

210 MW Musi Hydro Power Plant Bengkulu



TÜV Rheinland (China) Ltd.

Project Title	210 MW Musi Hydro Power Plant Bengkulu
Version	02
Report ID	01 996 9105074811

Report Title	210 MW Musi Hydro Power Plant Bengkulu
Client	South Pole Carbon Asset Management Limited
Pages	26
Date of Issue	10-June-2013
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Summary:

South Pole Carbon Asset Management Limited (SP) has commissioned the TÜV Rheinland (China) Ltd. to carry out the verification of the project - "210 MW Musi Hydro Power Plant Bengkulu" with regard to the relevant requirements of VCS Version 3.3 Standard/VCSA Rules.

The project activity involves installation and operation of three vertical shaft type Francis turbines with a unit capacity of 70 MW, resulting in a total capacity of 210 MW. All the three turbines started generation / export of electricity (to the grid) on and from 19/07/2006.

The project activity has been implemented as described in the VCS PD /B02/. The total installed capacity of the project activity during this monitoring period was 210 MW consisting of three vertical shaft type Francis turbines (3 X 70 MW).

The project activity is in continuous operation since commissioning of the three turbines of Musi Hydro Power Plant on 19/07/2006 and is located in Bengkulu Province about 30 km northeast of Bengkulu city, the capital of the province of Indonesia.

The emission reduction for the reported monitoring period is based on net electricity of 2,346,874 MWh supplied to Sumatra grid of Indonesia. The validated ex-ante grid emission factor ($=0.743 \text{ tCO}_2\text{e/MWh}$) /B02/ of Sumatra grid is applied for the calculation of baseline emission and emission reduction of this monitoring period.

The electricity supplied by the project activity to the grid is calculated as the difference of the electricity export figures {mentioned in the joint meter reports (JMR)}, electricity import figures (mentioned in the JMR) and the own consumption figures {mentioned in the joint meter reports (JMR)} derived from the continuously measured export, import and own consumption electricity (by 2 way tri-vector meters) at the transaction points from 01/04/2010 to 31/03/2013 period.

The electricity from the HTG (hydro turbine generator) is generated at 11 kV and stepped up to 150 kV. The joint meters at the 150 kV side of the sub stations are of tri vector type and are in the custody of PT. PLN (Persero). There are three individual dedicated meters for three HTGs and one own consumption meter for the project plant. These meters provide cumulative readings in kWh and were calibrated yearly by PT. PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan: Calibration Laboratory, a Certified Calibration Agency by National Accreditation Committee (Komite Akreditasi Nasional / KAN) /P05/ as per the VCS PD /B02/ during this monitoring period. The readings of meters (mentioned in the JMR) are used for the emission reduction calculations.

The primary objective of the project activity was to harness the hydro energy for generation of renewable electricity and supplying power to the PT. PLN (Persero) grid, thereby displacing fossil fuel dominated electricity generation of the Sumatra regional grid of Indonesia.

The Methodology ACM0002, Ver. 10: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" an approved methodology of UNFCCC CDM program is applied.

A risk based approach has been followed to perform this verification. In the course of the verification six (06) CAR and three (03) CR were raised and successfully closed out.

The verification is based on documents registered by VCSA, i.e., VCS PD /B02/, monitoring report (/P01/, /P02/) and other supporting documents made available to the verification team by project proponent.

Based on the verification of the registered VCS PD /B02/, MR and other supporting documents, the verification team confirms that:

The verified GHG emission reduction in the reported monitoring period (01/04/2010 to 31/03/2013 period) for given project is;

Year	Emission reduction in the reported monitoring period in tCO ₂ e
2010	544,337
2011	517,927
2012	534,274
2013	147,167
Total emission reduction in tCO₂e	1,743,705

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1 INTRODUCTION

1.1 Objective

The purpose of this verification, by independent checking of objective evidence, is as follows:

- to verify that the project is implemented as described in the VCS registered PD /B02/;
- to confirm that the monitoring system is implemented and fully functional to generate Verified Emission Reductions (VERs/VCUs¹) 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 of this VCS project is based on the VCS PD /B02/, monitoring report and supporting documents made available to the verifier and information collected through performing interviews during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The TÜV Rheinland (China) Ltd. has employed a risk-based approach in the verification, focusing on the identification of significant risks and reliability of project monitoring and generation of emission reductions.

1.3 Level of assurance

The verification report is based on VCS PD /B02/, Validation report /B03/ and Monitoring report (/P01/, /P02/) with supporting documents made available to the verifier and information collected through performing interviews and during the on-site assessment. The verification opinion is assured provided the credibility of all above.

1.4 Summary Description of the Project

The project activity is a run-off river hydropower plant located in Bengkulu Province, Indonesia. The project activity consists of 3 numbers of Hydro turbines of 70² MW capacities each, resulting to a total capacity of 210 MW. The project is owned and developed by PT. PLN (Persero), a state-owned electricity company. The project supplies electricity to the connected Sumatra grid. The starting of generation/export of electricity by the project activity (to the grid) is on and from 19/07/2006 (=VCS starting date) /P06/.

Points no. 2.a (iii) of section 4.1.5 of VCS guidance document "Registration and Issuance Process" dated 04/10/2012 /B06/ requires that "For projects registered under approved GHG programs, the approved GHG program validation (or verification) or VCS validation shall be completed or contracted before 19 November 2008. In relation to contracts entered into before 19 November 2008, the approved GHG program validation (or verification) or VCS validation, as the case may be, shall be completed before 19 November 2009 (i.e., at least one or other of the validations shall be completed before 19 November

¹ As per VCS, Verified Emission Reductions (VERs) are considered to be VCUs only after successful registration in an approved VCU Registry.

² Based on 'Musi Completion Report : Engineering services for detailed design' page I - 7

2009). Proof of contracting of the approved GHG program validation (or verification) or VCS validation, as the case may be, prior to 19 November 2008 shall be provided in accordance with Section 4.2.6.” This is a VCS registered project and the validation of this project is completed on 16/11/2009 i.e. before 19/11/2009 as per the date of validation statement provided by RINA S.P.A (Validator) to the project proponent /P18-2/ which is treated as validation completion date. Hence, this project activity fulfils the above VCSA requirement.

The starting date of this project activity is 19/07/2006 /P06/ as per the commissioning date of all the three Hydro turbines.

As per the section 3.11.1 “Right of Use” of VCS Standard under VCS Version 3.3, the definition of “Right of Use” and requirements with respect to evidencing proof of “Right of use” the validated documents of Proof of Title i.e. commissioning certificate /P06/ is matching with the evidencing proof for Right of Use “A right of use arising or granted under statute, regulation or decree by a competent authority.”, i.e., the right of PP to use the ERs arises due to this project activity provided by PT. PLN (Persero) through commissioning certificate. Hence, it fulfils the definition of Right of Use with evidencing proof /P06/.

The full capacity i.e. 210 MW (of the project activity) consisting of 3 numbers of HTGs was commissioned on 19/07/2006.

The emission reduction for the reported monitoring period is based on net electricity of 2,346,874 MWh supplied to the Sumatra grid of Indonesia. The validated ex-ante grid emission factor (=0.743 tCO₂e/MWh) /B02/ of Sumatra grid is applied for the calculation of baseline emission and emission reduction for this monitoring period. The applied CDM methodology is ACM 0002 (version 10). The net electricity supplied by the project activity is calculated as the difference of the export, import and own consumption electricity figures, all of which are registered in the joint meter reading reports i.e. JMRs. The electricity is measured continuously at the transaction points for the project activity. There are four meters (three dedicated meters for three hydro turbine generators and one for the own consumption of the project plant) at the 150 kV side of the transformers which are located at the project site for the monitoring of the electricity exported to the grid and electricity imported from grid by the Hydro turbine generators and own consumption for the project plant.

The meters at the 150 kV side of the transformers are of tri vector type and are in the custody of PT. PLN Transmission Unit. These continuous meters provide cumulative readings in kWh and were calibrated before installation and also subjected to periodic checking and testing. The reading of these four meters (registered in JMR) is used for the emission reduction calculation. All the four energy meters have neither been changed nor subjected to resetting during the reported monitoring vintage.

2 VALIDATION PROCESS, FINDINGS AND CONCLUSION

2.1 Validation Process

This is a VCS registered project (Project ID - 487), Validated by DOE “RINA S.p.A (RINA)”. The contract of the PP (PT. PLN (Persero)) with South Pole Carbon Asset Management Ltd. (VER consultant and Buyer of Project activity VERs) was entered on 18/11/2008 /P18-1/. The Validation statement was issued on 16/11/2009 /P18-2/.

2.2 Validation Findings

2.2.1 Gap Validation

Project is a VCS registered project (Project ID - 487), hence the Gap Validation is not applicable.

2.2.2 Methodology Deviations

No methodology deviation is applied to this project activity.

2.2.3 Project Description Deviations

During this monitoring period, PP has gone for the following two deviations in the monitoring plan of the registered PD /B02/.

1. As per the VCS PD /B02/, the electricity supplied to the grid as recorded in the monthly electricity transfer protocol would be cross checked with sales receipt.

However during this monitoring period, the water tax receipts issued by Dinas Pendapatan Daerah Propinsi Bengkulu (Bengkulu Province Tax Office) are used for cross-checking purpose instead of sales electricity receipt as there is no sale of electricity.

2. In the registered VCS PD, the FC parameter will be calculated from static graduated level gauges on the fuel injection tanks.

However during this monitoring period, FC is calculated considering the monitored running hours on monthly operation report of DG sets, converted to liters using the default diesel oil consumption per hour, from engine manufacturer datasheet on 100% load. Then liters are converted to tonnes using fuel specific density or scientifically proven fuel densities.

2.2.4 New Project Activity Instances

Since this is not a grouped project, Not Applicable.

2.3 Validation Conclusion

This is a VCS registered project (Project ID - 487), Validated by DOE “RINA S.p.A (RINA)”. The contract of the PP (PT. PLN (Persero)) with South Pole Carbon Asset Management Ltd. (VER consultant and Buyer of Project activity VERs) was entered on 18/11/2008 /P18-1/. The Validation statement was issued on 16/11/2009 /P18-2/.

3 VERIFICATION PROCESS

3.1 Method and Criteria

The verification consists of the following steps:

- A desk review of the VCS PD /B02/, Validation report /B03/, Monitoring report and supporting documents with the use of the relevant sections of a customised protocol according to the VCS Version 3;
- A desk review of the Monitoring Report and additional supporting documents which were submitted by the client. The relevant sections of the above mentioned customised protocol according to the VCS Version 3 were used;
- Verification audit planning;
- On-Site assessment;
- Background investigation and follow-up interviews with personnel of the project developer; and
- Verification reporting (Draft Verification Report and Final Verification Report).

The criteria of this verification include the relevant rules and steps as set out in the VCS Version 3 and VCSA rules.

3.2 Document Review

The following table outlines the documentation reviewed during the verification:

Documents referred during the course of verification:

Reference	Documents
/P01/	Monitoring Report dated 26/04/2013 for the reporting monitoring period, Version 1.0.
/P02/	Monitoring Report dated 16/05/2013 for the reporting monitoring period, Version 02.
/P03/	Emission reduction calculation spread sheet (related to /P01/ and /P02/).
/P04/	1. Copy of monthly electricity transfer protocol report/JMR covering the monitoring period 2. Water Tax receipts 3. Copy of Diesel fuel operational log-book
/P05/	1. All Calibration / testing reports during the reported monitoring period.

	2. Competency proof of the calibrating agency.
/P06/	Copy of commissioning certificates dated 19/07/2006
/P07/	Copies of Standard Operation Procedures for calibration, monitoring, metering and emergency preparedness.
/P08/	Training records of O & M team during the reported monitoring period.
/P09/	Details of the results for the internal audit conducted at site.
/P10/	Applicable statutory clearances covering this monitoring period.
/P11/	Right of Use (= Right of use as per definition of VCS version 3) for the project activity (as per the section 8.1 of the validated VCS PD /B02/).
/P12/	Single line diagram showing the electricity generation and consumption for the project plant and grid interface for electricity export.
/P13/	Snap shots of the following 1. Equipments: Covering the equipment and corresponding nameplates under project boundary (all major equipment). 2. All the meters and measuring & testing equipment (including their specifications/nameplates).
/P14/	1. Extract of operation and maintenance record of HTGs and DG sets. 2. Records of outage covering HTGs within this monitoring period. 3. Extract of manual of all the major equipment (HTGs, DG sets) and all meters/measuring instruments/devices clearly indicating their specifications/ technical details.
/P15/	Organization chart specific to the project activity.
/P16/	Proof of main meter reading on 1st day and end day of monitoring period.
/P17/	VCS version 3 Verification contract dated on 30/04/2013.
/P18/	1. Contract of the PP (PT. PLN (Persero)) with South Pole Carbon Asset Management Ltd. (VER consultant and Buyer of Project activity VERs) dated 18/11/2008. 2. Validation Statement issued by RINA S.p.A (RINA) on 16/11/2009

Background investigation and assessment documents:

Reference	Documents
/B01/	Applied baseline and monitoring methodology for the VCS project activity, i.e., ACM0002, Ver 10.

Reference	Documents
/B02/	Final VCS PD for the project: “210 MW Musi Hydro Power Plant Bengkulu”
/B03/	Validation Report for the project “210 MW Musi Hydro Power Plant Bengkulu” issued by RINA S.p.A (RINA).
/B04/	Monitoring Report for the project “210 MW Musi Hydro Power Plant Bengkulu” for the 1 st monitoring period.
/B05/	Verification Report for the project “210 MW Musi Hydro Power Plant Bengkulu” issued by RINA S.p.A (RINA) for the 1 st monitoring period.
/B06/	VCS Version 3; Program Guidelines; VCSA Rules; and VCS Guidance Document.
/B07/	Validation and Verification Manual, Version 3.0
/B08/	ISO 14064-2: ISO 14064-3: ISO 14065
/B09/	GHG Protocol for Project accounting Chap 7

Websites used:

Reference	Link	Organisation
/W01/	http://pasarkarbon.dnpi.go.id/web/index.php/komnasmpb/read/14/faktor-emisi-jaringan-listrik-sumatera-dan-jamali-2008.html	DNA of Indonesia
/W02/	http://www.ipcc-nggip.iges.or.jp/public/2006gl/	IPCC guidelines
/W03/	http://unfccc.cdm.int	United Nations Framework Convention on Climate Change
/W04/	www.v-c-s.org	Voluntary Carbon Standard

3.3 Interviews

During the on site-visit, a number of persons were interviewed. Date of interview, interviewee are given in the following table.

Reference	Date	Name	Organisation / Function
/I01/	01/05/2013 and 02/05/2013	Mr. Leonardo Sidabalok	South Pole Carbon Asset Management Limited/Assistant Manager
/I02/	01/05/2013 and 02/05/2013	Mr. Zakaria	PT. PLN (Persero)/Manager Sector
/I03/	01/05/2013 and 02/05/2013	Taufiq Fahrudin	PT. PLN (Persero)-Head office

3.4 Site Inspections

The DOE contracted by the Project participant South Pole Carbon Asset Management Limited has conducted on-site inspection in order to confirm all physical features of the project activity proposed in the registered VCS PD are in place and that the project participant has operated and correctly monitored all parameters of the project activity as per the registered VCS PD during this monitoring period, the verification team had visited the project site from **01/05/2013 to 02/05/2013**. The action items covered during the site visit include, but are not limited to.

- The on-site assessment included an investigation of whether all relevant equipments are installed and works as anticipated in the registered VCS PD.
- Assessment of any permanent changes in the project activity in comparison with the registered VCS PD /B02/.
- The operating staff was interviewed and observed in order to check the risks of inappropriate operation and data collection procedures.
- The on-site visit to check that the data recorded and stored as per the monitoring plan.
- Information flows for generating, aggregating and reporting the selected monitored parameters were reviewed.
- Check monitoring equipments including calibration performance.
- Cross-check the information provided in the MR documentation with other sources (raw data).
- The monitoring practices were checked to comply with the requirements of the Registered VCS-PD and the selected methodology.
- The data aggregation trails were checked via spot sample down to the level of the meter recordings.
- Calculations and assumptions made in determining the GHG data and emission reductions were reviewed.

An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters

3.5 Resolution of Any Material Discrepancy

Material discrepancies identified in the course of the verification are addressed either as CARs, CRs or FARs.

Corrective action requests (CARs) are raised, in case:

- (a) Non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;
- (b) Mistakes have been made in applying assumptions, data or calculations of emission reductions which will impair the estimate of emission reductions;
- (c) Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.

Requests for clarification (CRs) are raised, if information is insufficient or not clear enough to determine whether the applicable VCS Version 3 requirements have been met.

4 VERIFICATION FINDINGS

The findings of verification are summarised in table 4-1:

Table 4-1: Summary of CAR, CR and FAR issued

Verification topic (Cp VCS Version 3 Verification Report Template)	No. of CAR	No. of CR	No. of FAR
Project Implementation status (Sec 4.1).	03	01	----
Accuracy of GHG Emission Reduction or Removal Calculations (Sec 4.2).	00	01	----
Quality of Evidence to Determine GHG Emission Reductions or Removals (Sec 4.3).	03	01	----
Management and Operational System (Sec 4.4).	00	00	----
SUM	06	03	----

For an in depth analysis/evaluation of all CARs and CRs can be referred to the below sections from 4.1 to 4.4.

4.1 Project Implementation Status

The project activity involves installation and operation of three units that include three vertical shaft type Francis turbines and three generators; each turbine is of 70 MW capacity which is based on the FS and detail engineering design as given in the validation report /B03/. All the turbines are of vertical shaft type Francis turbine manufactured by VA Tech Hydro which have a rated output 73.6 MW and rated speed of 500rpm /P14-3/, /P13/. Generators are manufactured by Mitsubishi with a continuous rated output of 84.5 MVA and rated speed of 500rpm /P14-3/, /P13/. The machineries were physically verified by the verification team during the site visit. The project supplies electricity to the Sumatra grid through Pekalongan PLN main station with a 150 kV transmission line respectively. Project has been implemented as per the VCS PD /B02/ and validation report /P03/.

The water is taken from the Musi river through the intake dam. Electricity from HTG is produce at 11 kV which is further step up to 150 kV voltage at the project site. This electricity is then transmitted to the Sumatra grid through Pekalongan PLN main station with a 150 KV transmission line. All the turbines were commissioned on 19/07/2006 /P06/, verification team has cross checked the same by referring the commissioning certificates /P06/ during the site visit and found to be appropriate. The verification team confirms that all the components of the project activity as stated in the registered PD /B02/ are in place and were in operation. It is also confirmed that the commissioning date is same as the actual operational date of the plant.

It was verified in the course of this verification that the actual project activity was implemented in accordance with the VCS PD /B02/. Nevertheless, the following CAR's and CRs are raised and successfully closed.

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR 01 As per the requirement of the registered monitoring plan /B02/, Verification team has tried to cross check the electricity supplied by the project activity to the grid with sales electricity receipts however it was noted that there are no such procedure of raising invoice, which is inconsistent with what is mentioned in the PD and the validation report. PP is requested to justify.	VCS PD, MR	SP has proposed deviation plan on the Monitoring Plan to replace the sales receipt for cross check electricity supplied. PT. PLN (Persero) Musi HEPP Generation Unit and PT. P3B are under the same holding company, hence no money transaction occurs between them. Moreover, for this monitoring period, we use the Water Tax payment receipt issued by the local Tax Office as the cross-check document. Details available on the section 2.2 and 3.2 of the Monitoring Report	Section 2.2 page 7 and section 3.2 page 11 of the Monitoring Report	PP had submitted a proposal for deviation. As per the proposal, the electricity exported by the project activity to the grid is to be cross-checked with the Water Tax receipt issued by Bengkulu Province Tax Office (local government). PP is required to pay tax to the government for the utilization of water. The tax is calculated based on NPA- Nilai Perolehan Air (Water Recovery Value). This value is generally based on volume of water consumed. However for PT.PLN, it is calculated based on KWh (unit for electricity) which is approved by tax authority. Once it is confirmed that the value is correct, PP makes the tax payment and tax authority provides the receipts for the same. PP has used this document in order to cross check the electricity exported to the grid by the plant. Verification team has checked the Water Tax receipt /P04-2/ and accepted the same as the tax receipt is provided by a third party. Hence the justification provided by PP is accepted. Hence CAR is closed

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR 02 As per the VCS MR template requirement, - The Technical description of the major equipments need to be provided in the section 1.1 of the MR. - Report ID on page 1 of the MR is missing. - Section 1.8 is missing in the MR /P01/. - Section 2.1 of the MR /P01/ does not have the required information. - Section 5 of the MR should provide the comparison of the VERS between the estimated VER as per the registered VCS PD and actual VERS for the current monitoring period.	MR	- The Technical description of the major equipment has provided in the section 1.1 of the MR - Report ID on the page 1, VCS MUSI #2, has been provided. - Section 1.8 has been revised accordingly. - Referring to the VCS Monitoring Report template, v3.2.0, this section describes the implementation status of the project; provide information regarding the operation of the project activity during this monitoring period. The information above has been provided in the section 2.1 of Monitoring Report of Musi Project. - Section 5 of MR has been revised accordingly to provide the comparison of the VERS between the estimated VER as per the registered VCS PD and actual VERS for the current monitoring period.	Section 1.1 of MR Musi HEPP MR Section 1.8 of MR, Title and reference of Methodology Section 2.1 of MR, Implementation status of the project activity Section 5 of MR, Additional information	- The required information has been provided. Hence this part of CAR is closed. - The required information has been provided. Hence this part of CAR is closed. - Required correction has been done and found OK. Hence this part of CAR is closed. - Required corrections have been done and found OK. Hence this part of CAR is closed. - The required information has been provided. Hence this part of CAR is closed. Hence the CAR is closed

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR 03 Verification team has found that the futuristic sentences have been used in the MR /P01/ for the monitoring. PP need to provide the monitoring information for the current monitoring period only.	MR	The Monitoring Report has revised accordingly. Please be informed there are relevant section which still in the futuristic sentences: section 2.2 (project description deviations) as per registered VCS PD.	Musi HEPP MR	Required corrections have been done and found OK. Hence CAR is closed.

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CL 01 In the section 3.4 of the VCS PD /P02/, from the sentence “The main electricity meter of each power generation unit for establishing the electricity delivered to the grid.....main meter(revenue meter) that measures the quantity of electricity supplied to the grid.....in the verification process.” However during the site visit verification team has found that the JMR (which is the source of the monitoring parameter EGy) is prepared based on the main electricity meter of each power generation unit and the own consumption meter.” PP need to clarify the same.	VCS PD	It is correct that the Own Consumption is considered for the Net Electricity Supply to the Grid, and this can be checked on the Monthly Electricity Transfer Protocol Report and this information is not available on the VCS PD. To accommodate this information, the Monitoring Report is revised and now included the Own Consumption meter details. The calculation method for the parameter EGy has been revised as well.	MR	Verification team has checked the revised MR and found that the own consumption meter details have been included and found OK. Hence CL is closed.

As per the applied methodology, ACM0002, “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, version 10 /B01/, monitoring shall consist of metering the net electricity supplied to the grid by the project activity during the year y and project emissions from fossil fuel consumption in year y. As per the monitoring plan of the registered PD /B02/, version 3 dated 09/11/2009 /B02/, the parameters monitored are the net electricity supplied to the grid by the project activity during the year y and amount of diesel fuel used in the hydro power plant during the year y. Thus, the monitoring plan included in the registered PD is in accordance with the applied methodology /B01/.

The reporting /P02/, /P03/ is in line with the requirements of the validated monitoring plan as well however it was indicated in the registered PD /B02/ that the quantity of electricity supplied by the project activity to the grid will be cross checked with the sales electricity receipts. It was also indicated in the registered PD that the fuel consumption in DG sets would be calculated based on the static graduated level gauges on the fuel injection tanks. Verification team during the site visit found that none of these were followed at site. Hence CAR 01 and CL 02 were raised for the same and successfully closed. To close the same, PP had gone for the following two deviations in the monitoring plan of the registered PD /B02/.

1. As per the VCS PD /B02/, the electricity supplied to the grid as recorded in the monthly electricity transfer protocol would be cross checked with sales receipt.

However during this monitoring period, the water tax receipts issued by Dinas Pendapatan Daerah Propinsi Bengkulu (Bengkulu Province Tax Office) are used for cross-checking purpose instead of sales electricity receipt as there is no sale of electricity. Refer CAR 01.

2. In the registered VCS PD, the FC parameter will be calculated from static graduated level gauges on the fuel injection tanks.

However during this monitoring period, FC is calculated considering the monitored running hours on monthly operation report of DG sets, converted to liters using the default diesel oil consumption per hour, from engine manufacturer datasheet on 100% load. Then liters are converted to tonnes using fuel specific density or scientifically proven fuel densities. Refer CL 02.

The verification team has accepted the same as this is a conservative approach. The deviation proposed is pertaining to this current monitoring period i.e. from 01/04/2010 to 31/03/2013.

The JMR (Joint Meter Reports) provides the meter readings of export to grid, import to grid and own consumption by the project plant electricity in kWh on the day of reading taken jointly mostly once in a month, on the starting day of monthly billing cycle and hence the starting date of billing cycle of the subsequent is the end date of billing cycle of the previous month. The exported electricity, imported electricity and the own consumption electricity for a particular period as reported in the MR are derived from the joint meter readings difference of the current month and previous month with the multiplication of the CT-PT multiplication factor. The net electricity supplied from the project activity to the grid at the joint metering point for a given period is calculated based on the difference of exported electricity, imported electricity and own consumption.

During the course of verification, the resultant net electricity figure of PT. PLN statements /P04-1/ was checked by verifying original data registered in JMR and applying the same approach of calculation as explained above and found reproducible. The net electricity figures as reported in the MR and in the statements are found consistent. The same was also cross checked by the verification team against the monthly water tax receipt /P04-2/ and found it consistent and correct both in Monitoring report and VER spread sheet. The net electricity figure in the JMR forms the basis of emission reduction calculation.

All the four dedicated meters for the project activity are tri-vector digital Watt-hour type and of serial no. 36027156, 36027159, 36027158 and 35008966. The accuracy class of all the meters is 0.2s. All the four dedicated meters were calibrated once every year during this monitoring period according to the VCS PD /B01/ (refer section 4.3 of this report for more details). Three meters dedicated to three hydro turbine generators i.e. (36027156 (1st HTG), 36027159 (2nd HTG) and 36027158 (3rd HTG)) measure the electricity export and import by the HTGs on continuous basis. Fourth meter i.e. (35008966) measure the own consumption by the project plant on continuous basis. The Joint meter reading is considered for the calculation of Net electricity supplied by to PT. PLN Musi HEPP Generation Unit to PT. PLN transmission unit. There is no sale of electricity between these two.

As per the VCS PD /B02/, if main meter fails, production meters which are located at generation site (11 kV) of each power generation unit and the own consumption meter which is also located at the generation site (150 kV) will be used as cross-check meters.

There was no failure of the main meter during this monitoring period. None of the meters have been changed or reset during the reported monitoring vintage.

During the last (1st) verification following FAR were raised for which CARs (CAR 05 and CAR 06) have been raised and successfully closed during this monitoring period.

FAR 01: PP was asked to develop a procedure consisting of monitoring data/parameter, PIC to collect the data and data storage. The same was verified by the verification team during the current verification and found in order.

FAR 02: During internal Audit, PP was asked to focus on the VCS project and justification on the variation if any on the electricity generation compared to the estimated generation as mentioned in the registered VCS PD. Verification team has checked the internal audit conducted at site /P09/ and found in-line with the requirement. Internal Audit is also focusing on project and any variation on the electricity generation compared to the estimated generation as mentioned in the registered VCS PD.

4.2 Accuracy of GHG Emission Reduction or Removal Calculations

According to the applied methodology “ACM0002”, “Consolidated baseline methodology for grid connected electricity generation from renewable sources”, version 10 /B01/, the emission reductions have been calculated based on the following formula:

$$ER_y = BE_y - PE_y - LE_y$$

Where,

ER_y : Emission reductions in year y (tCO₂e/yr)

BE_y : Baseline emissions in year y (tCO₂e/yr)

PE_y : Project emissions in year y (tCO₂e/yr)

LE_y : Leakage Emissions in year y (tCO₂e/yr)

Baseline emissions are calculated as follows:

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

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 CO₂ emission factor for grid connected power generation in year y (tCO₂/MWh)

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CL 02 The method used for the calculation of the monitoring parameter “FC_{i,y}” used in the section 3.2 of the MR is not clear with respect to the method given in the registered PDD /P02/. PP need to clarify the same.	MR, VCS PD	In the registered VCS PD, the FC parameter will be calculated from static graduated level gauges on the fuel injection tanks. PP has proposed deviation monitoring plan to estimate the amount of diesel fuel used. For this monitoring period, the fossil fuel consumption is calculated from the monitored DG Set Operational Hours data (details is provided in the MR ver 2 section 2.2)	MR Version 2, section 2.2 page 8 and section 3.2 page 12	PP has requested for a deviation for monitoring the diesel Consumption in the plant. As per the deviation request, diesel consumption in the DG sets at plant will be calculated based on the running hours of the DG sets. From the review of MR /P02/, VER excel sheet /P03/ and Copy of Diesel fuel operational log-book /P04-3/, verification team has found that the Emergency diesel generator set are manually recorded and reported in monthly basis. The calculation uses fuel consumption at 100% load. Justification provided by PP is accepted as the calculation is done considering that the DG sets are running at maximum load. Hence the approach taken by the PP is conservative. Verification team has checked the calculations and found to be appropriate. Hence CL is closed.

The representatives of both PT. PLN Musi HEPP Generation Unit and PT. PLN transmission unit record the main meter readings on a monthly basis and a report is prepared based on this readings. This JMR is named as the monthly electricity transfer protocol report and is signed by the representatives of Musi HEPP and the transmission department /P04-1/. The value of EG_{PJ,y} is taken from this report and amounts to 2,346,874 MWh/yr for this monitoring period from 01/04/2010 to 31/03/2013. The methods of calculating the net electricity supplied figure and checking the accuracy of the reported electricity figures in the MR are described in the section 4.1 of this report.

The emission factor used for ER calculation is fixed ex ante as mentioned in the registered VCS PD /B02/ as 0.743 (tCO₂/MWh).

As per the registered PD, version 3 dated 09/11/2009 /B01/, 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. Hence a CL 02 was raised for the same. To resolve the issue, PP further requested for a deviation in monitoring plan of the registered PD. Accordingly FC is calculated considering the monitored running hours on monthly

operation report of DG sets, converted to liters using the default diesel oil consumption per hour, from engine manufacturer datasheet on 100% load. Then liters are converted to tonnes using fuel specific density or scientifically proven fuel densities. Refer CL 02. Verification team has checked the calculations and confirmed to be appropriate and conservative.

COEF_{i,y} is calculated using option B. Option B calculates the COEF_{i,y} based on the net calorific value and the CO₂ emission factor of fuel type i, as follows:

$$\text{COEF}_{i,y} = \text{NCV}_{i,y} \times \text{EF}_{\text{CO}_2,i}$$

Where,

NCV_{i,y}: Weighted average net calorific value of fuel type i in year (GJ/kg)

EF_{CO₂,i}: Weighted average CO₂ emission factor of fuel type i in year y (tCO₂/GJ)

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 verification cross checked the same with the technical specifications provided by the technological provider and found to be appropriate /P14/.

Leakage is zero as per applied meth /B01/ and registered VCS PD /B02/. Therefore the Emission Reduction equals to baseline emission minus project emission.

The total net electricity supplied by the project activity to the grid during the monitoring period is 2,346,874 MWh. The baseline emission factor has been fixed ex-ante as 0.743 tCO₂e/MWh based on the Indonesian DNA published data (Page 26 of the registered PD) /B02/. Based on the net electricity supplied and the emission factor the baseline emissions are 1,743,705 tCO₂e.

Moreover, during the on-site visit document review of calibration reports /P05/, it was found that the all the four meters at the transaction point were duly calibrated during this monitoring period.

4.3 Quality of Evidence to Determine GHG Emission Reductions or Removals

Proper data management inclusive of data acquisition and aggregation, data management system is being followed for the project activity.

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR 04 For the monitoring parameter "EGy" in the section 3.2 of the MR /P01/, the given calibration details are not consistent with the calibration certificates /P05/.	MR	The date of calibration on the section 3.2 has been revised.	Section 3.2 of MR, QA/QC procedures to be applied page 11	Required corrections have been done and found OK. Hence CAR is closed.

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR 05 PP need to justify for the raised FAR during last verification. <i>"FAR 1 SP will develop a procedure consisting of :</i> <i>a. The monitoring data/parameter</i> <i>b. The PIC to collect the data</i> <i>c. Data storage</i> <i>The same has to be verified in the coming verification."</i>	Previous Verification Report	SP: FAR 1: A new SOP for monitoring has been developed and submitted to PLN in 2012 which consisting of the monitoring data/parameter, the PIC to collect the data and data storage	/P08/SOP Monitoring Plan	Verification team has checked the SOP /P07/ submitted by SP and found that it consist following <i>a. The monitoring data/parameter</i> <i>b. The PIC to collect the data</i> <i>c. Data storage</i> This is in-line with the requirement. Hence this CAR is closed.

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR 06 PP need to justify for the raised FAR during last verification. <i>"FAR 2 During the next internal audit, PP is requested to focus on the VCS project and justification on the variation if any on the electricity generation compared to the estimated generation as mentioned in the registered VCS PD."</i>	Previous Verification Report	SP: As continuation for the 1st Verification, PT. PLN (Persero) Bengkulu Sector Office conducted their internal annual management review to the implementation of VCS project at their project site. This review could be considered as the internal audit on the VCS project. Starting from year 2012, PP has included the VCS project on the Internal Audit agenda, which focused on the Electricity production.	Bengkulu Sector Management Review in 2010, 2011 and 2012	Verification team has checked the internal audit conducted at site /P09/ and found in-line with the requirement. Internal Audit is also focusing on project and any variation on the electricity generation compared to the estimated generation as mentioned in the registered VCS PD. there were no variation on electricity generation. Hence CAR is closed.

CAR/CR/FAR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CL 03 For the monitoring parameter “EGy” in the section 3.2 of the MR, 1. As per the registered PDD /B02/, the calibration of the meters corresponding to the monitoring parameter “EGy” has to be done on yearly basis however in the section 3.2 of the MR /P01/ the calibration frequency of the meters is mentioned as once in five year. PP need to clarify. 2. Moreover the calculation method of the net electricity supplied to grid i.e. “EGy=EGexport-EGimport” is not clear.	MR, VCS PD	SP: 1. Clarification is provided in the MR that referring to the National Regulation from the Energy and Mineral Resources Ministry Number 37 in 2008, the required calibration interval for kWh meter is once every five year. Hence, on previous Verification round has proposed deviation on the Monitoring Plan for the calibration interval. It further clarifies the calibration interval in 2005 – 2010. However to be in-line with the VCS-PD, PP has conducted the calibration in yearly basis started from 2011 onward as described in the section 3.2. 2. The calculation method of net electricity supplied has been revised. Now the calculation method is considering the project Own Consumption in the net electricity export to the grid (details is provided in the section 3.2).	Section 3.2, Data and parameters monitored (parameter EG_y) Section 3.2, Data and parameters monitored (parameter EG_y)	Verification team has checked the revised MR /P02/ and found that now the written calibration frequency is yearly as per the VCS PD /B02/. Moreover during the 1st verification period (01/04/2009 to 31/03/2010), deviation was taken and the calibration frequency was considered as once in five year as per the National Regulation from the Energy and Mineral Resources Ministry Number 37 in 2008 however during this monitoring period calibration frequency is maintained as once in year and hence accepted. Hence this part of CL is closed. 2. Required correction has been done and found OK. Hence this part is closed. Hence CL is closed

All records needed for monitoring are archived in line with the requirements of the VCS PD. No significant, lack of evidence and missing data were detected during on-site verification.

It is evident from the monitoring data that the monitoring system ensures for continuous operation. All internal data are subjected to QA/QC measures and has proper procedures for data handling. Project proponents, themselves are conducting the annual maintenance hence responsible for data recording in

log sheet and shut down maintenance of the project activity. The personnel from project proponent daily check the data recorded by operators and providing for archiving purpose.

The monitoring personnel at site are well trained and follow reproducible routines. Thus, they are competent to carry out the relevant tasks with sufficient accuracy. All necessary monitored and measured raw data were checked during on-site verification.

All the four dedicated meters were calibrated once every year during this monitoring period according to the VCS PD /B01/ however for all the four meters the calibration in the year 2010 i.e. 27/07/2010 was done after 5 years from the initial calibration date 28/07/2005. Deviation was taken for this during the last (1st) verification and was accepted by the DOE. Hence the same is accepted and thus it is concluded that during this monitoring period, the calibration is done as per the VCS PD /B02/ requirement.

The calibration, accuracy class, make of dedicated meters for the reported monitoring period is summarized below:

S. No.		Meter Number /P05/, /P13/	Make of meter /P13/, /P14-3/	Accuracy Class /P05/, /P13/	Calibration Date /P05/
1.	Unit 1	36027156	ACTARIS SL7000	0.2s	28/07/2005, 27/07/2010, 07/07/2011, 06/07/2012
2.	Unit 2	36027159	ACTARIS SL7000	0.2s	
	Own consumption meter	35008966	ACTARIS SL7000	0.2s	
3.	Unit 3	36027158	ACTARIS SL7000	0.2s	28/07/2005, 27/07/2010, 07/07/2011, 08/07/2012

4.4 Management and Operational System

The allocation of responsibilities is documented in a written form /P15/ and is followed as described in the VCS PD /B02/. Routines for the archiving of data are defined and documented. Calculations are laid down in the monitoring report is in line with VCS PD.

The overall authority of the project site belongs to project proponent. The joint meter readings are noted in presence of officials from plant personnel and the PT PLN Transmission unit mutually.

All internal data are subjected to QA/QC measures. All monitored data are archived in Physical and Electronic form. The data will be kept for the whole crediting period and additional 2 years as given in the VCS PD.

The monitoring report satisfies the calibration procedure followed the calibration/testing frequency for the Main Meters.

5 VERIFICATION CONCLUSION

The scope of the verification relates to the registered VCS PD (project ID-487) submitted to verification team.

The period of the verification covers 01/04/2010 to 31/03/2013 (inclusive of the days).

Conclusions of the verification, including the verified amount of emission reductions for the given period are 1,743,705 tCO₂e

Reporting period: From 01/04/2010 to 31/03/2013 (Including both days)

The yearly VCUs for this verification period are as follows:

Year	Emission reduction in the reported monitoring period in tCO ₂ e
2010	544,337
2011	517,927
2012	534,274
2013	147,167
Total emission reduction in tCO₂e	1,743,705

Assessment of actual emission reductions with the estimate emission reductions in PD:

Estimated Emission Reduction as per Registered PD:	2,541,060
Actual Emission Reduction for the Monitoring Period	1,743,705
Is any increase of CER's occurred?	No
Reason for Increase of CER's	N/A

In summary, verification team confirms that the actual emission reduction is lower than the estimate of the registered for the current monitoring period.

Verified emission in the above reporting period:

GHG Emission Reductions or Removals	tCO ₂ e
Baseline Emissions	1,743,727
Project Emissions	22.34
Leakage	0
Net GHG emission reductions or removals	1,743,705

Annexure 1:

Abbreviations:

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CR	Clarification Request
DG	Diesel Generator
DOE	Designated Operational Entity
ER	Emission Reduction
FAR	Forward Action Request
FC	Fuel Consumption
GHG	Greenhouse gas(es)
HTG	Hydro Turbine Generator
ISO	International Standardisation Organisation
JMR	Joint Meter Reading Report
kV	kilo Volt
kWh	kilo Watt hour
MR	Monitoring Report
MW	Megawatt
MWh	Megawatt Hours
O&M	Operation and Maintenance
PD	Project Design
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
SP	South Pole Carbon Asset Management Limited
tCO ₂	tonnes of Carbon dioxide
UNFCCC	United Nations Framework Convention on Climate Change
VCSA	Voluntary Carbon Standard Association

VCU	Voluntary Carbon Unit
VER	Voluntary Emission Reduction