5 MW BRAHM GANGA HYDRO – ELECTRIC PROJECT AT KULLU DISTRICT OF HIMACHAL PRADESH, INDIA

Document Prepared By: LGAI Technological Center, S.A. (Applus+ Certification)

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Work Carried Out By	Dr. Atul Takarkhede - Lead Auditor/Technical expert

Summary:

Verification purpose: Harisons Hydel Construction Co. (P) Limited (HHCCPL) has commissioned the LGAI Technological Center, S.A. (Applus+ Certification) to carry out the verification of the project - "5 MW Brahm Ganga Hydro – Electric Project" at Kullu district of Himachal Pradesh, India" with regard to the relevant requirements of VCS standard, version 4.1. The project activity involves installation of 5 MW (2 x 2.5 MW) small scale grid connected power generation units. This renewable energy project is based on the run-of-river scheme. The generated electricity will be exported to the NEWNE grid of India. The project started generating commercial power since 2-April-2008.

Start date of the project activity is 02-April-2008, the day on which the project has accounted for emission reductions as per the registered VCS PD version 02, dated 30-March-2010 and final validation report dated 30-March-2010. An undertaking has been submitted by PP for double counting would never happens with the any other GHG program. During the current monitoring period, project activity undergoes continued operation and no major breakdown had taken place.

This is 2nd verification under VCS and covers this activity from 01-April-2010 to 31-March-2016 (inclusive both days). During the current verification period, the project activity has supplied 136,044.82 MWh (136.044 GWh) of electricity, and thus contributing to the GHG reductions 114,282 tCO_2e.

Thus, VCS crediting period is of 10 years (Renewable). The start date of crediting period is 02-April-2008[1] and 02-April-2018 is the end date of the crediting period.

A risk-based approach has been followed to perform this verification activity. In the course of verification, *05* Corrective Action requests (CAR), 01 Clarification Requests (CLs) and 00 Forward action requests (FARs) were raised and successfully closed. The review of the monitoring report and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and PP have provided DOE with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

[1] As per VCS Version 4.0 guidelines

LGAI Technological Center S.A. (Applus+ Certification) (Hereafter referred as Applus+ Certification) has been appointed by "Harisons Hydel Construction Co. (P) Limited (HHCCPL) (BPCL)" to perform the 2nd verification of the "5 MW Brahm Ganga Hydro – Electric Project at Kullu district of Himachal Pradesh, India" under VCS standard v.4.1 and guideline version 4.0. The objective of this verification activity is to have an independent third party for the assessment of the project design, monitoring report and Final Verification report and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- the project's baseline is assessed against "AMS-I.D version 15.0"
- the project's monitoring plan is assessed against "AMS-I.D version 15.0"
- the projects compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline v.4.0 and standard, version 4.1
- CDM Validation and Verification Standard for project activities, version 02.0
- CDM Project Standard for project activities, version 02.0
- CDM project cycle procedure for project activities, version 02.0
- VCS standard, version 4.1
- VCS guideline, version 4.0

Verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of verified emission reductions (VERs).

The scope of the verification is the independent and objective review of the monitoring report (MR). The MR is reviewed against the relevant criteria (see above) and decisions by the CDM Executive Board and VCS executive board, including the approved baseline and monitoring methodology. The verification was based on the guidance given in the CDM Validation and Verification Standard for the project activities, version 02, review against registered PD and Final Validation report, CDM Project Standard for project activities, version 02.0; CDM Project Cycle Procedure for project activities, version 02.0 and VCS program guideline v.4.0 and standard version 4.1.

The assessment team has employed a risk-based approach to assess the completeness and accuracy of the claims and conservativeness of the assumptions in the MR. The main focus of the assessment team is to identify the significant risks for the project implementation and the generation of VERs. The verification is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring report combined.

The only purpose of the verification is its usage during the issuance process as part of the VCS project cycle. Therefore, LGAI Technological Center S.A. (Applus+ Certification) can't be held liable by any party for decisions made or not made based on the verification opinion, which will go beyond that purpose.

The verification has been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. No sampling procedure applied for remote assessment or document verifications. The entire documents checked/plant verification conducted to arrive at positive verification conclusions.

1 INTRODUCTION

1.1 Objective

LGAI Technological Center S.A. (Hereinafter referred as Applus+ Certification) has been appointed by "Harisons Hydel Construction Co. (P) Limited (HHCCPL)" to perform the 2nd periodic verification of the project entitled "5 MW Brahm Ganga Hydro – Electric Project at Kullu district of Himachal Pradesh, India" under VCS standard version 4.1 and guideline version 4.0. The objective of this verification activity is to have an independent third party for the assessment of the project design, monitoring report and final verification report and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- the project's baseline is assessed against "AMS-I.D version 15.0"
- the project's monitoring plan is assessed against "AMS-I.D version 15.0"
- the project's compliance with the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline and standard version 4.1
- CDM Validation and Verification Standard for project activities, version 02.0
- CDM Project Standard for project activities, version 02.0
- CDM project cycle procedure for project activities, version 02.0
- VCS standard, version 4.1
- VCS guideline, version 4.0
- Verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of estimated verified emission reductions (VERs).

1.2 Scope and Criteria

The scope is defined as an independent and objective review of the Monitoring report (MR) prepared as per the registered PD and registered approved methodology AMS-I.D version 15.0. The MR is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board and VCS standard version 4.1 and guideline version 4.0, including the approved baseline and monitoring methodology AMS-I.D version 15.0. The verification was based on the requirements in the CDM validation and verification standard for project activities, Version 02.0, CDM Project Standard for project activities, version 02.0, CDM project cycle procedure for project activities, version 02.0 and VCS program guideline v.4.0 and standard version 4.1

The verification is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for

improvement of the Monitoring report. In line with Guidelines for Application of materiality in verifications, the verification team has conducted a complete verification of all the information presented in the monitoring report and data monitored as presented in the emission reduction calculation spread sheet. It invoices follows the paper trail back to the raw data such as meter reading records and invoices. There are no material errors, overestimation of ER, omission or misstatement. The verification team has reviewed all the documents like commissioning certificates, JMR, invoices etc.

1.3 Level of Assurance

The verification has been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. The entire documents checked/Power plant verification conducted to arrive at positive verification conclusions

1.4 Summary Description of the Project

The main purpose of this project activity is to generate clean form of electricity through 5 MW Hydro Power Plants in the state of Himachal Pradesh. The project envisages installation of two units of 2.5 MW Jet Pelton wheel Turbine, which makes total installed capacity of 5 MW. The project is located near the Manikaran village on the right bank of the Brahm Ganga Nallah in District Kullu of Himachal Pradesh. The electricity generated from the project activity is supplied to Northern grid of India (now Indian Grid), which is mainly dominated by thermal/fossil fuel-based power plant. The PP has entered into long term Power Purchase Agreement with Himachal Pradesh State Electricity Board Ltd. (HPSEB Ltd.) and the power generated by the project activity is being sold to HPSEB Ltd. The project is set up by Harisons Hydel Construction Co. (P) Limited (HHCCPL) and lies between Latitude 32° 02' N and Longitude 77° 21.20' E

During the Current Monitoring Period from 01-April-2010 to 31-March-2016 (First and last date included) the project activity has supplied 136,044.82 MWh (136.04482 GWh) of electricity, and thus contributing to the GHG reductions 114,282 tCO_2e.

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification Process: The project assessment is based on the Clean Development Mechanism Validation and Verification Standard for project activities, version 02.0 and VCS standard V.4.1 and guideline, version 4.0 and is conducted using standard auditing techniques to assess the correctness of the information provided by the project participants. Before the assessment begins, members of the team covering the technical scope(s), sectoral scope(s), and relevant host country experience for evaluating the VCS project activity are appointed.

Once the project is received by the assessment team, the members of the assessment team carried out:

I. A desk review of the monitoring Report against the registered PD;
II. Follow-up interviews with project participant;
III. The resolution of outstanding issues and the issuance of the final verification report and opinion.

The prepared verification report and other supporting documents then undergo an internal quality control at the HQ (Accredited office) before being submitted to the VCS executive board.

In order to ensure transparency, assumptions must be clear and stated explicitly and background material must also be referenced. LGAI Technological Center, S.A. (Applus+ Certification) has developed a specific checklist customized for the project. The checklist demonstrates, in a transparent manner, the project criteria (requirements), discussion on each criterion by the assessment team, and the results from verifying the identified criteria.
Appointment of the assessment team

According to the sectoral scope / technical area and experience in the sectoral or national business environment, LGAI Technological Center S.A. (Applus+ Certification) has composed a project assessment team in accordance with the appointment rules in the internal Quality Management System of LGAI Technological Center S.A. (Applus+ Certification).

The composition of audit team shall be approved by the LGAI Technological Center S.A. (Applus+ Certification) ensuring that the required skills are covered by the team.

The four qualification levels for team members that are assigned by formal appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A) / Auditor in Training (AiT).
- Technical Expert (TE).
- Technical Reviewer (TR).

The sectoral scope / technical area knowledge linked to the applied methodology/ies shall be covered by the assessment team.

Name	Role	SS Coverage	TA Coverage	Financial aspect	Host country experience
Dr. Atul Takarkhede	LA/TE	YES	YES	NA	YES
Mr. Jitendra Mohan Singh	A/TE	YES	YES	NA	YES
Mr. Simon Shen	TR	YES	YES	NA	NA

The complete list of CVs is included as Appendix 3 of this report.

Document review

The Monitoring Report version 1 submitted by the PP was reviewed against the approved methodology, registered PD, final validation report and other relevant criteria to verify the

correctness, credibility, and interpretation of the presented information. Furthermore, a cross-check between information provided and information from other sources has been done. A complete list of all documents and evidence material reviewed is included in this report below in appendix 1.

Follow-up interviews

A remote audit was conducted by LGAI Technological Center S.A. (Applus+ Certification) who performed interviews, telephone conferences with project stakeholders to confirm selected information and to resolve issues identified in the document review. The detail is provided in this report in the below sections.

Resolution of Clarification and Corrective Action Request

The objective of this phase of the Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for Applus+ Certification positive conclusion on the Monitoring report. The Corrective Action Requests and Clarification Requests raised by Applus+ Certification were resolved during communications between the Client and Applus+ Certification to guarantee the transparency of the verification process, the concerns raised and responses given are summarized below in the Appendix 2.

The final MR Version 02 submitted by PP on 21-April-2021 serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country

Internal quality control

As final step of a verification of the final documentation including the final verification report and the checklist have to undergo an internal quality control by the technical review committee, i.e., each report has to be finally approved either by the head of the technical review committee or the deputy. In case one of these two persons is part of the assessment team approval can only be given by the other one to avoid any conflict of Interest.

After confirmation of the project owners the positive verification opinion and relevant documents are submitted to the VCS secretariat through the VCS web-platform.

2.2 Document Review

The details of the document observed during the verification process are listed below in appendix 1 of this report.

2.3 Interviews

A remote audit was conducted for the project activity on 04-February-2021. Remote audit was conducted due to on going COVID-19 pandemic situation in the entire state of India. Taking into account the rules of relevant national and local authorities (local to the DOE offices as well as to locality of the site visits), World Health Organization (WHO) recommendations, policies of the DOE and other relevant travel restrictions and guidance (for example, a requirement to self-isolate upon return). Moreover, The VCS Program does not explicitly mandate site visits as part of the validation and verification process, only that VVBs must achieve a reasonable level of assurance on all validations and verifications (per Section 4.1.2 of the VCS Standard, version 4.1).

The VVB has taken alternative measures to reach reasonable level of assurance and conducted remote audit through Skype/Telephone with site personal & consultant (refer section 2.3) with the PP representative. This is also in line with the COVID-19 travel guidance for projects of VERRA[2] .

Technical details & metering/monitoring arrangement verified through onsite photographs/name plates and calibration certificates shared by PP. All the documents were cross checked to ensure conservative estimation of emission reduction.

During the remote audit, the PP representatives were questioned about the implementation of the project activity. Several topics like the verification of commissioning date of meters, the generation, recording, and monitoring of the data and the error accountability were discussed. To cross check the information provided by PP, various documents like technical specifications, commissioning certificates, PPA, JMR sheets, invoice, calibration certificates, s, etc. were also verified. The names of the persons interviewed during remote audit through Zoom & telephonic interview is given below;

Organization	Name of Persons/Designation	Topics discussed	Team Member
Harisons Hydel Construction Co. (P) Limited (HHCCPL)	Mr. Ghanshyam Sood Director	Project Management and Invoice Practicing	Dr. Atul Takarkhede
	Mr. Dharmesh Singh Site-In-charge	Project activity implementation, Project Description, LSC Mechanism Operation, Calibration, O&M practices, JMR, Mechanical maintenance, Electrical maintenance	

[2] https://verra.org/covid-19-travel-guidance/

Organization	Name of Persons/Designation	Topics discussed	Team Member
EKI Energy	Mr. Barun Sharma	MR, ER calculations etc.	
	Mr. Prakash Sahu, EKI Consultant	MR, ER calculations etc.	

2.4 Site Inspections

Duration of Remote Audit: 04-February-2021 (Via Skype video conference)				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	Assessment team checked the implementation of the project, Baseline emission, Emission reduction calculation, technical description of the project and Monitoring. Assessment team also checked that whether the monitoring plan as described in the VCS PD is actually practised onsite. Also, assessment team checked any change in host country criteria which may affect the baseline of the project activity.	Manikaran Village, District Kullu, Himachal Pradesh State, India	04-February-2021 (Via Skype video conference)	Dr. Atul Takarkhede

2.5 Resolution of Findings

The objective of this phase of the verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for LGAI Technological Center S.A. (Applus+ Certification)'s positive conclusion on the project design and Monitoring report. The Corrective Action Requests and Clarification Requests raised by LGAI Technological Center S.A. (Applus+ Certification) were resolved during communications between the Client and LGAI Technological Center S.A. (Applus+ Certification) to guarantee the transparency of the validation process, the concerns raised and responses given are summarized below in the appendix 2.

The final MR Version 02 submitted by project owners on 21-April-2021 serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Project design document and Monitoring report	00	00	00

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Description of project activity	01	03	00
Application of selected baseline and monitoring methodology and selected standardized baseline			
- Applicability of methodology and standardized baseline	00	00	00
- Deviation from methodology	00	00	00
- Clarification on applicability of methodology, tool and/or standardized baseline	00	00	00
Project boundary	00	00	00
Establishment and description of baseline scenario	00	00	00
Demonstration of additionality	00	00	00
Emission reductions	00	01	00
Calibration details	00	01	00
Monitoring plan	00	00	00
No Net harm assessment	00	00	00
Local stakeholder consultation	00	01	00
Others (please specify)	00	00	00
Total	**01**	**05**	**00**

The list of findings and their resolution is presented in appendix 2 of this report.

2.5.1 Forward Action Requests

This is 2nd periodic verification of the project activity under VCS and no FAR was raised from previous VCS and CDM verification process. No FAR raised during this verification.

2.6 Eligibility for Validation Activities

This section is not applicable for present verification, as Applus+ Certification holds the accreditation for Validation of projects under this Sectoral Scope.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The project activity is neither registered nor seeking registration in any other GHG programs. Moreover, project proponent has also provided undertaking that it would not GHG credits in any GHG program other than that in VERRA for the current monitoring period 01-April-2010 to 31-March-2016. Assessment team verified the same with UNFCCC webpage.

3.2 Methodology Deviations

The project activity used AMS-I.D version 15.0 which is as per the registered VCS PDD and thus no deviation is sought regarding the methodology. The project complies with all the requirement

of the methodology and thus deviation to the methodology is not a requirement for the present project activity.

3.3 Project Description Deviations

1. During this verification it was observed that Typo error related to turbine type have been revised in the current MR based upon actual site scenario. Francis turbine is mentioned in the VCS PD of the project activity whereas Pelton wheel type turbines are installed at the site. Same was verified during remote audit & commissioning certificate issued by Himachal Pradesh State Electricity Board.
2. There is permanent change in the *section* "Other Entities Involved in the Project", the *EKI Energy Services Limited* is now included as Project Consultant.

The nature of change is permanent & assessment team founds that the changes does not impact on scale, methodology, additionality or ability of the project activity to deliver emission reductions.

3.4 Grouped Project

The project is not a grouped project activity. thus, section is not applicable for this project activity.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

During the remote audit (Skype video conference video call), it was concluded that the project is implemented as per the instruction of the VCS PD and this is verified from the commissioning certificate. During the current monitoring period it was observed that no unforeseen situation evolved which can impact the operation of the project activity. The same was verified through the breakdown summary sheet of the project activity. Scheduled maintenance was carried out as per the instruction of the manufacturer and the same is acceptable to the assessment team.

Project location is confirmed by the assessment team through interview with PP and monitoring report. Assessment team also checked with the photograph of project site containing latitude and longitude of the project site and confirmed that the details as mentioned in the registered PD are correct. The latitude and longitude of the project activity is given below;

Project	State	Latitude	Longitude
5 MW BRAHM GANGA HYDRO – ELECTRIC PROJECT	Himachal Pradesh	32° 02' N	77° 21.20' E

The project activity comprises of two units of 2.5 MW capacity each. The construction of a simple diversion weir is carried out to divert the water which is then taken to the turbines after creating the necessary head. Electricity is generated by converting potential energy (available due to head of water) into kinetic energy (through Pelton wheel Turbines) and is then coupled with generators to further convert this kinetic energy (mechanical energy) into electrical energy. The detailed description of the project components has been described below: -

Parameters	Unit	Values
1. Diversion Structure		
Type of Structure	-	Boulder Type wire
Length	m	24
Number of Gates	-	2 nos. at inlet and one nos. at bottom outlet
2. Water Conductor System		
Intake and Approach channel		
Length	m	5
Size	m	3x3.5
Desilting Tank		
Type	-	Dufour Type
Dimension	m	45x8x3.5
2. Power Tunnel		
Shape		D-shaped tunnel
Length	m	996
Dimension	m	996x2x2.4
3. Fore Bay		
Size	m	15x8
Maximum Discharge Capacity	cumecs	2.52
4. Penstock		
Number	-	01
Length	m	330
Diameter	mm	1000
5. Power House		
Type	-	Surface
Dimension	m	24.95x9.5x11.2
6. Tail Race Tunnel		
Length	m	50
Shape	-	Two rectangular RCC ducts emanating from each unit & merging together in a rectangular open channel.

The electricity is generated at 6.6 kV level and evacuated at 33 kV level. Two step-up transformers, 6.6 kV/33 kV, one each for two machines is provided at switchyard near power house. The electricity at 33 kV is transmitted to the Himachal Pradesh State Electricity Board (HPSEB) sub-station

Assessment team checked the commissioning certificate of unit and confirms that the commissioning date are correct.

The assessment team confirmed through interview with O & M personal on Skype video conference that there are no changes in to the project design during this monitoring period. It was found that the monitoring plan was implemented as per the requirement of the VCS PD & approved monitoring Plan and approved methodology AMS.I-D version 15.0. The organisational role and responsibility as mentioned in the registered VCS PD is followed onsite. The calibration of energy meter is done as per the required frequency mentioned in the VCS PD. All the emergency preparedness as mentioned in the registered VCS PD is followed onsite and no discrepancies were found regarding the same.

The Project participant contribution from the project activity towards sustainable development in accordance to NCDMA as explained below:

Social well-being:

The project helps in generating employment. The project activity leads to development in infrastructure in the region like development of roads and also may promote business with improved power generation.

Economic well-being:

The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits. The project activity also help to reduce the demand supply gap in the state

Environmental well-being:

Hydro being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the Project activity also helps in avoiding significant amount of GHG emissions. The project activity generates power using zero emissions hydro energy based power generation which helps to reduce GHG emissions and specific pollutants like SOx, NOx, and SPM associated with the conventional thermal power generation facilities.

Technical well-being:

The operation of project activity leads to promotion of hydro based power generation and encourages other entrepreneurs to participate in similar projects.

The project activity is neither registered nor seeking registration in any other GHG programs. Moreover, project proponent has also provided undertaking that it would not GHG credits in any GHG program other than that in VERRA for the current monitoring period 01-April-2010 to 31-March-2016. The same is confirmed by the PP during the verification remote audit. Assessment team also conducted independent review regarding the same and found that the statement of the PP is accurate and wouldn't claim GHG credit in other GHG program for the current monitoring period except under VCS.

The assessment team observed that the project is in line with the registered PD and applied methodology and thus no clarification/deviation is sought. CL 01, CAR 02 and CAR 03 were raised during the verification process and closed successfully. Please refer below Appendix 2 for the detail closure of the CAR

Assessment team confirms following during the verification remote audit:

1. Start date of the project is 02-April-2008[3] (as per commissioning Certificate).
2. An undertaking letter dated: 08-April-2021 has been submitted by PP for double counting with any other GHG program. PP also has given a written declaration that project has not claimed other form of GHG credit for the concerned monitoring period.
3. Assessment team confirms that this is the 2nd monitoring under VCS and covers the activity from 01-April-2010 to 31-March-2016 (inclusive of both dates). Thus, VCS crediting period should be 10 years (Renewable) till end date of crediting period. 02-April-2008 is the start date and 02-April-2018 will be the end date of the crediting period.
   The VCUs for this monitoring period i.e., from 01-April-2010 to 31-March-2016 will be claimed under VCS only. At any point of time during the crediting period, the project proponent will abide by the "Double Counting". PP have submitted declaration dated 08-April-2021 for avoiding double counting of the emission reductions achieved during this monitoring period.
4. Assessment team checked and found that the Project proponent of the project activity is as below for the current monitoring period:

Organization name	Harisons Hydel Construction Co. (P) Limited (HHCCPL)
Contact person	Mr. Ghanshyam Sood
Title	Director
Address	Akhara Bazar, Kullu, Himachal Pradesh, India Pin- 175101
Telephone	+91-9816024893
Email	hhccpl_kullu@yahoo.co.in

5. The quantified emission reduction calculation for the monitoring period is correct and justified. Assessment team also compared actual VER with the estimated VER and found that the actual VER is 114,282 tCO_2e which is 6.50% higher than the estimated emission reduction 107,305 tCO_2e (17,868 tCO_2e/ 365 daysx2192 days) during this monitoring period.
   The increase in Emission Reductions is due to the variations in water availability which is dependent on rainfall, grid availability and other parameters which are not in the control of PP.

[3] As per the definition of VCS Ver-4.0 Guidelines

PP confirmed during interview that no change in project design occurred since installation of project, which can affect generation of electricity. Also, as per the registered PD, sensitivity analysis page number 22, an increase in 10% in annual electricity generation result in 13.30% of project IRR. The breaching values of Project IRR is 13.61%. Therefore, the increase in generation doesn't impact the addionality. Hence acceptable.

4.2 Safeguards

4.2.1 No Net Harm

No potential environment or socio-economic matter was found during the remote audit. The project is renewable energy project and thus no negative impact observed onsite.

The project activity promotes environmental and socio-economic well-being as it results in zero GHG emissions due to installation and operation of clean, renewable energy technology for electricity generation. The report on "Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects" prepared by MNRE dated September 2013. This report clearly mentioned that hydro power project activity operations do not result in direct air pollution, noise pollution.

However, assessment team still conducted the No net harm assessment for some of the parameters and the result is described below:

SL.NO	Indicator	Assessment team opinion
1	Air quality	The project generates clean energy which replaces the fossil fuel intensive electricity generation. Also report on "Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects" prepared by MNRE dated September 2013. This report clearly mentioned that hydro plant operations do not result in direct air pollution. Adequate measures were taken to mitigate the envisaged impacts like spraying water on the road side to reduce dust level, etc. This was confirmed by the local stakeholders. Therefore, it is validated that mitigation measures were robustly implemented on ground for air quality issues project will have a positive impact on air quality.
3	Soil condition	There are negligible impacts envisaged during operation of the project activity being run of river project. For mitigating the impacts during construction, various mitigation measures were taken which is validated from the plant records of PP and the interview with local villagers. It was also confirmed that, the vegetation done at site helps for soil erosion. The same is confirmed during the stakeholder interviews during remote audit. Therefore, it can be concluded that the project has no effect on soil conditions during its operation because it has no waste coming out.
4	Biodiversity	During the validation site visit it was observed that the condition of

		ground vegetation will be gradually improved; No rare species has been found in the around area. The project site is not on the migration route of migratory bird. As Such small hydro plant do not have any obstruction in the path of migratory birds. Nor project is affecting aquatic life. With the implementation of Project, the greening water will be increased significantly; the biodiversity in the vicinity will be improved with the vegetation improvement. No negative impact envisaged.
5	Employment Generation	The project activity employed local population as skilled workers as well as security guards which were envisaged during the validation site visit. The personnel employed by the project activity are also provided trainings and exposed to various awareness programs therefore a positive indicator has been accepted.
6	Livelihood of the poor	The project is associated with infrastructure development like roads in the nearby areas and promoting economic activities like grants to local school and communities temples etc. Also, project employed local villagers as guards for the security of power project. Positive impact envisaged.

4.2.2 Local Stakeholder Consultation

All the stakeholders are happy with the implementation and operation of the project activity and no negative comments envisaged for the project activity. There was no change in project description form the VCS PD which impacts local stakeholder consultation. Complaint/suggestion/feedback register is maintained at site as a part of ongoing communication with stakeholders in line with clause 3.16.17 of VCS Standard, ver. 4.0 and appropriate actions taken time to time by PP. Assessment team confirmed the same during the remote audit and document review i.e., grievance register etc.

4.3 AFOLU-Specific Safeguards

Not applicable

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

Means of verification	The verification team assessed whether the data and calculations of GHG emission reductions achieved resulting from the MR. The verification team has checked whether calculations of baseline GHG emissions, project GHG emissions and leakage GHG emissions have been carried out in accordance with the formulae and methods described in the monitoring plan of the VCS PD and MR.
Findings	CAR 04 was raised on this section and closed successfully. Please refer Appendix 2 for further details
Conclusion	Baseline emission: The baseline Emissions for a given year is calculated by

	multiplying the energy baseline (EB) with the regional grid emission factor of the grid. Formula Used: - $BE_y = EG_y * EF_{CO2}$ BE_y - baseline emissions in year y (tCO_2) EG_y - Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh), and EF_{CO2} - CO_2 baseline emission factor of the grid in year y (tCO_2/MWh) Ex-ante parameters Following parameters has been taken Ex-ante: $EF_{grid,OM,y}$ = Operating Margin CO2 emission factor in year y (tCO_2/MWh) Calculated from the CO2 emission factor and electricity generation database of Indian Power Sector, published by CEA database Version 5, November, 2009. The Operating Margin factor is taken as 1.00493. $EF_{grid,BM,y}$ = Build Margin CO2 emission factor in year y (tCO2/MWh) Calculated from the CO2 emission factor and electricity generation database of Indian Power Sector, published by CEA database Version 5, November, 2009. The Build Margin factor is taken as 0.67518. $EF_{grid,CM,y}$ or EF_{CO2} = Combined Margin CO2 emission factor in year y (tCO2/MWh) The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year y (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year y (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25% After calculation, the Combined Emission factor is taken as 0.84006. Ex-post parameters: EG_y = Net electricity supplied to the grid by the project (MWh) The net electricity supplied by project activity to grid is taken from Joint Meter Reading (JMR) sheet in which the parameter is calculated by subtracting total electricity imported by project from grid from total electricity delivered by project to grid. Monthly Joint Meter Readings (JMRs) as measured from the Interconnection Point (sub-station) are taken by the designated officials of the Himachal Pradesh State Electricity Board (HPSEB) and the project proponent. There is a separate dedicated transmission line connected to Jari substation. The joint meter readings shall be recorded and signed by the authorised representative (s) of

	both HPSEB & the proponent. The verification team has crosschecked the emission reduction sheet and monitoring report data with the JMR sheet and invoice bills and found all the values are matching. Thus, Net electricity exported to the grid by the project activity during the current monitoring period 136,044.82 MWh[4]. The calculation approach was in line with the VCS PD. Project Emission: As per registered PDD the Project emission is zero Leakage Emission: As per registered PDD the leakage emission is zero. Thus, Emission Reductions are: The emission reductions (ER_y) by the Project activity during a given year y is the difference between baseline emissions (BE_y), project activity emissions (PE_y) and leakage, as follows $ER_y = BE_y - PE_y - Ly$ Thus, the GHG emission reductions have been quantified correctly inline with the VCS PD and applied methodology.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

Means of verification	The verification team checked the break down log for the monitoring period. During the verification assessment the energy meters are also checked. The Calibration details of the monitoring meters are also checked with calibration certificates.
Findings	CAR 05 was raised on this section and closed successfully. Please refer Appendix 2 for further details
Conclusion	The metering arrangement is tri-vector three phase four wire electronic (digital display) energy meters of accuracy class 0.2s (main and check). These electricity meters are being used by state electricity board for monthly generation reports. The Net electricity supplied to the grid is then calculated from export and import values. The electricity Export, Import and Net electricity exported to the grid are cross checked from the invoices raised to respective state electricity board which is in line with Methodology requirement for small scale project activity. Hence assessment team confirmed that the value of net electricity exported to the grid as used in emission reduction calculation is correct. The calibration frequency of meters is annual as per the VCS PD and PPA. Electricity supplied to the grid is metered by main meters & Check meter and tested regularly by HPSEB. As per the state utility practice, set of main & check meters are periodically replaced with other set of calibrated meters and old meters are calibrated to check errors. Considering the frequency of meter calibration as once in a year, there have

[4] After application of error factor for delayed calibration.

been delays in calibration of meters in the current monitoring period as beow:

Meter Type	Delayed Calibration period
Main Meter	April 10 to June 10, Dec 11 to Feb 2012, June 2013
Check Meter	March 12 to June 2012, June 13, May 15 to Mar 16

Further, Information about Meter details and calibration dates are provided in Appendix 5.

PP has applied an approach in order to have error factor correctly in delayed calibration period. PP has applied error factor for months that are not covered in the calibration validity. Assessment team found it consistent thus accepted. Same method has been demonstrated in appendix 5.

Conservative error factor of 0.2% was deducted from export and added to the import conservatively inline with para 366(a) of the *CDM Validation and Verification Standard for project activities, version 02.0* as observed error was less than permissible error. Being conservative and inline with applicable guidance's same have been accepted by the assessment team. Details of the

The meter reading is taken jointly on a Renewable day of every month for the preceding month at the delivery point and signed by the representatives of state utility and PP. In the event of failure of main meter, the check meter will be used in monitoring the electricity data.

It is reported that the data will be kept for 2 years following the end of the crediting period or till the last issuance of VERs for the project activity whichever occurs later.

The responsibilities and authorities of project management, data handling and recording, measurement methods and QA/QC procedure have been systematically established and formalized and the same was verified during the remote audit.

Remote audit and interview with site personnel also confirms that the operational and organizational chart as mentioned in VCS PD is as per the site practice and thus assessment team confirms that the details are correct.

The break down log is checked and found that the plant undergone scheduled maintenance and break down. No unforced error observed.

Thus, during verification assessment found evidences in sufficient quantity and appropriate in terms of quality to determine the GHG reductions.

4.6 Non-Permanence Risk Analysis

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	NA	NA	NA	NA

5 VERIFICATION CONCLUSIONS

Applus+ Certification has been engaged by Harisons Hydel Construction Co. (P) Limited (HHCCPL) to perform the verification of the "5 MW Brahm Ganga Hydro – Electric Project at Kullu district of Himachal Pradesh, India"

The management of the project participant/owner is responsible for the preparation of the GHG emissions data and the reported/estimated GHG emissions reductions on the basis set out within the project's Monitoring Plan in the VCS PD and MR and the approved methodology AMS.I-D version 15.0.

Our Verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board and VCS Standard version 4.1. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. The verification can confirm that:

- the project is operated as planned and described in the project document;
- the monitoring plan is as per the applied methodology;
- the monitoring process in Monitoring Report is as per the PD
- the development and maintenance of records and reporting procedures are in accordance with the monitoring plan
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately except delayed calibration is addressed in line with para 366 (a) of the "CDM validation and verification standard for project activities, Version 02";
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements.
- A reasonable level of assurance was achieved during the verification.
- No limitation observed for the present verification

Verification period: From 01-April-2010 to 31-March-2016 (first and last date included).

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-April-2010 to 31-December-2010	19,658	0	0	19,658
01-January-2011 to 31-December-2011	21,131	0	0	21,131
01-January-2012 to 31-December 2012	21,468	0	0	21,468
01-January-2013 to 31-December-2013	20,840	0	0	20,840
01-January-2014 to 31-December-2014	16,422	0	0	16,422
01-January-2015 to 31-December-2015	13,013	0	0	13,013
01-January-2016 to 31-March-2016	1,750	0	0	1,750
Total	**114,282**	**0**	**0**	**114,282**

The quantified emission reduction calculation for the monitoring period is correct and justified. Assessment team also compared actual VER with the estimated VER and found that the actual VER is 114,282 tCO_2e which is 6.50% higher than the estimated emission reduction 107,305 tCO_2e (17,868 tCO_2e/ 365 days x 2,192 days) during this monitoring period. The variation in Emission Reductions is due to the variations in water availability which is dependent on rainfall, grid availability and other parameters which are not in the control of PP.

PP confirmed during interview that no change in project design occurred since installation of project, which can affect generation of electricity. In addition, as per the registered PD, sensitivity analysis page number 22, an increase in 10% in annual electricity generation result in 13.30% of project IRR. The breaching values of Project IRR is 13.61%. Therefore, the increase in generation does not impact the addionality. Hence acceptable.

APPENDIX I: DOCUMENTS REVIEWED DURING VERIFICATION

No.	Author	Title	References to the document	Provider
1.	NA	Commissioning certificate	Commissioning of the Hydro turbine unit	Project participant
2.	NA	Contract of the other entity with the DOE	Contract of the other entity with the DOE	Project participant
3.	NA	Technical specifications	Technical specifications of turbines	Project participant
4.	NA	Power Purchase agreement for the project activity	08-April-2006	Project participant
5.	NA	VCS Project Description	CDM Project Design Document, Version 02, Dated: 30-March-2010	Project participant
6.	NA	Initial Monitoring report Final Monitoring Report	Version 01, dated 08-January-2021 Version 02, dated 21-April-2021	Project participant
7.	NA	Emission Calculation sheet	Version 1, dated 08-January-2021	Project participant
8.	NA	Emission Calculation sheet	Version 02, dated 21-April-2021	Project participant
9.	NA	Tools/ guidelines used in the project activity • UNFCCC Methodology: AMS-I.D version 15.0 • VCS verification report template Version 4.0 • VCS Standard, version 4.1	UNFCCC CDM web site VERRA website	UNFCCC & VERRA
10.	NA	Calibration details of the project activity undergoing verification	Calibration certificates	Project participant
11.	NA	JMR records+ Invoices for the complete monitoring period	JMR copies Invoices for the complete Monitoring period	Project participant
12.	NA	Break down details of the complete monitoring period	Log Sheet	Project participant
13.	NA	VCS Declaration	Declaration dated 08-April-2021 from PP for Participation under Other GHG Programs	Project participant
14.	NA	Validation report for project activity under VCS by TÜV NORD CERT GmbH (Report No. 8106144531 - 10/65)	Version 01 dated 30-March-2010	Project participant
15.	NA	Verification report for 1st verification of project activity under CDM program by TUV Nord Cert (Report no. - 8106144531 -10/65 }	Version 01 dated 10-May-2010	Project participant

APPENDIX 2: CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS (CAR/CL/FAR)

Verification Findings

CL ID	01	Section no.	4.1	Date: 09-February-2021
Description of CAR				
In accordance with the commissioning certificate (Ref no. HPSEB/PHE/Brahmganga/08-3263-66, dated 31-March-2008) of project activity, HPSEB has stated that Pelton wheel type turbine is used in the project. However, in registered PDD and MR, PP has stated that Francis turbine is used in the project activity. Thus, Clarification required.				
Project participant response				**Date:** 18-February-2021
Based upon actual site practise and commissioning document, pelton wheel type turbine is used. A project deviation in section 3.2.2 is applied mentioning the change.				
Documentation provided by project participant				
1. *VCS MR v02*				
DOE assessment				
In section 3.2.2 of revised MR, PP has provided a justification on typo error related to turbine type used in the project activity. Moreover, during the site visit practise of assessment team, Auditor confirms that Pelton wheel is used in actual operation. Thus, accepted and CL01 is solved.				

Project Implementation Status

CAR ID	01	Section no.	4.1	Date: 09-February-2021
Description of CAR				
During Desk review following discrepancies has been found: 1. Date formats throughout the MR is not line with the guidelines to complete monitoring report. Corrective action sought. 2. Section 1.1 of Monitoring report not in-line with the guidelines to complete monitoring report. Information on the implementation and actual operation in section 1.1 of the MR of the project activity, including relevant dates (e.g., construction, commissioning, and start of operation) are missing. Corrective action sought. 3. Project participant mentioned the details regarding the technologies used in the project activity but to verify the same, no such document (i.e., technical equipment's details, power purchase agreement, technical lifetime etc.) is provided to DOE team. Corrective action is sought for the same.				
Project participant response				**Date:** 18-February-2021

1. Date formats have been revised throughout the MR V2. *2.The above observation have been included in section 1.1 of MR V2.* *3.Approved commissioning certificates is being shared having the details of audited Equipment.*
Documentation provided by project participant
1. VCS MR v02 and commissioning certificate
DOE assessment **Date:** 23-April-2021
1. Date formats throughout the revised MR has been rectified as per the guidelines to complete VCS MR. hence **CAR is closed**. 2. Relevant Information of Commissioning and implementation of project activity has been successfully mentioned in section 1.1 of revised MR. Moreover, in order to verify the same, PP has submitted commissioning certificate to assessment team. Team found consistency between certificates and MR, thus accepted and **CAR is closed**. 3. Technologies used in the project activity has been verified with commissioning certificates provided by PP. Assessment team found consistency in both documents. Thus, accepted and **CAR is closed.**

CAR ID	02	**Section no.**	4.1	**Date:** 09-February-2021
Description of CAR				
PP is requested to submit an undertaking for no any double accounting for current monitoring period and for project activity is participated in other GHG program other than VCS.				
Project participant response				**Date:** 18-February-2021
No double counting declaration is being provided.				
Documentation provided by project participant				
Undertaking that PP would not claim GHG credits in any GHG program other than that under VERRA for the current monitoring period and undertaking that PP is not availing REC benefits for the current monitoring period				
DOE assessment				**Date:** 23-April-2021
PP has submitted an undertaking for no any double accounting for current monitoring period and for project activity is participated in other GHG program other than VCS. Assessment team found it acceptable thus **CAR is closed.**				

CAR ID	03	**Section no.**	4.2.2	**Date:** 22 August-2020
Description of CAR				
Details of ongoing stakeholder's consultation mechanism is provided in section 2.2 of the MR inline with VCS guidelines to complete MR. however, PP also requested to submit records of ongoing local stakeholder consultation including grievance register etc.				
Project participant response				**Date:** 18-February-2021
1. *Site grievance register is being submitted.*				
Documentation provided by project participant				
2. *Grievance Register*				
DOE assessment				**Date:** 23-April-2021

PP has submitted Grievance register as an evidence for ongoing stakeholder's consultation mechanism of project activity. During verification, Team found no major grievances during the current monitoring period. Thus, accepted and **CAR is closed.**

Accuracy of GHG Emission Reduction and Removal Calculations

CAR ID	04	**Section no.**	4.4	**Date:**09-February-2021
Description of CAR				
1. PP has submitted the JMRs and invoices of project covering complete monitoring period. However, electricity generation values for months of May 2010, Nov 2010, August 2011, Jan 2013 & Oct. 2014 are not consistent with values under JMRs or invoices as commented in ER sheet. Thus, Corrective action sought for the same. 2. As PP mentioned in the MR that emission reduction achieved in this monitoring period is 19.29% higher than estimated values. therefore, PP is requested to justify the impact of higher electricity generation on project additionality.				
Project participant response				**Date:** 18-February-2021
1. ER values have been revised based upon the observation. *2. Generation values are revised and the overall emission reduction achieved is 6.50% more than the estimated values. As per the registered PD, sensitivity analysis page number 22, an increase in 10% in annual electricity generation result in 13.30% of project IRR. The breaching values of Project IRR is 13.61%. Therefore, increase in generation doesn't impact the addionality*				
Documentation provided by project participant				
Revised ER and JMR reports				
DOE assessment				**Date:** 23-April-2021
1. JMRs and invoices of all remaining months has been submitted to the assessment team by PP. Team found all JMRs and invoices are consistent with ER sheet and thus calculation of archived emission reduction found correct and **CAR is closed**. 2. In revised MR, PP has mentioned that achieved ER is only 6.50% higher than estimated ER. Assessment Team independently verified same with all supporting documents and found that percentage value is correct and increase in electricity generation during current monitoring period does not impact the project's additionality. Thus, accepted and **CAR is closed.**				

Quality of Evidence to Determine GHG Emission Reductions and Removals

CAR ID	05	**Section no.**	4.5	**Date:**09-February-2021
Description of CAR				
PP has submitted the copies of calibration certificate to the assessment team. however, calibration dates in MR are not consistent with calibration certificate. Also PP requested to submit copies of meter change MoM/certificate for meter change if any, covering complete monitoring period.				
Project participant response				**Date:** 18-February-2021

Calibration is under the purview of State electricity authority, billing meter is owned by state authority. They used to regularly change the meters and provide the latest calibration reports. The minutes are not provided therefore not available with PP. The calibration report is provided for the complete monitoring period. The error factor has been applied for the months that are not covered in the calibration validity.
Documentation provided by project participant
1. *Calibration Reports, MR and ER sheet.*

DOE assessment	**Date:** 23-April-2021
PP has rectified Appendix 1 (Calibration records) of revised MR as per the calibration certificates submitted to the assessment team. Moreover, during assessment, it is found that state authority regularly changed the monitoring meters of project activity and details regarding new and old meters has been mentioned in the respective month's JMR. Thus, PP has applied error factor in those periods which is beyond the 1-year (365 days) validity. This approach has been properly tabled in appendix 1. Thus, team accepted the approach and **CAR 05 is closed.**	

APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Verification team member

No.	Role	⊢ >	Last name	First name	Affiliation	Involvement in

					(e.g., name of central or other office of DOE or outsourced entity)	Desk review	On-site inspection	Interview(s)	Verification findings
1.	Lead Auditor/Technical Expert	OR	Takarkhede	Atul	TQC-Outsourced entity	Yes	No	Yes	Yes
2.	Auditor / Technical Expert	OR	Singh	Jitendra Mohan	TQC-Outsourced entity	Yes	No	Yes	Yes

Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer (TR)	EI	Shen	Simon	Applus+ Certification
2.	Approver	IR	Calle de Miguel	Agustín	Applus+ Certification

Short CVs of the Team:

1. Dr. Atul Takarkhede counts with 9 years of experience in field of Environmental Auditing, consulting and accreditation. He is an Expert in ISO 9001-14001, CO2/GHG Reporting, Carbon Foot Print, Energy, Water and Waste Management Reporting for organizations environmental performance. His professional portfolio is mainly related with carrying out EIA, conducting QA/QC of EIA Reports; Conducting Environmental/water Audits; NABET requirements appliance. Furthermore, he counts with solid experience on CDM-VCS-GS consultancy and auditing. He has Ph.D. (Environmental Science) from Institute of Science, RTM Nagpur University, Nagpur, and he has already published different technical reports related to environmental science.

2. Mr. Jitendra Mohan Singh has done Advanced MSc in Sustainable Energy Systems and Management from International Institute of Management, University of Flensburg, Germany and B.Tech. in Agricultural Engineering from Allahabad University. He has more than (17)

years of working experience in different organizations like IARI, ICAR, IIT Delhi, CAPART, SMEC and Perenia Carbon and MB Power (Madhya Pradesh) Ltd. Also, Jitendra has 3 years' experience in DOE EPIC Sustainability, Carbon Check and 4K Earth Science Pvt Ltd under various categories of projects stating from Renewable to waste projects. Currently he is associated with True Quality Certification Services Pvt Ltd and is empaneled with APPLUS certification to carry out GHG audit covering the sectoral scope 1, 3, 13 technical areas 1.2/1.1/13.1. Prior to this, Jitendra was validator and Verifier (Auditor) with Carbon Check covering the sectoral area 1, 3, 13 and Technical Expert with 4K Earth Science and EPIC Sustainability. He was also RIT expert (adhoc) in UNFCCC from 2010 to 2013 for assessment of projects submitted for registration and Issuance.

3. Mr. Simon Shen (Master Degree in Thermal Energy Engineering, Bachelor Degree in Environmental Engineering) is a Lead Auditor appointed by Applus+ LGAI for the GHG project assessment. He is based in Shanghai. He has several years of work experience in environmental protection field. Before he joined Applus+ LGAI, he had been worked for TÜV SÜD as a GHG Validator/Assessment team and ISO 9001/14001 Lead Auditor for 3.5 years.

APPENDIX 4: ABBREVIATIONS

Abbreviations	Full texts
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CEA	Central Electricity Authority
CL	Clarification request
CM	Combined Margin
CMS	Central Monitoring system
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNA	Designated National Authority
DOE	Designated Operational Entity
DR	Document Review
EF	Emission Factor
EIA	Environmental Impact Assessment
ER	Emission Reductions
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming potential
HPSEB	Himachal Pradesh Power Transmission Corporation Ltd.
RBI	Reserve Bank Of India
PP	Project Participant

APPENDIX 5: CALIBRATION DETAILS

Meter Type	Sl. No.[5]	Make	Accuracy Class	Calibration Date	Calibration compliance
Main Meter	07034165	L&T	0.2s	03-June-2010	Delay for April 10 to June 10, Dec 11 to Feb 2012, June 2013
Main Meter	07034165	L&T	0.2s	08-December-2010	
Main Meter	11068925	L&T	0.2s	28-February-2012	
Main Meter	11071309	L&T	0.2s	12-June-2012	
Main Meter	11071310	L&T	0.2s	28-June-2013	
Main Meter	07034167	L&T	0.2s	07-February-2014	
Main Meter	11071310	L&T	0.2s	11-September-2014	
Main Meter	07034167	L&T	0.2s	16-April-2015	
Main Meter	11071310	L&T	0.2s	01-February-2016	
Main Meter	15625796	L&T	0.2s	19-September-2016	
Main Meter	11071310	L&T	0.2s	05-July-2017	
Check Meter	07034167	L&T	0.2s	03-February-2010	Delay for March 12 to June 2012, June 13, May 15 to Mar 16
Check Meter	07034167	L&T	0.2s	04-September-2010	
Check Meter	07034167	L&T	0.2s	07-March-2011	
Check Meter	11071310	L&T	0.2s	12-June-2012	
Check Meter	11071309	L&T	0.2s	28-June-2013	
Check Meter	11068925	L&T	0.2s	07-February-2014	
Check Meter	11071309	L&T	0.2s	06-May-2014	
Check Meter	15625805	L&T	0.2s	19-September-2016	
Check Meter	11071309	L&T	0.2s	15-July-2017	

[5] As per the state utility practice, set of main & check meters are periodically replaced with other set of calibrated meters and old meters are calibrated to check errors.