VERIFICATION REPORT

for the CDM Project Activity

Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects

in

INDIA

Report No. 01 997 9105060712

Version 04, 2011-04-28

TÜV Rheinland Japan Ltd.

I. Project data:

Project title:	Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects	
Registration date:	30/04/2006	
Monitoring period:	01/07/2008 to 31/03/2010 (both days included)	
Methodology:	AMS-I.D. version 07	
Annual average emission reductions:	Estimated: 47,181 tCO2e (=26,961/12*21 month)	Verified: 54,281 tCO2e
GHG reducing measure/technology:	Supply of renewable electricity to local grid (interconnected with fossil fuel dominated regional grid of India) which is generated at the hydro power plant using potential energy of water flowing through the existing canal system.	

Party	Project participants	Party considered a project participant
India	Aqua Power Private Limited (APPL)	No

II. Verification data:

Contract party:	Aqua Power Private Limited (APPL)
Turn number of periodic verification	4th periodic verification

Verification team

Role	Full name	Appointed for Sectoral Scopes	Affiliation
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III. Verification report data:

Report No.:	Current revision No.:	Date of current revision:	Date of first issue:
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Abbreviations:

APPL	Aqua Power Private Limited
BE	Baseline Emission
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CL	Clarification Requests
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
DOE	Designated Operational Entity
ER	Emission Reduction
FAR	Forward Action Request
GHG	Green house gas(es)
JMR	Joint Meter Reading
kWh	Kilo Watt hour
L	Leakage
MMTS	Meter Mobile Testing Squad
MP	Monitoring Plan
MoV	Means of Verification
MR	Monitoring Report
MW	Mega Watt
MWh	Mega Watt hour
N/A	Not applicable
NABL	National Accreditation Board for Testing and Calibration Laboratories
PDD	Project Design Document
PPA	Power Purchase Agreement
PE	Project Emission
PLF	Plant Load Factor
PP	Project Participant
PSEB	Punjab State Electricity Board
PSPCL	Punjab State Power Corporation Limited
QA/AC	Quality Assurance / Quality Control
TG	Turbo Generator
UNFCCC	United Nations Framework Convention on Climate Change
VVM	Validation Verification Manual

Verification opinion — summary

The verification team assigned by the DOE (TÜV Rheinland Japan Ltd.) concludes that the CDM Project Activity “Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects” in India, as described in the registered PDD and monitoring report (version 04, dated 28/04/2011), meets all relevant requirements of the UNFCCC for CDM project activities including article 12 of the Kyoto Protocol, the modalities and procedures for CDM (Marrakesh Accords), simplified modalities and procedures CDM and the subsequent decisions by the COP/MOP and CDM Executive Board.

This verification is carried out as a fourth periodic verification. Rules based approach has been employed to perform this verification. In the course of the verification three (3) Corrective Action Requests (CARs) and seven (7) Clarification Requests (CLs) were raised and successfully closed. One FAR has been raised in order improve upon QA/QC procedures on data management.

The verification is based on the above mentioned UNFCCC project page documents (validated PDD, applied methodologies and validation report), monitoring reports, emission reduction calculation spreadsheet, supporting documents made available by the project participant.

The project activity was correctly implemented according to the registered PDD and selected monitoring methodology and monitoring plan. The monitoring equipment was installed, calibrated, and maintained in a proper manner, while collected monitoring data allowed to verify the amount of achieved GHG emission reductions. The DOE is pleased to issue a positive verification opinion expressed in the attached Certification statement.

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1. Introduction

The Aqua Power Private Limited (APPL) has commissioned the DOE TÜV Rheinland Japan Ltd. to perform the 4th periodic verification of the CDM Project Activity "Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects" in India (hereafter "project activity" or project). The verifiers have reviewed the GHG data collected for the 4th monitoring period covering 01/07/2008 to 31/03/2010 (including both the days). This report summarises the findings of this verification of the project, performed on the basis of paragraph 62 of the CDM modalities and procedures, as well as criteria given to provide for consistent project operations, monitoring and reporting and the subsequent decisions by the CDM Executive Board. Verification is required for all registered CDM project activities intending to confirm their achieved emission reductions and proceed with request for issuance of CERs.

The 1st, 2nd and 3rd periodic verifications were carried out by another DOE (TÜV SÜD Industries Service GmbH (TÜV SÜD)) for the monitoring period covering 20/11/2004 to 31/03/2006 (including both the days), 01/04/2006 to 30/04/2007 (including both the days), 01/05/2007 to 30/06/2008 (including both the days) respectively. There was one FAR raised during the 3rd periodic verification.

1.1 Objective

The purpose of verification is to review the monitoring results and verify that monitoring methodology was implemented according to monitoring plan and monitoring data, used to confirm the reductions in anthropogenic emissions by sources is sufficient, definitive and presented in a concise and transparent manner.

In particular, monitoring plan, monitoring report and the project's compliance with relevant UNFCCC and host Party criteria are verified in order to confirm that the project has been implemented in accordance with previously registered design and conservative assumptions, as documented.

1.2 Scope

The verification of this registered project is based on the validated project design document /B04/, the monitoring report covering the monitoring period from 01/07/2008 to 31/03/2010 /P01/, /P02/, emission reduction calculation spread sheet /P03/, /P04/, supporting documents made available to the verifier and information collected through performing interviews with stakeholders and during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

On-site visit and stakeholders interviews are also performed on 16/08/2010 and 17/08/2010 as part of this verification process.

2. Methodology

The verification consists of the following four phases:

1. Making the monitoring report /P01/ publicly available (http://cdm.unfccc.int/UserManagement/FileStorage/3HZN9QW75JXRBMFIS28YLK6CVOAGTP);
2. Desk review of the monitoring plan, monitoring report, project design document and other relevant documents;
3. On-site visit (including follow-up interviews with project stakeholders, when deemed necessary) and issuance of draft verification report; and
4. Resolution of outstanding issues and the issuance of the final Verification report and Certification statement.

The following sections outline each step in more detail.

2.1 Desk review

The following tables outline the documentation reviewed during the verification:

Documents provided by the project participant(s):

Reference	Document
/P01/	Monitoring report version 01 (published before commencement of verification), dated 15/06/2010.
/P02/	Monitoring report version 04, dated 28/04/2011.
/P03/	Spread sheet corresponding to /P01/.
/P04/	Spread sheet corresponding to /P02/.
/P05/	Calibration certificates for the electricity meters (generation, auxiliary, main and check) used in the project activity covering the monitoring period.
/P06/	Copies of Joint Meter Reading (JMR) reports covering the monitoring period.
/P07/	Copies of monthly Energy Bills covering the monitoring period raised by APPL.
/P08/	• Sample copies of pages of “daily generation log books” having day wise electricity generation and auxiliary consumption meter readings and day wise net exported electricity figures and unit wise – day wise running hours recorded at the power house control room. • Proofs of peak daily generation of three sites showing 46,838 kWh (in Lohgarh site on

	18/08/2009), 54,655 kWh (in Chakbhai site on 10/09/2009), 32,978 kWh (in Sidhana site on 16/09/2009) during monitoring period.
/P09/	Spreadsheets having calculation of monthly figures of net electricity exported to grid from export and import meter readings from respective monthly JMR reports.
/P10/	Verification contract in between PP and DOE, dated 22/06/2010.
/P11/	List of all auxiliary drives corresponding to the auxiliary meter.
/P12/	Extract of operation and maintenance record of the hydro turbines.
/P13/	Log of outages.
/P14/	Single line diagram for electricity and grid connectivity within project boundary.
/P15/	Photographic evidence of grid connectivity, i.e., electricity transmission and evacuation system.
/P16/	Data capturing and QA/QC procedures, roles and responsibilities of the company personnel for the project activity.
/P17/	Proof of training and competency of the project operators.
/P18/	Copy of Consents to Operate covering the monitoring period from Punjab State Pollution Control Board.
/P19/	Proof of start of operation of the project at Lohgarh (2 MW) in October 2005, Chakbhai (2 MW) in November 2004 and Sidhana (1.20 MW) in October 2007.
/P20/	Extract of valid Power Purchase Agreement (PPA).
/P21/	Technical specifications of the hydro turbines and generators (provided by the manufacturer) of rated capacities of Lohgarh 2 MWe (1000 kW x 2 with 10% overloading), Chakbhai 2 MWe (1000 kW x 2 with 15% overloading) and Sidhana 1.20 MWe (1200 kW with 15% overloading).
/P22/	Technical specifications of the electricity meters (covering accuracy class, meter standard, model number).
/P23/	Proof of approval of multiplication factor of the installed electricity meters.
/P24/	Evidence for change in name of PP from Aqua Power Limited to Aqua Power Private Limited.
/P25/	Evidences of application letter to MMTS-PSEB/PSPCL to carry out due calibration for

	main and check meters.

Background investigation and other referred documents/websites:

Reference	Document
/B01/	Approved CDM Methodology AMS.I.D, version 07: “Renewable electricity generation for a grid”.
/B02/	Kyoto Protocol (1997).
/B03/	Decision 3/CMP.1 (Marrakesh – Accords).
/B04/	Project Design Document for CDM project: “Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects”, registered on 30/04/2006, UNFCCC project reference number 0327.
/B05/	Validation report for CDM project “Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects”, UNFCCC project reference number 0327.
/B06/	UNFCCC Validation and Verification Manual, version 1.2.
/B07/	E-mail from CDM Secretariat confirming the monitoring report /P01/ made publically available from 23/07/2010.
/B08/	UNFCCC project page of project reference number (0327): http://cdm.unfccc.int/Projects/DB/TUEV-SUED1142612177.68/view
/B09/	Websites referred • http://cdm.unfccc.int/index.html • http://www.cea.nic.in • Directory of Accredited Calibration Laboratories available on website: http://www.nabl-india.org/nabl/asp/users/documentMgmt.asp?cp=4&docType=both • http://itouchmap.com/latlong.html
/B10/	Deviation request outcome web reference: http://cdm.unfccc.int/UserManagement/FileStorage/66Q9K4AGPKO6MT4DK6GUEK53Z0U8HM EB Response: http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_J359UPI4G71PM1QMIVS81FHIEJKYFE

2.2 On-site visit and follow-up interviews with project stakeholders

In order to confirm all physical features of the project activity described in the registered PDD are in place and that the project participant has operated and correctly monitored all parameters of the registered CDM project activity as per the registered PDD, the verification team had carried out this on-visit on 16/08/2010 and 17/08/2010. 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 equipment is installed and works as anticipated.
- Assessment of any permanent changes in the project activity in comparison with the registered PDD.
- The operating staff was interviewed and observed in order to check the risks of inappropriate operation and data collection procedures.
- Information flows for generating, aggregating and reporting the selected monitored parameters were reviewed.
- The duly calibration of all metering equipment was checked.
- The monitoring processes, routines and documentations were audited to check their proper application.
- The monitoring data were checked completely.
- The data aggregation trails were checked via spot sample down to the level of the meter recordings and original recoded data.
- Identification of QA/QC procedures.

During the visit, a number of identified stakeholders were interviewed. Prior to the visit salient points to be discussed were planned. Date of interview, interviewee and points discussed are given in the following table:

Reference	Date	Name	Organization	Topic
/I-01/	16-17/08/2010	Mr. Pushpinder Singh	Consultant, APPL	Plant details and Monitoring Plan; Implementation and Management Review; Training and competency developments; Assessment of monitoring and QA/QC procedures.
/I-01/	16-17/08/2010	Mr. Anil Jagga	Plant Manager, APPL	Power plant operation and monitoring of data; Data collection and archiving procedures; Calibration of monitoring instruments; Data trail till the reported values; Outage time analysis; Data archiving and estimation of emission reduction.
/I-01/	17/08/2010	Mr. Gurinpiar Singh, Mr. Sanjeev Kumar, Mr. Harjit Singh,	Plant Shift Supervisors, APPL	Plant operation, Data capturing and recording procedure.

		Mr. Dharminder Pal Singh		
/I-01/	17/08/2010	Mr. Narender Singh	Senior Electrician, APPL	Plant operation and maintenance.
/I-02/	19/08/2010	Mr. Sukhwinder Singh	Senior Executive Engineer, PSPCL	JMR procedures

2.3 Resolution of outstanding issues

The objective of this phase of the verification is to resolve any outstanding issues which have to be clarified prior to final DOE's conclusions on the project implementation, monitoring practices and achieved emission reductions. In order to ensure transparency a verification protocol is completed for the project activity. The protocol shows in transparent manner criteria (requirements), means of verification and resulting statements on verification actual project activity against identified criteria.

The verification protocol serves the following purposes:

- It organises in a table form, details and clarifies the requirements, which CDM project is expected to meet;
- It ensures a transparent verification process where the DOE will document how a particular requirement has been verified and the result of the verification.

The verification protocol consists of two tables. Table 1 reflects the verification requirements and reference to the materials used to verify the project activity against those requirements, as well as means of verification. Table 2 reflects the responses provided by the PP (s) including the references of changes in the MR or supporting spreadsheets; the opinion of the DOE on every particular responses. The completed verification protocol for this project is enclosed in Appendix A to this report.

Findings during the verification can be interpreted as a non-compliance with CDM criteria or a risk to the compliance. 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 (CLs) are raised, if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

2.4 Internal quality control

The verification report has passed a technical review before being submitted to the project participant(s). The technical review was performed by a technical reviewer qualified in accordance with TÜV Rheinland's qualification scheme for CDM validation and verification.

3. Verification findings

The findings of the verification are described in the following sections. The verification criteria (requirements), the means of verification and the results of validation are documented in detail in the verification protocol in Appendix A.

3.1 Project implementation

3.1.1 The implementation of the project activity

The project activity involves renewable electricity generation by 5.2 MW hydro electric plant of run-of-canal type and supply of electricity to Punjab State Electricity Board (PSEB) in the Punjab state of India. The project plant consists of three (3) sites viz. Lohgarh, Chakbhai and Sidhana with installed capacities of 2.0 MW (=2 x 1,000 kW), 2.0 MW (=2 x 1,000 kW) and 1.2 MW (=1 x 1,200 kW) respectively. The GPS coordinates in degrees, minutes and seconds as incorporated in the MR were cross checked with /B09/ and found to be correct.

Electricity generation and supply to NEWNE grid (formerly it was northern regional grid which is now interconnected with NEWNE grid) is enabled through independent transmission lines for the project /P15/. After implementation and commissioning of the project technology, no changes have been carried out or are envisaged. The same has been confirmed from the registered PDD /B04/, on-site visit /I-01/ /I-02/ and past three verification reports available on UNFCCC website /B08/.

The on grid supply of the renewable electricity from project activity results in reduction of GHG emissions by displacing grid power dominated with fossil fuels based electricity generation. The equipment and facilities consisting of generators coupled with vertical full Kaplan turbines, forebay, mechanical intake gates, trash racks, draft tubes, powerhouses with discharge channels and power transformers were verified to be as described in the PDD.

The crediting period start date for the project activity is 20/11/2004 and the commissioning dates for Lohgarh, Chakbhai and Sidhana sites are October 2005, November 2004 and October 2007 respectively. Hence the crediting period start date is after the commissioning of one of the project sites. The project activity is operational as described in the registered PDD

/B04/ and the third verification period was over on 30/06/2008. The fourth monitoring period is from 01/07/2008 to 31/03/2010 /P02/. The site specific details are provided in the below table:

Parameter	Site		
	Lohgarh	**Chakbhai**	**Sidhana**
Rated Power generation capacity	2 MW (=2x1,000 kW)	2 MW (=2x1,000 kW)	1.2 MW (=1x1,200 kW)
Turbine	2 numbers of vertical full Kaplan turbine; Make : Boving Fouress	2 numbers of vertical full Kaplan turbine; Make : Boving Fouress	1 number of vertical full Kaplan turbine; Make : Boving Fouress
Generator	2 numbers of synchronous generators; Make : Marelli Motori	2 numbers of synchronous generators; Make : Marelli Motori	1 number of synchronous generator; Make : Marelli Motori
Generation voltage	6.6 kV	6.6 kV	6.6 kV
Step-up voltage	11 kV	11 kV	11 kV

The project activity has been implemented as planned. The commissioning dates of projects, as mentioned in the table above, have been verified to be the commercial power generation dates from the evidences provided by the PP /P19/. The operation of the project activity complies with all statutory requirements /P18/.

The project's emission reductions are determined as the product of the net electricity supplied to the NEWNE grid by the project and the validated ex-ante (fixed as per the validation report section 3.3.1 /B05/) grid emission factor of 0.942 kg of CO_2 /kWh during the crediting period. As the turbines run exclusively with hydro energy without any usage of fossil fuel, there are no project emissions associated with the project. Leakage is considered to be zero as per the applied methodology. The same was also confirmed during on-site visit.

The gross electricity generation from the power plants is measured through the cumulative type online gross generation meters which are installed in the respective power plant control rooms. All auxiliaries of the power plant are connected to the respective auxiliary meters as verified from the single line diagram of the electricity system /P22/. Main meters are installed at the respective project sites (after 6.6 kV/11kV transformer) for measuring the export and import electricity, the difference of which gives net electricity supplied to the grid. Check meters are installed at the respective PSEB sub stations of the projects. The Joint Meter Readings (JMRs) /P06/ are recorded once in the first week of every month, jointly by the

representatives of PSEB and APPL for all the three (3) sites separately. Main meters are the basis for billing and emission reduction calculation purpose as per the registered PDD.

During on-site visit, verification team verified the actual implementation of the project as described in the PDD and detailed verification of all data contained in the monitoring report was performed. The instruments for measuring electricity (gross electricity generation, auxiliary consumption and export - import electricity meters) and the calibration records /P05/ for these meters were checked and found to be in accordance with the registered monitoring plan of the PDD and are periodically calibrated /P05/ by authorised agencies.
Details of the main meters in service for this monitoring period at the three (3) sites are as given in the table below:

	Lohgarh		Chakbhai		Sidhana
	Unit I	Unit II	Unit I	Unit II	Unit I
Main meter					
Manufacturer	Larson & Tubro		Larson & Tubro		Larson & Tubro
Model	ER 300P		ER 300P		ER 300P
Serial number of Meter	04223075		04187462		05271089
Accuracy Class	0.5s		0.5s		0.5s

Data variables those are most directly related to the emission reductions (i.e. electricity export and import figures) are measured continuously and data element that is generally constant and indirectly related to the emission reductions (i.e. grid emission factor) has been determined and fixed ex-ante for the whole crediting period, thereby complying the requirements of para 17 (b) of “General guidelines to SSC CDM methodologies”, version 15. The plant outages have been recorded and verified to be correctly reported for this monitoring period.

The whole calculation of emission reductions are found correct and having no material misstatement. The net saleable energy values reported in the MR /P02/, included in the CER spread sheet /P04/, the compiled data of daily recording at project site /P08/, the figures in JMRs /P06/ and energy bills /P07/ are found internally and mutually consistent.

Based on above assessment, verification team confirms that no change in the project design has happened during the implementation and operation of the project activity. This also confirms to §178 (a) and §178(c) of VVM /B06/.

In accordance with § 182 of VVM /B06/ the verification team reviewed the registered PDD, including the monitoring plan and the corresponding validation report, previous verification reports, the applied monitoring methodology, relevant decisions from the CMP and the CDM

EB and found that the MR for this monitoring period is line with all the above mentioned documents.

Nevertheless, CL-01 was raised and successfully closed (refer Table 2 for more details).

3.1.2 The actual operation of the CDM project activity

The project activity comprises of operation of three (3) sites i.e., Lohgarh - 2 MW, Chakbhai – 2 MW and Sidhana 1.2 MW. The operation of the project activity was verified from the daily log sheets /P08/ and monthly JMRs /P06/. The voltage at the generator terminals is 6.6 kV at each of three (3) sites, which is stepped-up to 11 kV to match the nearest PSEB substation voltage level.

During this reported monitoring period the net electricity exported (derived as the difference of metered export and import electricity figures) by the project activity to the grid is 57.669 million kWh. The metering system consists of one main meter and one check meter of same make and specification for continuous two way measurement of export and import electricity. The monthly readings of export and import electricity, from main and check meters in the first week of every month were taken and recoded in the JMRs, which are certified by PSEB. The corresponding electricity figures (in kWh) are calculated by multiplying the multiplication factor with the meter reading difference. These net electricity figures derived from main meter readings (in JMRs) are used as basis for preparation of energy bills and as well as for CER calculation. The project's emission reductions are determined as the product of the net electricity supplied to the NEWNE grid by the project and the validated ex-ante (fixed as per the validation report) grid emission coefficient of 0.942 kg CO2 per kWh during the crediting period.

3.1.3 The assessment of the impact of change in project design

As described in the section 3.1.1 and 3.1.2 of this report above, the project activity has been implemented and operated with the physical features as described in the registered PDD. Hence submission of validation opinion / notification of changes along with documentation (in line with Annex-66 and Annex-67 of EB 48) are not sought.

3.2 Compliance of the monitoring plan with the monitoring methodology

The project is grid connected renewable power generation project with installed capacity of 5.2 MW. The monitoring plan and the monitoring system implemented are in compliance to the applied monitoring methodology AMS I.D, version 07.

All other requirements of the applied methodology are met. Furthermore, it can be confirmed that the ex-ante value for grid emission factor (EF) sourced from CEA data base has been correctly applied in the calculation of emission reductions.

3.3 Compliance of the monitoring with PDD and monitoring plan

The submitted revised MR /P02/, which forms the basis of the verification statement, was prepared by summarizing consolidated daily and monthly data over the whole monitoring period in accordance with the monitoring plan of the registered PDD. The monitoring system and all applied procedures are completely in compliance with the registered monitoring plan.

3.3.1 Monitored parameters

During the verification all relevant monitoring parameters (as listed in section D.3 of the PDD) have been verified with regard to the appropriateness of the verification method, the correctness of the values applied for ER calculation, the accuracy and applied QA/QC measures. The results as well as the verification procedure are described parameter-wise in the section 4 of Table 1 of the verification protocol. After appropriate corrections, carried out by the project participant, it is confirmed that all monitoring parameters have been measured / determined without material misstatements and are in line with all applicable standards and relevant requirements.

Particulars of the monitoring parameters	Verifier Comments
Energy Exported: Energy Exported to the grid	"Energy Exported" is the electricity exported to the NEWNE grid for this monitoring period
Data unit – kWh	The unit is as per the registered PDD.
Frequency of recording	Continuous measurement and monthly recording.
Source of data/ means of (cross) verification	Monthly Joint Meter Reading records /P06/ and cross checked with Monthly energy sales bills /P07/.
Reported value in the MR /P02/	57,712,364
Measuring equipment details	Bidirectional Tri -Vector meters of 0.5s accuracy are used for measurement of this parameter. The energy meters are supplied by a reputed manufacturer (L&T) /P22/.
Calibration	The installed energy meters are calibrated every six months by MMTS (MMTS-PSEB), a division of PSEB. PSEB is statutory body under the Indian Electricity Act 1948 and owned by the Government of Punjab and hence deemed to be competent. The calibration certificates are verified and found OK. However, recalibration was delayed beyond the period of six months and the calibration dates and meter serial numbers were not mentioned correctly in the hosted MR. In this context CAR-01, CL-03 and CL-04 were

	raised and successfully closed (refer table 2 of this report).
QA/QC measures	Power exported by the project, which is data source for CER calculation, is estimated from the monthly reports (=JMRs /P06/). The readings are cross checked with energy bills raised to PSEB for electricity exported to the grid /P09/.

Particulars of the monitoring parameters	**Verifier Comments**
Energy Imported: Energy Imported from the grid	"Energy Imported" is the electricity imported from the NEWNE grid for this monitoring period.
Data unit – kWh	The unit is as per the registered PDD.
Frequency of recording	Continuous measurement and monthly recording.
Source of data/ means of (cross) verification	Monthly Joint Meter Reading records /P06/ and cross checked with Monthly energy sales bills /P07/.
Reported value in the MR /P02/	43,218
Measuring equipment details	Bidirectional Tri -Vector Meters Tri-vector meters of 0.5s accuracy are used for measurement of this parameter. The energy meters are supplied by a reputed manufacturer (L&T) /P22/.
Calibration	The installed energy meters are calibrated every six months by MMTS (MMTS-PSEB), a division of PSEB. PSEB is statutory body under the Indian Electricity Act 1948 and owned by the Government of Punjab and hence deemed to be competent. The calibration certificates are verified and found OK. However, recalibration was delayed beyond the period of six months and the calibration dates and meter serial numbers were not mentioned correctly in the hosted MR. In this context CAR-01, CL-03 and CL-04 were raised and successfully closed (refer table 2 of this report).
QA/QC measures	Power imported by the project, which is data source for CER calculation, is estimated from the monthly reports (=JMRs /P06/). The readings are cross checked with energy bills raised to PSEB for electricity imported from the grid /P09/.

Particulars of the monitoring	**Verifier Comments**

parameters	
Net Saleable Energy: Net saleable energy to the grid	"Net Saleable Energy" is the net electricity exported to the grid by the project activity (=difference of measured values of export and import electricity) for this monitoring period.
Data unit – kWh	The unit is as per the registered PDD.
Frequency of recording	Calculated from monthly recorded export and import values of electricity.
Source of data/ means of (cross) verification	Monthly Joint Meter Reading records /P06/ and cross checked with Monthly energy sales bills /P07/.
Reported value in the /P02/	57,669,146
Measuring equipment details	This value is arrived by deducting the grid electricity import from the grid electricity export.
Calibration	Not applicable
QA/QC measures	Power exported by the project, which is data source for CER calculation, is taken from the monthly reports (=JMRs /P06/). The readings are cross checked with the monthly energy sales bills /P07/.

Particulars of the monitoring parameters	Verifier Comments
Energy Generated: Gross energy generated	"Energy Generated" is the electricity generated by individual turbine.
Data unit – kWh	The unit is as per the registered PDD.
Frequency of recording	Continuous measurement and hourly recording.
Source of data/ means of (cross) verification	Daily Log sheet books /P08/ and cross checked with spreadsheet values in daily electricity generation /P09/.
Reported value in the /P02/	59,340,258
Measuring equipment details	<table><tr><th></th><th colspan="2">Lohgarh</th><th colspan="2">Chakbhai</th><th>Sidhana</th></tr><tr><th></th><th>Unit I</th><th>Unit II</th><th>Unit I</th><th>Unit II</th><th>Unit I</th></tr><tr><td>Manufacturer</td><td colspan="2">Minsun</td><td colspan="2">Minsun</td><td>Enercon</td></tr><tr><td>Accuracy Class</td><td colspan="2">1s</td><td colspan="2">1s</td><td>0.5s</td></tr></table>
Calibration	The installed energy meters have been calibrated every six months by Balaji Control, who is accredited and registered by National Accreditation Board for Testing and Calibration Laboratories (NABL), Govt. Of India, to do the calibration of energy meters and hence deemed to be competent. The calibration certificates are verified and found OK. However, the calibration dates as mentioned in the MR /P01/ were incorrect. In this context CL-03 was

	raised and successfully closed (refer table 2 of this report).
QA/QC measures	Gross energy generation meter readings are recorded by the shift supervisor in the daily log sheet which are counter signed by the plant site supervisor.

Particulars of the monitoring parameters	**Verifier Comments**
Auxiliary Energy consumption: Auxiliary Energy consumption	**"**Auxiliary Energy consumption**"** is the energy-electricity consumed by the plant machinery in order to operate the plant.
Data unit – kWh	The unit is as per the registered PDD.
Frequency of recording	Continuous measurement and monthly recording.
Source of data/ means of (cross) verification	Monthly Joint Meter Reading records /P06/ and cross checked with Monthly energy sales bills /P07/.
Reported value in the /P02/	802,815
Measuring equipment details	<table><tr><th></th><th>Lohgarh</th><th>Chakbhai</th><th>Sidhana</th></tr><tr><td>Manufacturer</td><td>Enercon</td><td>Enercon</td><td>Enercon</td></tr><tr><td>Accuracy Class</td><td>0.5s</td><td>0.5s</td><td>0.5s</td></tr></table>
Calibration	The installed energy meters have been calibrated every six months by Balaji Control, who is accredited and registered by National Accreditation Board for Testing and Calibration Laboratories (NABL), Govt. Of India, to do the calibration of energy meters and hence deemed to be competent. The calibration certificates are verified and found OK. However, the calibration dates as mentioned in the MR /P01/ were incorrect and accuracy class mentioned also were incorrect. In this context CL-03 and CL-05 were raised and successfully closed (refer table 2 of this report).
QA/QC measures	Auxiliary energy consumption meter readings are recorded by the shift supervisor in the daily log sheet which is counter signed by the plant site supervisor.

The grid emission factor (EF) is determined ex-ante and considered as fixed for the crediting period. Its value is as tabulated below:

Parameter	Value	Reference
Grid Emission Factor (EF) for the Northern Regional Grid	0.942 kg CO2/kWh	Validation report /B05/

3.3.2 Information flow

As required by § 206 of VVM, verification team has checked information flow (from data generation, aggregation, to recording, calculation and reporting) for each parameter including the values used for the emission reduction calculation from the project which is mentioned below:

Gross electricity generation: Energy generation by the individual turbines at all the three sites is measured by the respective energy meter on continuous basis. Hourly readings (in MWh) are noted down by the Plant Shift Supervisor in the daily log sheet book /P08/. At the end of the day at 8:00 AM daily, the day wise electricity generation is calculated as the difference of 9:00 AM reading of the previous day and the 8:00 AM reading of the current day and recorded in kWh /P08/.

Auxiliary electricity consumption: Each site has one auxiliary meter which continuously monitors the electricity consumption in the plant by auxiliary components. The auxiliary consumption is recorded hourly by the shift supervisor in the daily log sheet book /P08/. Hourly readings are aggregated to give daily auxiliary consumption.

Export / Import electricity: Each site has one main meter installed (after step-up transformer) by PSEB to measure export and import of electricity by the plant on continuous basis. In the first week of every month (on a suitable date to the PP and PSEB), Joint Meter Readings (for export and import electricity) are recorded /P06/ (i.e. previous months opening reading and current month closing reading). The Joint Meters Readings are signed by PP, Executive Engineer (Punjab State Power Corporation Limited) and a representative from Billing Department of PSEB /P06/. The difference of export and import of electricity is the net electricity supplied to the grid for the respective month and this is the basis for raising invoice to PSEB by the PP /P07/ and also for the ER calculations /P04/.

Please refer to section 3.1.2, 3.3.1 and table 1(section 4) of the report for further details. The verification team hereby confirms that there is no material misstatement in the calculation of reported emission reductions.

For the assessment of data and calculation of greenhouse gas emission reductions, section 3.4 of this report can be referred.

3.3.3 Monitoring responsibility

The shift supervisor is responsible for the data recording and maintains the daily recorded data. The plant shift supervisor verifies the recorded data and counter signs the same. The recoded data flows through the assistant plant manager to plant manager to general manager and finally to the managing director. JMRs are generated based on the monthly

electricity generation and import. Finance department confirms the data from the data received from the plant.

The monitoring personnel of APPL are well trained and have the necessary competence to carry out the relevant tasks with sufficient accuracy. Based on the data recording procedures and on-site visit, it is confirmed that the management system for monitoring plan of the CDM project is in place with responsibilities properly identified.

However, the QA/QC of reported data management is not proper and resulting in the issuance of FAR-01 (refer to closure of CAR-02 and CL-02). The same shall be verified in the next verification period.

3.3.4 Accuracy of measuring equipment

Details of the main meters, energy generation meters and auxiliary meters in service during this monitoring period, for all three sites with respect to manufacturer, model, meter serial number and accuracy class is provided in the table below:

	Lohgarh		Chakbhai		Sidhana
	Unit I	Unit II	Unit I	Unit II	Unit I
Main meter					
Manufacturer	Larson & Tubro		Larson & Tubro		Larson & Tubro
Model	ER 300P		ER 300P		ER 300P
Meter Serial Number	04223075		04187462		05271089
Accuracy Class	0.5s		0.5s		0.5s
Period of meter in service beyond the due date of calibration	16/01/2009 to 18/03/2009 20/02/2010 to 22/02/2010		20/12/2008 to 24/01/2009		01/07/2008 to 19/08/2008, 19/02/2009 to 09/03/2009 09/03/2010 to 20/03/2010
Energy Generation Meter					
Manufacturer	Minsun	Minsun	Minsun	Minsun	Enercon
Model	MSDP-882	MSDP-882	MSDP-882	MSDP-882	EM 6400
Meter Serial Number	6851013	68B0512	6851001	6790517	66927/3665 - 0605
Accuracy Class	1%	1%	1%	1%	0.5s
Auxiliary Meter					
Manufacturer	Enercon		Enercon		Enercon
Model	EM 6400		EM 6400		EM 6400
Meter Serial Number	56248/1285-3404		E64/1640-903		66927/3667-0605 (from 01/07/2008 to 20/12/2008) and 148153/ 13538 –

			1608 (from 20/12/2008 to 31/03/2010)
Accuracy Class	0.5s	0.5s	0.5s

The calibration certificates of the energy meters used during this monitoring period were verified during the on-site visit. The verifying team confirms that the electricity meters confirm to national standards and are (re)calibrated according to the national standards at the intervals (< 3 years), thereby complying the requirements of paragraph 17 (c) of "General guidelines to SSC CDM methodologies", version 14.1.

Nevertheless, the recalibration of the main and check meters was not done in the stipulated 6 months frequency during this monitoring period for some periods. PP had applied for calibration of the main and check energy meters within the due dates of 6 months for calibration /P25/. However, state electricity board has recalibrated these meters with some delays. As the project proponent had sent applications for recalibration, to PSEB before the due date of meter calibration. As PP has no authority over the Government agency for calibration (=beyond the control of PP), DOE has accepted the approach with a deduction based on the maximum inaccuracy specification of the meters as per the EB guidance for the delayed calibration months, Annex 60, EB 52 and also in line with the deviation request response by EB to this project activity /B10/. CAR-01 was raised for applying the maximum inaccuracy specification for the months during which the meters were in service beyond the due dates of calibration and successfully closed.

3.3.5 Deviation from and Revision of the registered monitoring plan

As the registered monitoring plan is in accordance with the approved monitoring methodology; the actual monitoring systems and procedures comply with the monitoring plan; data for all monitoring parameters are available and reported; (Cp § 206 of VVM); no delayed installation / operation of monitoring equipment is observed (Cp para 57 of EB 43); the need of requesting deviation or revision of MP is not sought.

3.4 Assessment of data and calculation of greenhouse gas emission reductions

The calculations and applied formulae and method for calculation of baseline emission are in accordance with the registered monitoring plan and are in line with the requirements of the applied methodology (AMS I.D, Version 07). The formulae and the methods referred in the MR and the spread sheet for estimation of emission reduction comply with the methods described in the registered PDD (section E).

The calculation of emission reductions is based on subtracting project emissions and leakage from the baseline emissions. As the turbines run exclusively with hydro energy without any usage of fossil fuel, the project emissions are considered as zero. Leakage is considered to

be zero as per applied methodology and PDD /B04/. For the calculation of baseline emissions the ex-ante and validated fixed value of baseline parameters, i.e. Northern Regional Grid Emission Factor (subsequently amalgamated to NEWNE grid) is taken into account.

Baseline Emissions:

The formula used for the determination of baseline emissions which is line with the PDD section E:

Baseline Emissions (tCO2/yr) = [Emission Coefficient (EFy) (kg CO_2/kWh) X Net Saleable Energy (kWh)] / 1000

The grid emission factor is taken as 0.942 kg CO_2/kWh as per the value mentioned in section B.5 of registered PDD (Cp. Page 20).

The net electricity exported to the grid for the period 01/07/2008 to 31/03/2010, (both days included) is 57,669,146 kWh.

Deduction due to delayed calibration:

As per guidance provided in para 4(a) of "Guideline of assessing compliance with the calibration frequency requirements", Annex 60, EB 52 and with the reference to the deviation request made by the PP, EB has provided the project specific guidance applicable to the project activity /B10/. The same was also confirmed from the second verification report (Cp page 12 of the second verification report) by the verification team. Accordingly the maximum inaccuracy specification of meters has been conservatively applied such that the adjusted measured values resulting in lower baseline emissions (electricity export) and higher project emissions (electricity import) respectively:

1) Lohgarh: For the month of January, February and March in 2009 and February 2010, a discount of 0.50 % on the main meter (of serial number 04223075) has been applied on the energy exported and imported.
2) Chakbhai: For the month of December 2008 and January 2009, a discount of 0.50 % on the main meter (of serial number 04187462) has been applied on the energy exported and imported.
3) Sidhana: For the month of July and August in 2008; February and March in 2009 and March 2010, a discount of 0.50 % on the main meter (of serial number 05271089) has been applied on the energy exported and imported.

The corrected energy exported to the grid, for this monitoring period, works out to be 57,666,722 kWh and corrected energy imported from grid works out to be 43,257 kWh.

Thus the corrected net energy exported to the grid is 57,623,465 kWh.

Hence the corrected baseline emission for this monitoring period works out as 54,281 tCO_2e.

The calibration reports /P05/ covering this monitoring period of all the meters, the JMR /P06/ for the monitoring period and the emission reduction spreadsheet /P04/ have been verified and found to be OK.

Project Emissions:

As the turbines run exclusively with hydro potential without any usage of fossil fuel, the project emissions are considered as zero.

Leakage:

In accordance with AMS I.D. version 7 para 8, as no transfer of equipment has been carried out in the project, no leakage estimation is required.

An ER calculation was prepared by the PP and presented to the verification team /P02/. It is confirmed that the ER calculation is overall correct. The total emission reductions during the monitoring period are 54,281 tCO_2e.

The project is a canal based hydropower generation plant. The actual net export of electricity during this monitoring period was 15.05% higher than the estimated value in the PDD. This was mainly due to higher natural availability of water flow in the canal which resulted in higher electricity generation followed by export to grid. Moreover, this monitoring period covered two Indian rainy seasons [1] (July 2008 to September 2008 and June 2009 to September 2009). Hence this resulted increase in the electricity output is beyond the control of the PP (Cp paragraph 198 (C) of VVM version 1.2).

The over (than estimated in the PDD) generation of electricity has resulted in the increase of 7,100 CERs in comparison to the estimated CERs in the PDD for this monitoring period (=21 months). Nevertheless, the peak daily generations /P08/ out of the monitored data for this monitoring period has not crossed the technically possible maximum generation value corresponding to respective over rated capacities /P21/ of the respective turbo generators i.e. 110% of the rated capacities of 2000 kW for Lohgarh site, 115% of the rated capacities of 2000 kW for Chakbhai site and 115% of the rated capacity of 1200 kW for Sidhana site /P21/.

Moreover, in the context of “General Guidelines to SSC CDM methodologies” para 3. (a) (ii), the activity level of this project activity did not cross the limit of Type I (within 15 MWe) during this monitoring period. Hence the reported emission reductions deem acceptable to the verification team.

No significant reporting risks have been identified for the data reported. The operational procedures for training, emergency preparedness, maintenance and calibration of monitoring equipments, monitoring measurements and reporting, record handling and maintenance, reviewing monitored data, project performance reviews and corrective actions are available at the plant. All the monitored data are archived in electronic form. The data will be kept for the whole crediting period and additional 2 years thereby meeting the requirement of the

[1] http://www.imd.gov.in/section/climate/jun-sep-rainfall.htm

PDD and also complying the requirements of para 17 (a) of “General guidelines to SSC CDM methodologies”.

Nevertheless, CL-06, CAR-01 and CAR-02 were raised and successfully closed (refer Table 2 for more details).

The closure of all the CARs and CLs resulted in change of net ER from 54,297 t CO_2e /P01/ to 54,281 t CO2e /P02/.

Verified emission in this monitoring period:

Project emissions 00 t CO_2 equivalents

Baseline emissions 54,281 t CO_2 equivalents

Emission reductions 54,281 t CO_2 equivalents

3.5 Issues remaining from the validation and previous verification period (s)

All raised CARs and CLs were successfully closed during the previous verifications and validation of the project design. This verification has been carried out based on the previous verifications, final registered PDD and CDM-UNFCCC Project registration sheet /B08/.

Consideration of FAR $_{3rd\ ver}$ 1, raised by the DOE during the 3rd periodic verification:

FAR $_{3rd\ ver}$ 1			
Findings	**Initial Response (as per previous verification report)**	**Evidence of Compliance**	**Conclusion**
Though main meter has not been changed in any of the sites of project activity, main, check, gross and auxiliary meters are needed to be calibrated in six month frequency to ensure the accuracy of the data measurement in the event of failure of any meter.	The requirement will be met in future.	During the on-site visit respective calibration certificates /P05/ were verified which covered the six month frequency as mentioned in the monitoring plan of the registered PDD /B04/ and also in the FAR raised during the periodic third verification. In compliance to the FAR raised during the 3rd verification, PP had informed the PSEB (authorised government agency to carry out the calibration) in advance for calibration of the main and check meters /P25/. But PSEB could not perform the same	In consequence to the FAR raised during the 3rd verification period, PP had applied for calibration of the main and check energy meters within the due dates of 6 months for calibration /P25/. However, state electricity board has calibrated these meters with some delays (Refer to section 3.3.4 of this report). As the project proponent sent an application for calibration to state electricity board before the due date of meter calibration and PP has no authority over the Government agency for calibration, DOE has accepted the approach with a deduction based on the maximum

		in the stipulated time despite the applications. Hence this non compliance was beyond the control of the PP. However, lapse in the calibration frequency of the main meter for the months of January, February, March-2009 and February-2010 for Lohgarh site; December 2008 and January 2009 for Chakbhai site' July and August in 2008, Feb and March in 2009 and March 2010 for Sidhana site resulted into the application of maximum inaccuracy specification for export and import calculation hence demonstrating the conservative approach for Emission Reduction calculation for the said months as per the guidance provided by the EB for this specific project activity /B10/ and also in line with Annex 60 of EB 52.	inaccuracy specification of the meters as per the EB guidance for the delayed calibration months, Annex 60, EB 52 and also in line with the deviation request response by EB to this project activity /B10/. As per para 190(c) of VVM, CAR-03 was raised in this respect and successfully closed. This resulted in the reduction of CER from 54,297 tCO2e /P01/ to 54,281 tCO2e /P02/. This FAR was successfully closed in this verification. (Cp Para 221 (f) of VVM).

Appendix A

CDM Verification protocol

Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects

in

INDIA

Report No. 01 997 9105060712

Table 1: Verification requirements (based on §56, §57 and §62 of the CDM Modalities and Procedures and on CDM Validation and Verification Manual, Annex 1 of EB 55)					
Checklist question	**Ref.**	**MoV[2]**	**Findings, comments, references, data sources**	**Draft conclusion**	**Final Conclusion**
1. Implementation					
1.1 Have all physical features proposed in the registered PDD been implemented at the project site?	/P01/ /P21/ /P15/ /P22/ /B04/ /I01/ /I02/	DR, I	All the physical features (technology, project equipment, grid connectivity and monitoring equipment) mentioned in the registered PDD have been implemented at the project site. This was verified during on-site visit via name plate verification of all equipment. There is no change of project design with respect to registered PDD. However, PP needs to include capacities of each turbine in the revised MR. In this context CL-01is raised.	~~CL-01~~	OK
1.2 Has the project activity been operated in accordance with the project scenario described in the registered PDD and relevant guidance? Reference: <http://cdm.unfccc.int/EB/033/eb33rep.pdf>, §75	/P01/ /P02/ /P05/ /P22/ /B04/	DR, I	The installed equipments were operated as described in the registered PDD with the changes of electricity meters. The serial number of the Auxiliary meter for Sidhana site has been incorrectly mentioned as 148153/13538-608 instead of 148153/13538-1608 in section D.2 of the MR. Moreover, during the on-site visit it was observed that this meter was replaced on 20/12/08 by meter serial no. 66927/367-0605. The change of meter is not reflected	~~CL-02~~	OK

[2] MoV = Means of Verification, DR = Document Review, I = Interview, www = internet search.

			in the MR. In these contexts, CL-01 is raised.		
1.3 If the project activity is implemented on a number of different locations, has the Monitoring report provided the verifiable starting dates for each site?	/P01/ /P06/ /P07/ /P08/ /B04/ /I-01/	DR, I	The project activity is implemented at three different locations – Lohgarh, Chakbhai and Sidhana. The start dates for the monitoring period were verified for each location by verifying JMRs, Energy bills for the respective months and daily generation log books for each location.	OK	
2. Monitoring plan and methodology					
2.1 Is the monitoring plan established in accordance with the monitoring methodology?	/B01/ /B04/ /B05/	DR	Yes, the monitoring plan as described in section D of the PDD is in accordance with the monitoring methodology.	OK	
2.2 In case the implemented monitoring plan differs from the monitoring methodology, has any requests for revision to or deviation from the monitoring methodology been officially communicated to the CDM EB? Reference: <http://cdm.unfccc.int/EB/033/eb33rep.pdf>, §84, §58	/B01/ /B04/ /B05/ /B08/ /B09/	DR	Not applicable.	-	-
2.2.1 Have the above changes to the monitoring plan been approved by the CDM EB?	/B01/ /B04/ /B08/	DR	Not applicable.	-	-
3. Monitoring and the monitoring plan					

3.1 Is monitoring established in full compliance with the monitoring plan, contained in the registered PDD (or new monitoring plan approved by the CDM EB)?	/P01/ /B01/ /B04/ /B05/ /B08/	DR	Yes, the monitoring of the parameters is established in full compliance with the monitoring plan, contained in the registered PDD.	OK	
3.2 Are all baseline emission parameters monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions?	/P01/ /B01/ /B04/ /B05/ /B08/ /B09/	DR	The reporting is in line with the requirements of the applied methodology which requires that the net electricity generated by the renewable energy. The electricity parameter of the baseline emission parameters was monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions. The baseline emissions is the direct product of electricity baseline emission factor and net electricity generated by the project activity which is equal to net power exported by the project activity	OK	
3.2.1 Was the monitoring equipment for baseline emission parameters controlled and monitoring results recorded as per approved frequency?	/P01/ /P06/ /P07/ /P08/ /P09/ /B04/ /I-01/	DR, I	The main meter is the basis the JMR and invoice to respective JMR is done through the data obtained from these meters. The ER calculations are also done through the received data from these meters. Net Electricity Export readings are recorded in the monthly JMR. The daily electricity generation and auxiliary consumption readings are taken on hourly basis in the daily log sheet book as per the registered monitoring plan which was verified during the site visit by the DOE.	OK	

3.2.2 Was the monitoring equipment for baseline emission parameters calibrated in accordance with QA&QC procedures described in the registered monitoring plan?	/P01/ /P05/ /B04/ /B08/ /B09/	DR, I	All the electricity meters used during this monitoring period were calibrated in accordance with the registered monitoring plan (Cp section D.4 of the PDD). However, incorrect calibration validity periods are provided in section D.2 of the MR and the requirements of assessment of the calibration frequency as specified in Annex 60 of EB 52 has not been fully complied. In this context, CAR-01 and CL-02 are raised.	~~CAR-01 CL-03~~	OK
3.3 Are all project emission parameters monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions?	/P01/ /B01/ /B04/ /I-01/	DR, I	No project emissions are projected as per registered PDD and meth. The same was also reconfirmed during the on-site visit.	OK	
3.3.1 Was the monitoring equipment for project emission parameters controlled and monitoring results recorded as per approved frequency?	-	DR	See above comment	-	-
3.3.2 Was the monitoring equipment for project emission parameters calibrated in accordance with QA&QC procedures described in the registered monitoring plan?	-	DR	See above comment	-	-
3.4 Are all leakage emission parameters monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions?	/P01/ /B01/ /B04/ /I-01/	DR, I	No leakage is projected as per registered PDD and meth. The same was also reconfirmed during the on-site visit.	OK	
3.4.1 Was the monitoring equipment for leakage emission parameters controlled and monitoring results recorded as per approved frequency?	-	DR	Same as above	-	-

3.4.2 Was the monitoring equipment for leakage emission parameters calibrated in accordance with QA&QC procedures described in the registered monitoring plan?	-	DR	Same as above	-	-
3.5 Were all monitoring parameters available and verifiable through the whole monitoring period?	/P01/ /P06/ /P07/ /P08/ /P09/ /P12/ /P13/ /I-01/	DR, I	The daily and monthly electricity generation and auxiliary consumption meter readings are recorded in the daily generation log book at power house. The monthly export and import electricity figures are recorded in the monthly JMR reports prepared by PSEB. The corresponding monthly energy bills confirm the monthly electricity figures in the JMRs. All the electricity meter readings and the electricity figures in the reported monitoring period could be verified through JMRs and invoices raised for the respective JMRs. PP needs to provide correct serial numbers of the main meters for export and import of electricity, as displayed in the respective meters (i.e. 04223075 and 04187462 for Lohgarh and Chakbhai respectively) in the revised MR.	~~CL 04~~	OK
3.5.1 In case, only partial monitoring data is available and PP(s) provide estimations or assumptions for the rest of data, was it possible to verify those estimations and assumptions? Reference: <http://cdm.unfccc.int/EB/026/eb26rep.pdf>, §109(b)	/P01/ /P06/ /P07/ /P08/ /B04/	DR	Not applicable	OK	

3.6 Was management and operation system established and operated in accordance with the monitoring plan?	/P01/ /P16/ /P17/ /B04/ /I-01/	DR, I	QA/QC procedures for cross checking the electricity exported to the grid is not as per the registered PDD. PP needs to correct the same in the revised MR. Refer to Section 3.2.2, 4.1.4, 4.1.5, 5.1	~~CAR 02, CL-03, CL-05~~	OK
3.7 Was is it possible to verify that involved management and operation personal is fully aware of the responsibilities and perform all operations according to the registered monitoring plan and internally developed manuals?	/P01/ /P16/ /P17/ /B04/ /I-01/	DR, I	Refer to Section 3.2.2, 3.6, 4.1.4, 4.1.5, 5.1	~~CAR 02, CL-03, CL-05CAR-02CL-03CL-05~~	OK
4. Parameters					
4.1.1 **Monitored parameter** Title: **Grid emission factor for the Northern Regional Grid** Indication: **EF_y** Units: **kg CO2/kWh** Estimated value (*ex-ante*): **0.942**	/P01/ /B01/ /B04/ /B05/ /B08/ /B09/	DR	This parameter is determined ex-ante as per the registered PDD and used as fixed for the crediting period.	OK	
4.1.2 **Monitored parameter** Title: **Energy Exported** Indication: **Energy Exported to the grid** Units: **kWh** Reported value (*ex-post*): **57,712,364**	/P01/ /P06/ /P07/ /P08/ /B01/ /B04/ /B05/ /B08/ /B09/	DR, I	The electricity exported from the grid is measured by the bi-directional tri-vector energy meter installed at the project site on continuous basis. Once in a month JMR is signed by the representatives of Punjab State Electricity Board (PSEB) and Aqua Power Private Ltd. The JMRs are thus the monthly statements of the calculated net electricity exported to the grid (= export- import). The measurement method is in accordance with the monitoring plan of the PDD. No deviations from the validated	~~CAR 01, CAR-02~~	OK

			monitoring plan have been identified. Accuracy testing of energy meters are carried out by Mobile Meter Testing Squad (MMTS) of PSEB and all the calibration records were checked and found OK. The values are sufficiently justified as they are in agreement with the joint meter readings for each month of the monitoring period and sales invoices for the entire monitoring period. Due to incomplete reporting of calibration of main meter and incorrect reporting of emission reduction calculation in accordance with Annex 60 of EB 52, PP needs to correct the emission reduction CAR-01 and CAR-02 have been raised.		
4.1.3 **Monitored parameter** Title: **Energy Imported** Indication: **Energy imported from the grid** Units: **kWh** Reported value (*ex-post*): **43,218**	/P01/ /P06/ /P07/ /P08/ /B01/ /B04/ /B05/ /B08/ /B09/	DR, I	The electricity imported from the grid is measured by the bi-directional tri-vector energy meter installed at the project site on continuous basis. Once in a month JMR is signed by the representatives of Punjab State Electricity Board (PSEB) and Aqua Power Private Ltd. The measurement method is in accordance with the monitoring plan of the PDD. No deviations from the validated monitoring plan have been identified. Accuracy testing of energy meters are carried out by Mobile Meter Testing Squad (MMTS) of PSEB and all the calibration records were checked and found OK. Due to incomplete reporting of calibration of main meter and incorrect reporting of	~~CAR-01, CAR-02~~	OK

			emission reduction calculation in accordance with Annex 60 of EB 52, PP needs to correct the emission reduction CAR-01 and CAR-02 have been raised.		
4.1.4 **Monitored parameter** Title: **Net Saleable Energy** Indication: **Net Saleable Energy to the grid** Units: **kWh** Reported value (*ex-post*): **57,669,146**	/P01/ /P06/ /P07/ /P08/ /B01/ /B04/ /B05/ /B08/ /B09/	DR, I	The net saleable electricity is the calculated subtracting electricity imported from electricity for the respective month for each site of the project activity. This monitored value is calculated from the JMR readings and for this value bills are raised to PSEB for the supply of the electricity to the grid. The value of net saleable electricity was cross checked with the bills raised to PSEB and found OK. Due to incomplete reporting of calibration of main meter and incorrect reporting of emission reduction calculation in accordance with Annex 60 of EB 52, PP needs to correct the emission reduction CAR-01 and CAR-02 have been raised.	~~CAR-01, CAR-02~~	OK
4.1.5 **Monitored parameter** Title: **Energy Generated** Indication: **Gross energy generated** Units: **kWh** Reported value (*ex-post*): **59,340,258**	/P01/ /P06/ /P07/ /P08/ /B01/ /B04/ /B05/ /B08/ /B09/	DR, I	The electricity generated from the generators is measured by the energy meter installed at the project site on continuous basis. The same is recorded hourly in the daily log sheet book by the technical assistance/ operator. The measurement method is in accordance with the monitoring plan of the PDD. No deviations from the validated monitoring plan have been identified. The values given in the monitoring report and the corresponding Excel sheets are	OK	

			correct. Accuracy testing of energy meters are carried out by Balaji Control (accredited by NABL) and all the calibration records were checked and found OK.		
4.1.6 **Monitored parameter** Title: **Auxiliary Energy Consumption** Indication: **Auxiliary Energy consumption** Units: **kWh** Reported value (*ex-post*): 802,815	/P01/ /P06/ /P07/ /P08/ /B01/ /B04/ /B05/ /B08/ /B09/	DR, I	The electricity consumed in-house from the generated electricity to run the plant auxiliaries is measured by the energy meter installed at the project site on continuous basis. The same is recorded hourly in the daily log sheet book by the technical assistance/ operator. The measurement method is in accordance with the monitoring plan of the PDD. No deviations from the validated monitoring plan have been identified. The values given in the monitoring report and the corresponding Excel sheets are correct. Accuracy testing of energy meters are carried out by Balaji Control (accredited by NABL) and all the calibration records were checked and found OK.	OK	
4.2 **Default parameter** Title: Indication: Units: Default/Used value:	/B01/ /B04/ /B08/	DR	Not applicable as per the registered PDD.	-	-
5. Calculations					

5.1	Have all the calculations related to the baseline emissions been carried according to the formulae and methods described in the registered PDD and applied methodology?	/P01/ /P03/ /P06/ /P07/ /P08/ /B01/ /B04/ /I-01/	DR, I	The calculations and applied formulae and method for calculation of baseline emission are in accordance with the registered monitoring plan and are in line with the requirements of the applied methodology AMS ID/ Version 07. The formulae and the methods referred in the MR and the spread sheet for estimation of GHG reduction comply with the corresponding formulae and methods in the registered PDD. Due to incomplete reporting of calibration of main meter and incorrect reporting of emission reduction calculation, in accordance with Annex 60 of EB 52, PP needs to correct the emission reduction and in this context CAR-02 has been raised. Also CL-06 is raised for higher CERs during this monitoring period in comparison to that mentioned in the registered PDD.	~~CAR 02~~ ~~CL 06~~	OK
5.2	Have all the calculations related to the project emissions been carried according to the formulae and methods described in the registered PDD and applied methodology?	/B01/ /B04/ /B05/ /B08/ /I-01/	DR, I	This is a fourth periodic verification. Project emissions are not applicable because for this project which is confirmed by justification provided in PDD and it is also reconfirmed during the site visit. However, non applicability of project emissions needs to be addressed in the MR.	~~CL 07~~	OK

5.3	Have all the calculations related to the leakage emissions been carried according to the formulae and methods described in the registered PDD and applied methodology?	/B01/ /B04/ /B05/	DR	Non applicability of project emissions needs to be addressed in the MR.	~~CL 07~~	OK

Table 2: List of Requests for Corrective Action (CAR) and Clarification (CL)

No.	Type of request	Observation	Reference (Table 1)	Summary of project owner response	Revised section(s)/Annexe(s) of the MR	Verification team conclusion
1.	CAR-01	a) During the on site visit while cross checking the accuracy test reports, it was observed that the Main meter (Sr. No: 04223075) at Lohgarh site was in service beyond the due date of calibration from 16/01/2009 to 18/03/2009, 20/02/2010 to 22/02/2010for Lohgarh Site, from 20/12/2008 to 24/01/2009 for Chakbhai Site and from 01/07/2008 to 19/08/2008, 19/02/2009 to 09/03/2009, 09/03/2010 to 20/03/2010 for Sidhana site. In accordance with Annex 60 of EB 52, PP needs to correct the emission reduction calculation for the above mentioned period and also report it in section E.1 of the MR. b) During the UNFCCC completeness check, it was	3.2.2, 4.1.4, 4.1.5	a) The project proponent based on EB guidelines has applied a corrective action based on maximum accuracy specification of the meter i.e. Emission reductions has been recalculated after giving a effect of (±) 0.5% of the export & import for the period tabulated below: Name of the site: Period MHP Lohgarh: January 2009, February 2009, March 2009 & February 2010 MHP Chakbhai: December 2008 & January 2009 MHP Sidhana: July 2008, August 2008, February 2009, March 2009 & March 2010. b) There was an error in the ER calculation which has been corrected and also the MR has been revised consistently.	E.1	a) Maximum inaccuracy corrections have been applied and the corrections applied for the emission reduction calculation are in line with Annex 60 of EB 52. Hence the CAR is closed. b) For the Sidhana site for the month of March 2010, correction had not been applied. The mistake has been rectified and ER sheet and MR has been revised. Due to this the ER has been re calculated as 54,281 tCO2 for this monitoring period. The same has been consistently revised in the ER sheet, MR and VR.

		found that the MR is not consistent with the ER calculation sheet. PP needs to correct the same.				
2.	CAR-02	While cross checking of the export and import electricity data as presented in the Annexure III of the MR and ER calculation sheet with the corresponding figures of the respective JMRs, data in Annexure III for the month of Dec 08 (Energy exported), Jun 09 (Energy exported), Nov 09 (Energy imported) and Feb 10 (Energy exported) did not match with that of JMR. The value for "Auxiliary energy consumption" as reported in section D.2.5 of the MR is incorrect as cross verified with the plant records and also Annexure II of the MR. Moreover, in section D.2 of the MR, data for Lohgarh and Chakbhai sites have been incorrectly stated i.e. Lohgarh site data have been written for Chakbhai site and vice versa. PP needs to correct the	3.6, 3.7, 4.1.4, 4.1.5, 5.1	Export and import electricity data as presented in the Annexure III has been corrected in the revised MR and ER calculation sheet with values of the respective JMRs. The "Auxiliary energy consumption" value has been corrected in the revised MR. Corrections have been made in the revised MR.	D.2, Annexure III, E.R. Sheet	The corrections made in the revised MR and ER calculation spread sheet are found OK. Also in response to the FAR-01 raised, the QA/QC procedure will be updated to avoid such errors in the future monitoring period. Hence the CAR is closed.

		same in MR and ER calculation sheet. This also resulted in FAR - 01 in context of QA/QC on data management.				
3.	CAR-03	PP needs to explain why the corrective measure against FAR raised in 3rd verification (Cp 15 of 3rd verification report) was not complied in this monitoring period.		The PP had applied for calibration to PSEB within the time limits of six months. But PSEB was unable to do the calibration in time because of shortage of staff and other reasons attributable to PSEB. This is beyond the control of PP. However, deduction in CER calculation has been applied in line with EB 52, Annex 60.	----	In consequence to the FAR raised during the 3rd verification period, PP had applied for calibration of the main and check energy meters within the due dates of 6 months for calibration /P25/. However, state electricity board has calibrated these meters with some delays. As the project proponent sent an application for calibration to state electricity board before the due date of meter calibration and PP has no authority over the Government agency for calibration, DOE has accepted the approach with a deduction based on the maximum inaccuracy specification of the meters as per the EB guidance for the delayed calibration months, Annex 60, EB 52 and also in line with the deviation request response by EB to this project activity /B10/. Hence the FAR is successfully closed in this verification.

4.	CL-01	In section A.1 of the MR, PP needs to include capacities of each turbine along with the name of the generator manufacturer. Moreover, accurate GPS coordinates for the three sites need to be provided in section A.2 of the MR.	1.1	Section A.1 and A.2 of the MR have been revised to include the turbine capacities, generator manufacturer and accurate GPS coordinates for all the three sites.	A.2	Revisions made in the MR are found appropriate. The GPS coordinates were cross checked with the web site http/www/itouchmap.com/latong.html and found OK. Hence the CL is closed.
5.	CL-02	The serial number of the Auxiliary meter for Sidhana site has been wrongly mentioned as 148153/13538-608 instead of 148153/13538-1608 in section D.2 of the MR. Accuracy class needs to be corrected for auxiliary meters at Lohgarh and Chakbhai sites. Moreover, during the onsite visit it was revealed that this meter was replaced on 20/12/08 by meter serial no. 66927/367-0605. The change of meter is not reflected in the MR.	1.2	The serial number of the Auxiliary meter along with their accuracy class for Sidhana site have been corrected in the revised MR. The change of this meter on 20/12/08 is also shown in the revised MR.	D.2	The corrections made in the MR are found OK. Hence the CL is closed.
6.	CL-03	Cross checking of the accuracy test reports revealed the following incorrect information on the validity of the reports: 1) Lohgarh site	3.2.2, 3.6., 3.7	The correct dates of calibrations of the respective meters have been incorporated in the revised MR.	D.2	Changes made in section D.2 of the MR are correct. Also in response to the FAR-01 raised, the QA/QC procedure will be updated to avoid such errors in the future monitoring period. Hence the CL is closed.

		Export/Import meter – should be 15/01/2008 to 16/07/2008 instead of 16/01/2008 to 16/07/2008; 2) Lohgarh site Export/Import meter – should be 22/02/2010 to 22/08/2010 instead of 22/10/2008 to 22/08/2010; 3) Lohgarh site Gross generation meter – should be 30/11/2009 to 31/05/2010 instead of 01/12/2009 to 01/06/2010; 4) Chakbhai site Gross generation meter – should be 30/11/2009 to 31/05/2010 instead of 01/12/2009 to 01/06/2010; 5) Sidhana site Auxiliary meter – should be 30/11/2009 to 31/05/2010 instead of 01/12/2009 to 01/06/2010; PP need to correct the same in the revised MR. This resulted in issuance of FAR-01 in context of QA/QC on data management.				
7.	CL-04	The correct serial numbers of the main meters for export and import of electricity, as displayed in the respective meters (i.e. 04223075 and 04187462 for Lohgarh and Chakbhai respectively) are	3.5	The meter serial numbers have been corrected in the revised MR.	D.2	As the meter serial numbers have been corrected in the revised MR, the CL is closed.

		to be provided in the MR section D.2.				
8.	CL-05	QA/QC procedures for cross checking the electricity exported to the grid is not as per the registered PDD. PP needs to correct the same in the revised MR.	3.6, 3.7	The QA/QC procedure for cross checking the electricity exported to the grid has been revised as per the PDD and actual monitoring practice. The stated statement has been removed in the revised MR.	D.2	The change in MR is found appropriate. Hence the CL is closed.
9.	CL-06	The actual emission reductions during this monitoring period (=54,281 tCO2e – in the hosted MR it was 54,297) are higher than the estimated value in the PDD (=47,181 tCO2e). PP needs to justify this.	5.1	The net electricity export to the grid during this monitoring period was 57.669 million kWh in comparison to the estimated value of 50.086 (=28,621*21/12) million kWh. This happened due to increased water availability in the canal during this monitoring period leading to higher electricity generation and higher CERs (15.05% more than the estimated value of the PDD). It may be noted that this monitoring period was of 21 months and covered two rainy seasons.	E	The project is canal based hydropower generation plant. The actual net export of electricity during this monitoring period was 15.05% higher than estimated value. This was mainly due to higher water availability in the canal which increased the electricity output from the hydro power plant. Moreover this monitoring period covered two rainy seasons (July 2008 to September 2008 and June 2009 to September 2009). Hence the increase in the electricity output is beyond the control of the PP. The over generation of electricity resulting in the increase of 7,100 CERs in comparison to the estimated CERs in the PDD for this monitoring period (=21 months). Nevertheless, the peak generation value out of the reported data for this monitoring period has not crossed the rated capacity generation (=maximum possible generation including over rated generation). Moreover, in the context of “General

						Guidelines to SSC CDM methodologies" para 3. (a) (ii), the activity level of this project activity did not cross the limit of Type I (within 15 MWe) during this monitoring period. Hence the reported emission reductions are accepted. The CL is closed.
10.	CL-07	PP is requested to further elaborate regarding the non applicability of project emissions and leakage for this project activity during this monitoring period in section E.2 and E.3 of the MR.	5.2, 5.3	MR has been revised.	E	OK. The CL is closed.

Table 3: List of forward action requests (FARs)

FAR number	Observation	Reference (Table 1)	Summary of project participants' response	Verification team conclusion
FAR 01	In context of CAR-02 and CL-02, PP needs to improve the QA/QC procedures on data management to avoid potential mistakes of manual data transfer during future verification period.	3.2.2, 3.6, 3.7, 4.1.4, 4.1.5, 5.1	The QA/QC procedure will be further improved to avoid such error.	The compliance of this response will be verified during next verification.

Appendix B

Certification statement

to the Verification report 01 997 9105060712

Certification statement

TUV Rheinland Japan Ltd., the DOE, has performed a periodic verification of the registered CDM project activity No 0327, "Lohgarh, Chakbhai and Sidhana Mini Hydroelectric Projects" in India. The project activity is designed to generate emission reductions by electricity generation from hydro power plant. This verification was performed to identify the compliance of the project activity with implementation and monitoring requirements, and to verify the actual amount of achieved emission reductions.
The verification is based on:

— PDD, registered with the CDM Executive Board on 30/04/2006;

— Approved monitoring methodology AMS I.D "Renewable electricity generation for a grid", version 7;

— Monitoring report version 04 dated 28/04/2011.

This statement covers verification period of 21 months between 01/07/2008 and 31/03/2010.

The DOE has raised seven (7) clarification and three (3) corrective action requests, all of which have been successfully resolved by the PP. The DOE has also raised a FAR which shall be assessed during the next verification period.

The DOE, herewith certifies that the project activity, achieved emission reductions by sources of GHG equal to 54,281 tCO_2e and all monitoring requirements have been fulfilled.

2011-04-28 Date	2011-04-28 Date	2011-04-28 Date
Dr. Manfred Brinkmann CDM Program Manager TUV Rheinland Japan Ltd.	Mr. Praveen Nagaraje URS Technical Reviewer TUV Rheinland India Pvt.Ltd.	Asim Kumar Jana Team Leader TUV Rheinland India Pvt.Ltd.

Appendix C

Certificates of Competence

Qualification

Jana, Asim Kumar /

Emission Trading
United Nations Framework Convention on Climate Change

Auditor No.:
(AuditorenRegNr)

Appointed: (Zugelassen)	☒ ja	Qualification Level: (Qualifikationsstufe)	
External: (Externer)	☐ ja	Add. reviewer: (Zusätzlicher Prüfer)	☐ yes
EAC Scopes: (EAC Branchen)	CDM 01 – Energy industries (renewable – / non-renewable sources) CDM 03 – Energy demand CDM 04 – Manufacturing industries CDM 12 – Solvents use CDM 02 – Energy distribution CDM 11 – Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride CDM 13 – Waste handling and disposal CDM 05 – Chemical industry		
Add. qualification: (zus. Qualifikation)			
First Appointment: (Erstberufung)	2009/06/02	Valid to: (Gültig bis)	2012/06/01

Remarks:	2010-10: revised to meet Accreditation Standard Ver.02: – CDM 01: valid for TA1.1, 1.2 – CDM 02: valid for TA2.1, 2.2 – CDM 03: valid for TA3.1 – CDM 04: valid for TA4.5 – Other WHR and Fuel switch projects – CDM 05/11/12: valid for TA5.1 / 11.1 / 12.1 – CDM 13: valid for TA13.1 – Waste handling and disposal
Languages:	Hindi English

Experience Exchange

Date	Location	Remarks	Accreditation(s)

Monitoring

Latest Monitoring:
(letzte Beurteilung)

Next Monitoring:
(nächste Beurteilung)

Remarks:

View / Edit Monitoring

History of scope allocation

Date:	2009-06-03
Change:	EAC CDM, CDM, CDM, CDM added
By:	Manfred Brinkmann
Reason:	scope 4 limited to fuel switch

History

Created:	2009/04/21 19:24:07 ZE5B	Asim Kumar Jana/Ind/TUV
Modified:	2011/01/06 11:55:54	Manfred Brinkmann/Jpn/TUV
	2010/09/12 18:07:27	Manfred Brinkmann/Jpn/TUV

Qualification

Urs, Praveen /

Emission Trading
United Nations Framework Convention on Climate Change

Auditor No.:
(AuditorenRegNr)

Appointed: (Zugelassen)	☒ ja	Qualification Level: (Qualifikationsstufe)	
External: (Externer)	☐ ja	Add. reviewer: (Zusätzlicher Prüfer)	☒ yes
EAC Scopes: (EAC Branchen)	CDM 01 – Energy industries (renewable – / non-renewable sources) CDM 13 – Waste handling and disposal		
Add. qualification: (zus. Qualifikation)			
First Appointment: (Erstberufung)	2010/08/31	Valid to: (Gültig bis)	2013/08/30

Remarks:	Valid for TA 01.2, 13.1
Languages:	Hindi English

Experience Exchange

Date	Location	Remarks	Accreditation(s)

Monitoring

Latest Monitoring:
(letzte Beurteilung)

Next Monitoring:
(nächste Beurteilung)

Remarks:

View / Edit Monitoring

History of scope allocation

Date:	2010-11-17
Change:	EAC CDM, CDM added
By:	Manfred Brinkmann
Reason:	Valid for TA 01.2, 13.1

History

Created:	2010/11/17 11:47:44	Manfred Brinkmann/Jpn/TUV

Modified:	2010/11/17 11:54:09	Manfred Brinkmann/Jpn/TUV
	2010/11/17 11:48:19	Manfred Brinkmann/Jpn/TUV