intake and reregulating dam and the maximum amount of fuel that can be consumed by these sets at 100% load are 154 l/hr, 34 l/hr and 22.8 l/hr. The monthly running hours of each DG set is recorded in log books and verified the same for the entire monitoring period /**14**/. Accordingly, $FC_{i,j,y}$ (Quantity of fuel type i combusted in process j during the year y (ton/y) for the monitoring period is 100.11 ton. The net calorific value of diesel is 0.043 TJ/t and diesel emission factor is 74.1 tCO2/TJ as per registered PD /**02**/.

Accordingly, project emission from diesel consumption for the monitoring period 01/04/2013 to 31/07/2016 is 321 tCO_2e.

Leakage emissions: As per the methodology ACM0002 “Consolidated baseline methodology for grid connected electricity generation from renewable sources”, version 10 of 28/05/2009, no leakage emission is considered.

Emission Reductions:

Therefore, overall emission reductions achieved from the project activity during the monitoring period is **1,776,009 tCO_2e**.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

During the verification site visit, all relevant documents were checked to assess the correctness and quality of data submitted by the project participants, which are used to determine emission reductions. Monthly electricity generation reports, water tax receipts were verified to ensure that there is no over estimation of the VCUs. The provided data was found to be of adequate quality.

All records needed for monitoring are archived in line with the requirements of the registered monitoring plan. No significant, lack of evidence and missing data were detected during onsite verification. Hence, the verification team confirms that the monitoring system ensures required quality of the monitoring system to ensure the quality of the monitored data. All internal data are subjected to QA/QC measures.

All the meters were calibrated at appropriate calibration frequency (described in section 4.1) to ensure the quality of the data.

It was verified through onsite interviews that the plant's team involved in the monitoring of project activity is well experienced. Hence, the verification team concludes that competent staff is employed by the project proponent to carry out the relevant tasks with sufficient accuracy.

RINA is of the opinion that this method of estimation is accurate and results in conservative estimation of emission reduction and is line with the applicable VCS requirements.

4.4 Non-Permanence Risk Analysis

There is no non-permanence risk rating determined by the project proponent.

5 SAFEGUARDS

5.1 No Net Harm

The project activity received environmental clearance from government /**16**/. In terms of EIA requirement, the project activity has been taking all measures required during operational phase. Therefore, there is no net harm from the project activity.

5.2 Local Stakeholder Consultation

Local stakeholder consultation is not applicable for the project proponent during verification. PP organized stakeholder consultation during validation of the project activity which was validated by the validation agency/**09**/. RINA has interacted local stakeholders during this verification site visit and details are summarized in section 2.3 of this report. There was no negative comment or feedback from local stakeholders as recorded by RINA during site visit.

6 VERIFICATION CONCLUSION

RINA Service Spa (RINA) has performed verification of the emission reductions reported for the project activity "210 MW Musi Hydro Power Plant, Bengkulu" in Indonesia, VCS Registry Project ID 487, for the period 01/04/2013 to 31/07/2016, with regard to the relevant requirements for VCS activities. The project participants of the "210 MW Musi Hydro Power Plant, Bengkulu" project are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered project design document version 3 of 09/11/2009
- the development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project.

It is the responsibility of RINA to express an independent verification opinion about the project's conformity with the requirements of VCS Standard version 3 and GHG program applied, on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an on-site assessment RINA can confirm that:

- the project has been implemented and operated as per the registered VCS-PD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS Standard version 3 requirements;
- the monitoring is in place as per the applied baseline and monitoring methodology;

- the monitoring plan in the registered VCS-PD is as per the applied baseline and monitoring methodology.

It is RINA's opinion that the GHG emission reduction stated in the monitoring report version 02 of 30/01/2018 for the "210 MW Musi Hydro Power Plant, Bengkulu" in Indonesia for the period 01/04/2013 to 31/07/2016 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology ACM0002 'Consolidated methodology for grid-connected electricity generation from renewable resources' version 10 of 28/05/2009 and the monitoring plan contained in the registered VCS-PD.

Hence RINA is able to certify that the emission reduction from the project during the monitoring period 01/04/2013 to 31/07/2016 is amount to 1,776,009 tCO_2e.

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01/04/2013 to 31/12/2013	431,050	6	0	431,044
01/01/2014 to 31/12/2014	516,534	305	0	516,299
01/01/2015 to 31/12/2015	477,283	4	0	477,279
01/01/2016 to 31/07/2016	351,463	6	0	351,457
Total	1,776,330	321	0	1,776,009

APPENDIX A: ABBREVIATIONS

Abbreviations	Full texts
BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM M&P	Modalities and Procedures CDM
CER(s)	Certified Emission Reduction(s)
CH4	Methane
CR	Clarification Request
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
CRT	Coordination and Technical Control Staff
DCI	Certification Division of RINA Services Spa
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EF	Emission Factor
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
HFO	Heavy Fuel Oil
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of Approval
MoV	Means of Verification
MR	Monitoring Report
NGO	Non-governmental Organization
ODA	Official Development Assistance
PDD	Project Design Document

PE	Project Emission
PEA	Provincial Electricity Authority
PP(s)	Project Participant(s)
Ref.	Document Reference
RINA	RINA Services Spa
SS(s)	Sectoral Scope(s)
TA(s)	Technical Area(s)
TPD	Tons per day
UASB	Upflow Anaerobic Sludge Blanket Reactor
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCU	Verified Carbon Unit
VER	Voluntary Emission Reductions
VVS	Validation and Verification Standard

APPENDIX B: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUEST

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	xx	**Section no.**	2.5.1	**Date:** DD/MM/YYYY
Description of FAR				
No remaining FAR to be addressed.				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 2. CR from this verification

CR ID		**Section no.**		**Date:** DD/MM/YYYY
Description of CR				
No CR raised.				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 3. CAR from this verification

CAR ID	01	**Section no.**	4.1	**Date:** 05/01/2018
Description of CAR				
a) Calibration details of energy meter used for in house consumption is not provided in the MR. *b) BEy, EGPJ,y value provided in page number 24 of the MR (para 4.2.1) is not consistent with ER sheet.*				
Project participant response				**Date:** 30/01/2018
a) Calibration details of energy meter used for in house consumption has been provided in the MR section 3.2 and 3.3.3. *b) BE_y and $EG_{PJ,y}$ values provided in page number 24 of the MR (para 4.1.1 – revised previously from para 4.2.1) have been revised to make them consistent with ER sheet.*				
Documentation provided by project participant				
Revised MR and calibration records				
DOE assessment				**Date:** 06/02/2018

Calibration details of the in house consumption meter is provided and copy of the calibration certificate confirm the same. Also the MR is corrected in consistent with ER sheet for reported values of BEy and EGpj,y. Hence, response is accepted and CAR is closed.

Table 4. FAR from this verification

FAR ID	xx	**Section No.**		**Date:** DD/MM/YYYY
Description of FAR				
No FAR raised during this verification.				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

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CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI*
*QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES**

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms: **Champok Buragohain**

è qualificato come:
is qualified as: **TEC, VAL, VER, TL, ITR, Local Expert**

per le seguenti aree tecniche:
for the following technical areas:

AREE TECNICHE *TECHNICAL AREAS*	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.2	Renewables	1
2.1	Electricity distribution	2
13.1	Solid waste and wastewater	13
13.2	Manure	13

REVISIONE *REVISION*	DATA *DATE*	MOTIVAZIONI PER LA REVISIONE *REASON FOR THE REVISION*
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)
1	11/07/2017	Qualification update

Responsabile di schema
Scheme Leader
Laura SEVERINO

*SCHEMI VOLONTARI/ VOLUNTARY SCHEMES: ACR American Carbon Registry, CCB The Climate, Community & Biodiversity Alliance, GS Gold Standard, JI Joint Implementation, SCS Social Carbon Standard, VCS Verified Carbon Standard.

TEC: Technical expert; VAL: Validator; VER: Verifier; TL: Team leader; FIN EXP: Financial Expert; ITRP: Indipendent technical reviewer

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Ecologica Institute	per condurre la Validazione e la Verifica di rapporti SCS *to carry out Validation and Verification of SCS Reports*
American Carbon Registry ACR	per condurre la Validazione e la Verifica di Progetti ACR *to carry out Validation and Verification of ACR projects*
The Climate, Community & Biodiversity Alliance CCB	per condurre la Validazione e la Verifica di Progetti co-benefit CCB *to carry out Validation and Verification of co-benefit CCB projects*

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CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI*
*QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES**

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Hui Feng Liu

è qualificato come:
is qualified as:

TEC, VAL, VER, TL, ITRP

per le seguenti aree tecniche:
for the following technical areas:

AREE TECNICHE *TECHNICAL AREAS*	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.1	Thermal energy generation	1
1.2	Renewables	1
8.1	Mining and mineral processes	8
9.2	Iron, steel and Ferro alloy production	9
13.1	Solid waste and wastewater	13

REVISIONE *REVISION*	DATA *DATE*	MOTIVAZIONI PER LA REVISIONE *REASON FOR THE REVISION*
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)

Responsabile di schema
Scheme Leader
Rita Valoroso

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