GS PoA Verification Report

Alternative Energy Promotion Centre (AEPC)

Nepal Biogas Support Program-PoA

PoA UNFCCC Ref. No. : 9572

PoA GS Ref. No. : 3110

Report No: 18/080

Date: 29/10/2018

TÜV NORD CERT GmbH
JI/CDM Certification Program
Langemarckstraße, 20
45141 Essen, Germany
Phone:+49-201-825-3335
Fax: +49-201-825-2139
www.tuev-nord.de
www.global-warming.de

Verification Report:	***Report No.***	***Rev. No.***	***Date of 1st issue:***	***Date of this rev.***
	18/080	0	29/10/2018	29/10/2018
Programme of Activities:	***Title:***		***UNFCC Registration date:***	***UNFCCC-No.:***
	Nepal Biogas Support Program-PoA		31-01-2013	9572
			GS Registration date:	***GS-No.:***
			14-08-2015	3110
			Verification No.:	
			4th periodic verification	
			PoA Scale	
			☐ *Large Scale*	☒ *Small Scale*
	Lifetime of the PoA:		***From:***	***To:***
	28 years		22-06-2007	21-06-2035
	CPA/VPA #1 title:		***UNFCCC Inclusion date***	***UNFCCC-No.:***
	Nepal Biogas Support Program- CPA 1: 20,000 digesters		31-03-2013	CPA 9572-0001
			GS Inclusion date	***GS-No.:***
			14-08-2015	GS 3109
	Crediting period:		***From:***	***To:***
	☒ *Renewable (7y)* ☐ *Fixed (10y)*		31-01-2013	30-01-2020
	CPA/VPA #2 title:		***UNFCCC Inclusion date***	***UNFCCC-No.:***
	Nepal Biogas Support Program- CPA 2: 19,927 digesters		08-05-2014	CPA 9572-0002
			GS Inclusion date	***GS-No.:***
			14-08-2015	GS 3113
	Crediting period:		***From:***	***To:***
	☒ *Renewable (7y)* ☐ *Fixed (10y)*		08-05-2014	07-05-2021
	CPA/VPA #3 title:		***UNFCCC Inclusion date***	***UNFCCC-No.:***
	Nepal Biogas Support Program- CPA 3: 19,959 digesters.		08-05-2014	CPA 9572-0003
			GS Inclusion date	***GS-No.:***
			14-08-2015	GS 3114
	Crediting period:		***From:***	***To:***
	☒ *Renewable (7y)* ☐ *Fixed (10y)*		08-05-2014	07-05-2021
	CPA/VPA #4 title:		***UNFCCC Inclusion date***	***UNFCCC-No.:***
	Nepal Biogas Support Program- CPA 4: 19,970 digesters.		08-05-2014	CPA 9572-0004
			GS Inclusion date	***GS-No.:***
			14-08-2015	GS 3116
	Crediting period:		***From:***	***To:***
	☒ *Renewable (7y)* ☐ *Fixed (10y)*		08-05-2014	07-05-2021
Project Participant(s):	***Client:***		**Coordinating/Managing Entity**	
	Alternative Energy Promotion Centre (AEPC)		Alternative Energy Promotion Centre (AEPC)	
	Non Annex 1 country:		***Annex 1 country:***	

		Nepal			Germany	
		PP from non Annex 1 country:			***PP from Annex 1 country:***	
		Alternative Energy Promotion Centre (AEPC)			atmosfair gGmbH	
CPA No.	***Monitoring period (MP):***			***Applied methodology/ies***		
1	***From:***	***To:***	***No. of days:***	***Title:***	***No.:***	***Scope(s) / TA(s)***
	01/08/2016	31/07/2017	***365***	Switch from Non-Renewable Biomass for Thermal Applications by the User	AMS-I.E version 04,	1 / 1.2 13/13,2
CPA No.	***Monitoring period (MP):***			***Applied methodology/ies***		
2	***From:***	***To:***	***No. of days:***	***Title:***	***No.:***	***Scope(s) / TA(s)***
	01/08/2016	31/07/2017	***365***	Switch from Non-Renewable Biomass for Thermal Applications by the User	AMS-I.E version 04,	1 / 1.2 13/13,2
CPA No.	***Monitoring period (MP):***			***Applied methodology/ies***		
3	***From:***	***To:***	***No. of days:***	***Title:***	***No.:***	***Scope(s) / TA(s)***
	01/08/2016	31/07/2017	***365***	Switch from Non-Renewable Biomass for Thermal Applications by the User	AMS-I.E version 04,	1 / 1.2 13/13,2
CPA No.	***Monitoring period (MP):***			***Applied methodology/ies***		
4	***From:***	***To:***	***No. of days:***	***Title:***	***No.:***	***Scope(s) / TA(s)***
	01/08/2016	31/07/2017	***365***	Switch from Non-Renewable Biomass for Thermal Applications by the User	AMS-I.E version 04,	1 / 1.2 13/13,2

Monitoring Report #1:			***Monitoring Report #2:***		
Draft version:	***Final version:***	**CPA Batch**	***Draft version:***	***Final version:***	**CPA Batch**
18/02/2018	06/09/2018	1-4	NA	NA	NA

Verification team / Technical Review and Final Approval:	***Verification Team:***		***Technical review:***	***Final approval:***
	Prakash Kumar Mishra (TL) G. Ezhilarasu (TM/TE)	Manoj Kumar Borekar	Stefan Winter Rami Kunal	Rainer Winter
Key dates of verification:	***Uploading of VER Work & Audit Plans :***	***DVerR issued:***	***On-site (from):***	***On-site (to):***
	24-05-2018	27/06/2018	24/05/2018	06/06/2018[1]
			04/06/2018	06/06/2018[2]
Summary of Verification opinion	Alternative Energy Promotion Centre (AEPC) has commissioned the TÜV NORD JI/CDM Certification Program to carry out the 4th periodic verification of the PoA : "", with regard to the relevant requirements for GS project activities. As a result of this verification, the verifier confirms that: ☒ all operations of the project are implemented and installed as planned and			

[1] Combined site visit for CDM PoA with 8 CPAs and 4 other PA by same PP with same technology
[2] Exclusively for GS PoA

<table>
<tr><td></td><td colspan="3">described in the validated project design document,
☒ the monitoring plan is in accordance with the applied approved CDM/GS methodology,
☐ the installed equipment essential for measuring parameters required for calculating emission reductions are calibrated appropriately,
☒ the monitoring system is in place and functional. The project has generated GHG emission reductions, and
☒ the GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner.
☒ the project has contributed to sustainable development.
TÜV NORD JI/CDM CP herewith confirms that the project has achieved emission reductions in the above mentioned reporting period as listed below (verified amount).</td></tr>
<tr><td rowspan="2">Emission reductions: [tCO_{2e}]</td><td>Total verified amount</td><td>As per draft MR #1:</td><td>As per CPA-DD per annum:</td></tr>
<tr><td>218,588</td><td>218, 588
As per draft MR #2
218,588</td><td>CPA1: 61,889
CPA2: 66,236
CPA3: 66,329
CPA4: 66,397</td></tr>
<tr><td rowspan="2">Document information:</td><td colspan="2">Filename:</td><td>No. of pages:</td></tr>
<tr><td colspan="2">GS PoA 4th VER Report – GS 3110</td><td>60</td></tr>
</table>

Abbreviations:

AEPC	***Alternative Energy Promotion Centre***
AQL	***Acceptable quality level***
BSP	***Biogas Support Program***
BUS	***Biogas User Survey***
CA	***Corrective Action / Clarification Action***
CAR	***Corrective Action Request***
CDM	***Clean Development Mechanism***
CER	***Certified Emission Reduction***
CME	***Coordinating and Managing Entity***
CO_2	***Carbon dioxide***
CO_{2eq}	***Carbon dioxide equivalent***
CL	***Clarification Request***
CPA	***Component Project Activity***
DVerR	***Draft Verification Report***
ER	***Emission Reduction***
FAR	***Forward Action Request***
GHG	***Greenhouse gas(es)***
GS	***Gold Standard***
MP	***Monitoring Plan***
MR	***Monitoring Report***
NRB	***Non Renewable Biomass***
PA	***Project Activity***
PCP	***Project Cycle Procedure***
POA-DD	***Programme of Activities Design Document***
PP	***Project Participant***

PS	***Project Standard***
QA/QC	***Quality Assurance / Quality Control***
UNFCCC	***United Nations Framework Convention on Climate Change***
UQL	***Acceptable quality level***
VVS	***Validation and Verification Standard***
XLS	***Emission Reduction Calculation Spread Sheet***

Table of Contents *Page*

1. INTRODUCTION

Alternative Energy Promotion Centre (AEPC) has commissioned the TÜV NORD JI/CDM Certification Program (CP) to carry out the 4th periodic verification of the Programme of Activities:

"Nepal Biogas Support Program-PoA" GS 3110

with regard to the relevant requirements for GS project activities. The verifiers have reviewed the implementation of the monitoring plan(s) (MP) as described in the registered PoA-DD and CPA-DD and GS PoA Passport.

GHG data for this monitoring period was verified in detailed manner applying the set of requirements, audit practices and principles as required under the CDM Validation and Verification Standard/VVS/ of the UNFCCC and the applied methodology.

Sustainable Development Indicators for this monitoring period were verified in detailed manner as required under the GS Toolkit/GST/, GS requirements/GSR/, relevant GS Annexes, and the GS Validation and Verification Manual/GS-VVM/.

This report summarizes the findings and conclusions of this GS 4th periodic verification of the above mentioned UNFCCC and GS registered project activity.

1.1. Objective

The objective of the verification is the review and ex-post determination by an independent entity of the GHG emission reductions. It includes the verification of the:

- implementation and operation of the project activity as given in the CPA-DD and GS passports,
- compliance with applied approved methodology and the provisions of the sustainability monitoring plan,
- data given in the monitoring report by checking the monitoring records, the emissions reduction calculation and supporting evidence,
- accuracy of the monitoring equipment,
- quality of evidence,
- significance of reporting risks and risks of material misstatements.

1.2. Scope

The verification of this registered project is based on the validated Programme of Activities design document /PoA-DD/, the validated Component Project Activity Design Document (s) (CPA-DD/VPA-DDs), the GS PoA Passport, the monitoring report(s) /MR/, emission reduction calculation spread sheet /XLS/, supporting documents made available to the verifier and information collected through performing interviews and during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The verification is carried out on the basis of the following requirements, applicable for this Programme of Activities:

- Article 12 of the Kyoto Protocol /KP/,
- guidelines for the implementation of Article 12 of the Kyoto Protocol as presented in the Marrakech Accords under decision 3/CMP.1 /MA/, and subsequent decisions made by the Executive Board and COP/MOP,
- other relevant rules, including the host country legislation,
- CDM Validation and Verification Standard /VVS/,
- GS Validation and Verification Manual /GS-VVM/
- GS Toolkit and Requirements versions 2.2 /GST//GSR/
- monitoring plan as given in the registered PoA-DD and CPA-DD(s) /PoA-DD//CPA-DD/,
- Approved CDM/GS Methodology (ies).

2. GHG PROJECT DESCRIPTION

2.1. Technical Project Description of the Programme of Activities

The following description of the programme as per the GS monitoring report (for CPA-1, CPA-2, CPA-3 and CPA-4) and registered PoA-DD was verified:

The PoA involves the implementation of household biogas units individual household in Nepal. These applications displace firewood with biogas produced from anerobic digestion of animal waste and human excreta. The biogas is used as a fuel for cooking. Following the methodological guidance under Programme of Activities (PoA), only the replacement of non-renewable biomass (NRB) is counted as emission reduction under the Clean Development Mechanism (CDM) for this project.

Target group under the BSP are rural households who currently use non-renewable biomass (firewood). The BSP is centrally managed by Alternative Energy Promotion Centre (AEPC) with the support of Biogas Sector Partnership Nepal (BSP-NEPAL), the implementing agency of the AEPC. AEPC is a public entity that executes all renewable/alternative energy programs in Nepal including BSP. Its main objectives are disseminating and promoting renewable energy technologies and mitigating environmental degradation. AEPC is responsible for administrating the government subsidy, coordination with all relevant stakeholders and monitoring BSP-NEPAL. AEPC is the coordinating and managing entity of this PoA.

The information presented in the PoA documents on the technical design is consistent with the actual planning and implementation of the Programme of Activity Design Document (PoA-DD) and Component Project Activity Design Document (CPA-DD) confirmed in the following ways:

- A review of data and information ;
- An on-site visit/PHOTO/IM/ to the place where the respective real case CPAs are being implemented and interview with relevant stakeholder and personnel with knowledge of the project in attendance; and

In conclusion, validation team confirms that the PoA project description, as included in the monitoring report for CPA-1, CPA-2, CPA-3 and CPA-4 are sufficiently accurate and complete in order to comply with the requirements of the CDM.

The key parameters of the CPA types are given in Table 2-1.

Table 2-1: Technical data of the Bio digesters in POA and CPAs

Parameter	Unit	Value
Model No. of Bio-Digester	-	GGC 2047
Capacity of Bio-Digester	m^3	2, 4, 6, 8 & 10
Type of Bio-Digester	-	closed underground container made of concrete or other materials

2.2. Project Location

The details of the Project locations are given in Table 2-2:

Table 2-2: Project Location

No.	Project Location
Host Country	Nepal
Region:	various locations across Nepal
Project location address:	Nepal
Latitude:	North 26.20 degree to North 30.45 degree
Longitude:	East 80.07 degree to East 88.20 degree

2.3. Project Verification History

Essential events since the registration of the PoA-DD are presented in the following Table 2-3.

Table 2-3 a: Status of previous Monitoring Periods – CDM cycle

#	Item	Time	Status
1	1st Monitoring period	31/01/2013-31/07/2014	issued
2	2nd Monitoring period	01/08/2014 -31/07/2015	Issued
3	3rd Monitoring period	01/08/2015 -31/07/2016	Issued
4	4th Monitoring period	01/08/2016 -31/07/2017	On going

Table 2 -3 B: Status of previous Monitoring Periods – GS cycle

#	Item	Time	Status
1	1st Monitoring period	14/08/2013 until 31/07/2014	GS -issued
2	2nd Monitoring period	01/08/2014 -31/07/2015	Issued
3	3rd Monitoring period	01/08/2015 -31/07/2016	Issued
4	4th Monitoring period	01/08/2016 -31/07/2017	On going

An overview of all Post Registration Changes is given in the following table.

Table 2-4: Overview Post Registration Changes

#	Applicable from – to / as of	MP	Type of post registration change[1)]	Description	Status[2)] / Date
1	N/A		TDfrMP	N/A	Not applicable
2	N/A		TDfMM	N/A	Not applicable
3	For CPA-1	1st MP	CrCPA-DD	Under CPA-1 corrections in the ecological zones of biogas digesters implemented are required. Out of the 20,000 digesters (10,011 in terai, 9,873 in hills and 116 in remote hill) reported during registration. As verified by verification team it was noted that there have been some cross posting of ecological zones in the spreadsheet communicated during the registration of the PoA/CPA inclusion. Hence a correction is proposed for CPA-1 for which the number and identity of the digesters will remain the same however, they are distributed as 10,955 in Terai, 8,940 in Hills and 105 in Remote Hills. The rearrangement of the digesters across the ecological zones is presented in the CPA-DD of CPA-1. The rearrangement of the digesters doesn't involve any changes in the CPA threshold and scale of the CPA. However, there is a slight revision in the ex-ante emission estimation (from 61,510 tCO_2 e to 61,889 tCO_2e) as the rearrangement of the digesters triggered the revision in emission reduction in each ecological zone category	Approved
4	N/A		PCfrMP	N/A	Not applicable
5	N/A		PCfMM	N/A	Not applicable
6	N/A		CoPD	N/A	Not applicable

1) ICPAiPoA : Inclusion of component project activities in programme of activities
TDfrMP : Temporary deviation from registered monitoring plan
TDfMM : Temporary deviation from the monitoring methodology
CrCPADD : Corrections to the registered CPA-DD
PCfrMP : Permanent changes from registered Monitoring Plan

PCfMM : Permanent changes from Monitoring Methodology
CoPD : Changes to the project design of a registered PoA, or generic or specific CPA

[2] Approval (by EB) or Acceptance (by DOE)

3. METHODOLOGY AND VERIFICATION SEQUENCE

3.1. Verification Steps

The verification consisted of the following steps:

- Contract review
- Appointment of team members and technical reviewers
- A desk review of the carbon (CDM PoA MR) and SD Monitoring Reports/MR/ submitted by the client and additional supporting documents with the use of customised verification protocol /CPM/ according to the Validation and Verification Standards /VVS//GS-VVM/,
- Verification planning,
- On-Site assessment,
- Background investigation and follow-up interviews with personnel of the project developer and its contractors,
- Draft verification reporting
- Resolution of corrective actions (if any)
- Final verification reporting
- Technical review
- Final approval of the verification.

3.2. Contract review

To assure that

- the project falls within the scopes for which accreditation is held,
- the necessary competences to carry out the verification can be provided,
- Impartiality issues are clear and in line with the CDM accreditation requirements

a contract review was carried out before the contract was signed.

3.3. Appointment of team members and technical reviewers

On the basis of a competence analysis and individual availabilities a verification team, consisting of one team leader and 2 additional team members, was appointed.

The list of involved personnel, the tasks assigned and the qualification status are summarized in the Table 3-1 below.

Table 3-1: Involved Personnel

	Name	Company	Function [1]	Qualification Status [2]	Scheme competence [3]	Technical competence [4]	Verification competence [5]	Host country Competence	On-site visit
☒ Mr. ☐ Ms.	Prakash Kumar Mishra	TUV India Pvt. Ltd.	TL	SA	☒	1.2	☒	☒	☒
☒ Mr. ☐ Ms.	Govindarajan Ezhilarasu	TN CERT	TM/ TE[A]	LA	☒	1.2 & 13.2	☒	☒	☒
☒ Mr. ☐ Ms.	Manoj Kumar Borekar	TUV India Pvt. Ltd.	TM	LA	☒	1.2	☒	☒	☐
☒ Mr. ☐ Ms.	Kunal Rami	TN CERT GmbH	TR[B]	SA	☒	1.2	☒	☒	-
☒ Mr. ☐ Ms.	Stefan Winter	TN CERT GmbH	TR[B]	SA	☒	1.2 &13.2	☒	☐	-
☒ Mr. ☐ Ms.	Rainer Winter	TN CERT GmbH	FA[B]	SA	☒	1.2 &13.1	☒	☐	-

1) TL: Team Leader; TM: Team Member, TR: Technical review; OT: Observer-Team, OR: Observer-TR; FA: Final approval

2) GHG Auditor Status: A: Assessor; LA: Lead Assessor; SA: Senior Assessor; T: Trainee; TE: Technical Expert

3) GHG auditor status (at least Assessor)

4) As per S01-MU03 or S01-VA070-A2 (such as 1.1, 1.2, …)

5) In case of verification projects

A) Team Member: GHG auditor (at least Assessor status), Technical Expert (incl. Host Country Expert or Verification Expert), not ETE

B) No team member

All team members contributed to the review of documents, the assessment of the component project activities and to the preparation of this report under the leadership of the team leader.

Technical experts contributed to the assessment of special aspects of the project activity, e.g. technical or host country aspects.

Statements of competence for the above mentioned team members are enclosed in annex 2 of this report.

3.4. Verification Planning

In order to ensure a complete, transparent and timely execution of the verification task the team leader has planned the complete sequence of events necessary to arrive at a substantiated final verification opinion.

Various tools have been established in order to ensure an effective verification planning.

Risk analysis and detailed audit testing planning

For the identification of potential reporting risks and the necessary detailed audit testing procedures for residual risk areas table A-1 is used. The structure and content of this table is given in Table 3-2 below.

Table 3-2: Table A-1; Identification of verification risk areas

Table A-1: GHG calculation procedures and management control testing / Detailed audit testing of residual risk areas and random testing				
Identification of potential reporting risk	**Identification, assessment and testing of management controls**	**Areas of residual risks**	**Additional verification testing performed**	**Conclusions and Areas Requiring Improvement (including *Forward Action Requests*)**
The following potential risks were identified and divided and structured according to the possible areas of occurance.	*The potential risks of raw data generation have been identified in the course of the monitoring system implementation.* *The following measures were taken in order to minimize the corresponding risks.* *The following measures are implemented:*	*Despite the measures implemented in order to reduce the occurrence probability the following residual risks remain and have to be addressed in the course of every verification.*	*The additional verification testing performed is described. Testing may include:* - *Sample cross checking of manual transfers of data* - *Recalculation* - *Spreadsheet 'walk throughs' to check links and equations* - *Inspection of calibration and maintenance records for key equipment* - *Check sampling analysis results* *Discussions with process engineers who have detailed knowledge of process uncertainty/error bands.*	*Having investigated the residual risks, the conclusions should be noted here. Errors and uncertainties are highlighted.*

The basic structure of this project specific monitoring parameters verification protocol for the periodic verification is described in Table 3-3.

Table 3-3: Table A-2; Structure of the project specific Monitoring parameters periodic verification checklist

Table A-2: Periodic verification checklist				
Checklist Item	***Reference***	***Verification Team Comments***	***Draft Conclusion***	***Final Conclusion***
The checklist items in Table A-2 are linked to the various require-ments the monitoring of the project should meet. The checklist is organised in various sections as per the requirements of the topic and the individual project activity. It further includes guidance for the verification team.	*Gives reference to the information source on which the assessment is based on.*	*The section is used to elaborate and discuss the checklist item in detail. It includes the assessment of the verification team and how the assessment was carried out. The reporting requirements of the VVS shall be covered in this section.*	*Assessment based on evidence provided if the criterion is fulfilled (OK), or a CAR, CL or FAR (see below) is raised. The assessment refers to the draft verifi-cation stage.*	*In case of a corrective action or a clarification the final assessment at the final verification stage is given.*

3.5. Desk review

During the desk review all documents initially provided by the client and documents relevant for the verification were reviewed. The main documents are listed below:

- the last revision of the PoA-DD and CPA-DD including the monitoring plan/PoA-DD//CPA-DD/,
- the last revision of the validation report/VAL/,
- documentation of previous verifications/VER/
- the monitoring report(s), including the claimed emission reductions for the project/MR/,
- the emission reduction calculation spreadsheet/XLS/.
- The SD monitoring report

Other supporting documents, such as publicly available information on the UNFCCC website and background information were also reviewed.

3.6. On-site assessment

As most essential part of the verification exercise it is indispensable to carry out an inspection on site in order to verify that the project is implemented in accordance with the applicable criteria. Furthermore the on-site assessment is necessary to check the monitoring data with respect to accuracy to ensure the calculation of emission reductions. The main tasks covered during the site visit include, but are not limited to:

- The monitoring data were checked completely.
- An assessment of the implementation and operation of the registered component project activity as per the registered CPA-DD or any approved revision thereof;
- A review of information flows for generating, aggregating and reporting the monitoring parameters;
- The data aggregation trails were checked via spot sample down to the level of the meter recordings.
- Interviews with relevant personnel to determine whether the operational and data collection procedures are implemented in accordance with the monitoring plan in the CPA-DD;
- A cross check between information provided in the monitoring report and data from other sources such as plant logbooks, inventories, purchase records or similar data sources;
- A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PoA-DD, CPA-DD and the selected methodology and corresponding tool(s), where applicable;
- A review of calculations and assumptions made in determining the GHG data and emission reductions;
- A detailed review of the implementation and monitoring of all SD indicators as per the registered GS PoA Passport
- An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

Before and during the on-site visit the verification team performed interviews with the project participants to confirm selected information and to resolve issues identified in the document review.

Representatives of Alternative Energy Promotion Centre (AEPC) including the operational staff of the plant were interviewed. The main topics of the interviews are summarised in Table 3-4.

Table 3-4: Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
Projects & Operations Personnel; Alternative Energy Promotion Centre (AEPC) Representatives from Biogas companies	- General aspects of the project - Technical equipment and operation - Changes since validation / previous verification - Monitoring and measurement equipment - Remaining issues from validation/ previous verification - Calibration procedures

Interviewed Persons / Entities	Interview topics
Randomly selected biogas users	- Quality management system/QC/ISO/ - Involved personnel and responsibilities - Training and practice of the operational personnel - Implementation of the monitoring and sampling plans - Monitoring data management - Data uncertainty and residual risks - GHG emission reduction calculation - Procedural aspects of the verification - Maintenance - Environmental aspects

The list of interviewees is included in chapter 7.4.

3.7. Draft verification reporting

On the basis of the desk review, the on-site visit, follow-up interviews and further background investigation the verification protocol is completed. This protocol together with a general project and procedural description of the verification and a detailed list of the verification findings form the draft verification report. This report is sent to the client for resolution of raised CARs, CLs and FARs.

3.8. Resolution of CARs, CLs and FARs

Nonconformities raised during the verification can either be seen as a non-fulfilment of criteria ensuring the proper implementation of a project or where a risk to deliver high quality emission reductions is identified.

Corrective Action Requests (CARs) are issued, if:

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

The verification team uses the term Clarification Request (CL), which is be issued if:

- information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

Forward Action Requests (FAR) indicate essential risks for further periodic verifications. Forward Action Requests are issued, if:

- the monitoring and reporting require attention and / or adjustment for the next verification period.

For a detailed list of all CARs, CLs and FARs raised in the course of the verification pl. refer to chapter 4.

3.9. Final reporting

Upon successful closure of all raised CARs and CLs the final verification report including a positive verification opinion can be issued. In case not all essential issues could finally be resolved, a final report including a negative verification opinion is issued.

The final report summarizes the final assessments w.r.t. all applicable criteria.

3.10. Technical review

Before submission of the final verification report a technical review of the whole verification procedure is carried out. The technical reviewer is a competent GHG auditor being appointed for the scope this project falls under. The technical reviewer is not considered to be part of the verification team and thus not involved in the decision making process up to the technical review.

As a result of the technical review process the verification opinion and the topic specific assessments as prepared by the verification team leader may be confirmed or revised. Furthermore reporting improvements might be achieved.

3.11. Final approval

After successful technical review an overall (esp. procedural) assessment of the complete verification will be carried out by a senior assessor located in the accredited premises of TÜV NORD.

After this step the request for issuance can be started.

4. VERIFICATION FINDINGS

In the following paragraphs the findings from the desk review of the monitoring report(s)/MR/, the calculation spreadsheet/XLS/, PoA-DD/PoA-DD/, CPA-DD/CPA-DD/, the Validation Report/VAL/ and other supporting documents, as well as from the on-site assessment and the interviews are summarised.

The summary of CAR, CL and FAR issued are shown in Table 4-1:

Table 4-1: Summary of CAR, CL and FAR

Verification topic	No. of CAR	No. of CL	No. of FAR
A – Description of project activity	0	1	0
B – Implementation of project activity	0	0	0
C – Description of monitoring system	0	0	0
D – GHG Data and parameters & SD Indicators	2	1	0
E - Calculation of Emission Reductions	1	1	0
SUM	**3**	**3**	**0**

The following tables include all raised CARs, CLs and FARs and the assessments of the same by the verification team. For an in depth evaluation of all verification items it should be referred to the verification protocols (see Annex).

CL ID	1	**Section no.**		**Date:**27/06/2018
Description of CL				
1. The Sectoral scope mentioned in first page of the MR is not correct, please clarify 2. The information provided in the MR section A.1.2 is not consistent with other sections 3. The leakage emissions mentioned in the MR is not as per the filling guidelines 4. The information about the QA/QC procedures mentioned in section E.7.1 is missing in the MR				
CME response				**Date:**18/7/2018
1. The sectoral scope has been corrected in the first page of MR as per the UNFCCC web link for the PoA. 2. The information provided in the MR section A.1.2 is revised accordingly. 3. The respective section in MR for leakage emissions calculation is updated accordingly. Please see section F.3 of revised MR. 4. The information about the QA/QC procedures mentioned in section E.7.1 of PoA DD is incorporated in revised MR. See section E.2 & E.3 of revised MR.				
Documentation provided by the CME				

1. Revised CDM MR version 02	
DOE assessment	**Date:** 07/08/2018
1. The Sectoral scope is correctly mentioned as Energy industries (renewable - / non-renewable sources) 2. The CPA title and reference number given in section A.1.2 is in line with the CPA titles appearing in UNFCCC PoA page. 3. The default leakage factor is used to estimate the leakage and information is given in Section F.3 of the revised MR 4. The QA/QC procedure to check the construction progress of the bio digesters as mentioned in the PoA DD and also about the training requirements and QA/QC procedures followed by the survey team is incorporated in section E.3 of the revised MR. Also the QA/QC check for new digesters are given in section E,2. Hence Accepted CL 1 is closed	

CL ID	2	**Section no.**		**Date:**27/06/2018
Description of CL				
The following documents need to be submitted 1. Quality control documents, done by AEPC and BSP 2. Screen Shots of the random number generated for the sample selections 3. ISO certificates 4. Construction progress report issued by BSP Nepal to AEPC				
CME response				**Date:18/7/2018**
1. A sample of a Quality Control report of Biogas Installation prepared by BSP-Nepal and the Quality control of Biogas User Survey done by Climate and Carbon Unit of AEPC are provided with this response. 2. The Screen shots for the random sample selection for the Biogas User Survey 2016/17 for Nepal Biogas Support Programme-PoA is provided with this response. 3. ISO Certificate of BSP Nepal is provided with this response. 4. A sample of Construction Progress report submitted by the BSP-Nepal to AEPC is provided with this response.				
Documentation provided by the CME				
1. BSP-Nepal Quality Control & Monitoring for Nepali fiscal year 2071/72 2. Quality control report for the BUS reports conducted in 2016-17, dated Aug 2017 by AEPC. 3. Screen shots of random selection. 4. ISO 9001:2008 Certificate no ET/ISO/1606/1238 by Eurotech to BSP Nepal issued 20/06/2016 and valid till 19/06/2019 5. Construction progress report_ BSP- May 2016.				
DOE assessment				**Date:** 07/08/2018
1. The quality observation reports by Climate and Carbon Unit of AEPC (CCU) for the year 2071/72, (Nepali fiscal year) submitted is verified and the sample of corrections /suggestions as per the quality report are done by the Biogas construction companies and the closing reports are verified for further processing (that is the closing reports are deemed as actual completion and commissioning of the biogas digesters). 2. The screen shorts are provided and the sample selected are based on the random number generated, hence accepted 3. The quality management system certificate based on ISO 9001:2008 is submitted by the client is verified and it is valid till date. 4. The sample construction progress report especially for the digesters in CPA -8 (which is recently added to the PoA) is checked for May 2016 and found the digesters for CPA -8 are installed, the same is provided in section E.2 and hence accepted. CL 3 is closed				

CL ID	3	**Section no.**	GS MR Section 1	**Date:**27/06/2018

Description of CL	
1. The Monitoring report it is mentioned that out of 18700 digesters damaged due to earthquake only 6030 are repaired and completed. Please clarify how the remaining digester's are taken in to account	
CME response	**Date:14/09/2018**
1. The total numbers that are mentioned in section 1 is for the entire country. This is based on the government estimate. The same is revised to have clarity in the MR.	
Documentation provided by the CME	
Revised GS MR version 02	
DOE assessment	**Date:** 07/08/2018
1, The Statement in section of the GS MR is revised accordingly. This is also confirmed during the site visit when the VT had discussions with the Program Officer. The digesters belonging to the GS PoA and other activities are also taken up for repair work . Hence CL is closed	

CAR ID	1	**Section no.**		**Date:**27/06/2018
Description of CAR				
The values of P taken from the BUS reports and MR are not transparent as per the information provided in the table in section E,2 under calculation methods.				
CME response				**Date:18/7/2018**
The operational percentage of the plants "P" under section E.2 of the MR is calculated taking the weighted average of the population of Biogas plants in Hill, Remote hill and Terai based on the Biogas User Survey sample results. This is mentioned in the revised CER calculation spread sheet and second table under the Part II of the MR.				
Documentation provided by the CME				
Revised CDM MR Version 02 and Revised CER sheets Version 02				
DOE assessment				**Date:**DD/MM/YYYY
The information about the operational status is provided in the Part II of the MR and the section E.2 the reference for the same is added. The Calculation presented in the CER is based on the information in BUS reports. The weighted average value for each CPA is taken and the overall operational proportion is higher as observed during site visit hence accepted and CAR 1 is closed.				

CAR ID	2	**Section no.**		**Date:**27/06/2018
Description of CAR				
The sample size calculation is not transparently provided in the MR and calculation sheets, also the value of pi taken in each strata and the justification provided for the same is not clear. Please clarify				
CME response				**Date: 18/7/2018**
The sample size calculation is transparently given in the section E.3 of the revised MR and in the revised CER Sheets. The justification for the value of p taken is based on the previous verification results; accordingly 25% for remote hill, 60% for hill and 80% for Terai is taken. The revised CER and MR is submitted. The CME increased the samples by 15% and rounded it to 135 (which is maximum for CPA 3 and CPA4) and taken uniformly for all the 4 CPAs.				
Documentation provided by the CME				
Revised CDM MR Version 02 and Revised CER sheets Version 02				
DOE assessment				**Date:**07/08/2018

The PP considered the value of pi (value of the proportion) from the previous verification results (minimum value of 25% for remote hill, 60% for hill and 80% for Terai) and the estimated numbers varied from 106 to 112 for the CPAs and the PP increased the size to 135 for all CPAs. But as per the PoA DD the PP is required to take only 72 samples (with 75% response) and thus took more samples

The revised MR and CER Sheets are checked and found that the equations used are as per the sampling guidelines and the calculation is transparent hence CAR 2 is closed

CAR ID	3	**Section no.**	Section 3 and Section 4 of GS MR	**Date:**27/06/2018
Description of CAR				
Please clarify the following 1. the samples for CPA-4 is mentioned as 1135, under table-8, 2. Ex ante Estimated emission reduction for the monitoring period is not given in the MR 3. The CER Apportion for CPA4 is not correct 4. Table 11 the values are not matching 5. Table 14 the total is not correct 6. Table 28 the values are wrong.				
CME response				**Date: 14/09/2018**
1. The sample numbers are 135 only and now revised. 2. The same is added in the table10. 3. The total is now corrected. 4. The typo errors are corrected in table 11. 5. Table 14 the total is corrected. 6. The values in table 28 is corrected. The revised MR is submitted				
Documentation provided by the CME				
Revised GS MR Version 02				
DOE assessment				**Date:**14/09/2018
The Typo errors are corrected in the respective tables and the Ex ante Estimated emissions are given table 10 of the GS MR. Hence CAR is closed.				

5. SUMMARY OF VERIFICATION ASSESSMENTS

The following paragraphs include the summary of the final verification assessments after all CARs and CLs are closed out. For details of the assessments pl. refer to the discussion of the verification findings in chapter 4.

5.1. Involved Parties and Project Participants

The following parties to the Kyoto Protocol and project participants are involved in this project activity.

Table 5-1: Project Parties and project participants

Characteristic	Party	Project Participant
Non-Annex 1	Nepal	Alternative Energy Promotion Centre (AEPC)
Annex 1	Germany	atmosfair gGmbH

5.2. Implementation of the project

During the verification a site visit was carried out. On the basis of this site visit and the reviewed project documentation/CR//PCR//BSPDB//BUB/ (like construction progress report and Plant completion progress/CR/ for Bio digester installation) it can be confirmed that w.r.t. the realized technology, the project equipment, as well as the monitoring the project has been implemented and operated as described in the registered CPA-DD for all four CPA's involved in the current monitoring period. Details of which is given below:

Co-ordinating and Managing entity/Project Participants:	Alternative Energy Promotion Centre (AEPC)
Title of the PoA:	Nepal Biogas Support Program-PoA
UNFCCC registration number & date GS Registration number & Date	9572- 31/03/2013 GS- 3110- 14/08/2015.
Applied Baseline and monitoring methodology:	AMS-I.E. ver. 4 - Switch from Non-Renewable Biomass for Thermal Applications by the User
Title of the CPA:	Nepal Biogas Support Program - CPA 4: 19,970 digesters. Nepal Biogas Support Program - CPA 3: 19,959 digesters. Nepal Biogas Support Program - CPA 2: 19,927 digesters Nepal Biogas Support Program- CPA 1: 20,000 digesters

CDM - CPA reference number/ incl. date: CPA-4 CPA-3 CPA-2 CPA-1	 9572-0004 / 08/05/2014 9572-0003 / 08/05/2014 9572-0002 / 08/05/2014 9572-0001 / 31/01/2013
CPA start date: CPA-4 CPA-3 CPA-2 CPA-1	 20/02/2011 10/03/2010 19/03/2009 22/06/2007
CPA start of operation:	First digester of CPA-1 implemented on 22/06/2007 First digester of CPA-2 implemented on 19/03/2009 First digester of CPA-3 implemented on 10/03/2010 First digester of CPA-4 implemented on 19/02/2011
GS Reference number and inclusion date CPA-4 CPA-3 CPA-2 CPA-1	 GS3116 - 14/08/2015 GS3114 - 14/08/2015 GS3113 - 14/08/2015 GS3109 - 14/08/2015
CPA implementer	Alternative Energy Promotion Centre (AEPC)
Project Scale:	Small Scale
Location of the CPA:	Nepal
CPA crediting period: CPA-4 CPA-3 CPA-2 CPA-1	 08/05/2014 - 07/05/2021 (Renewable) 08/05/2014 - 07/05/2021 (Renewable) 08/05/2014 - 07/05/2021 (Renewable) 31/01/2013 - 30/01/2020 (Renewable)
Reported monitoring Period verified in this CDM verification:	01/08/2016 – 31/07/2017
Reported monitoring Period verified for GS CER issuance in this verification:	01/08/2016 – 31/07/2017

Verification team has checked the contract signed between AEPC and BSP Nepal for conducting the service of national service provider for installation of biogas plant in households across rural areas of Nepal.

For the first monitoring period of this POA which includes CPA-1, CPA-2, CPA-3 and CPA-4 the project involves installation and operation of biogas plants of sizes 2, 4, 6, 8, and 10 m^3, which are in operation at across various districts of Nepal. The construction date of these bio-digesters starts from database maintained by BSP Nepal for all the Biodgiesters/BSPDB/. The construction date is also referred as the operational date is checked from the construction progress report issued by BSP Nepal to AEPC/CR/. The same was checked during the site visit and the random check from the database. Further based on the physical inspection of biogas plants and interviews with the technology suppliers, contractors and household it was

confirmed that the technology employed in the project is as same as discussed in the registered CDM POA-DD, GS PoA DD and respective CPA-DDs. In addition, individual households were interviewed during the site visit to confirm the owners name, size of the plant, operational date and operational status of the plant, UID no and other fuel used apart from the Biogas. This is also is in line with the biogas user survey report conducted by surveying agency.

5.3. Project history

During the validation the validating DOE has not raised any issues that could not be closed or resolved during the validation stage. For this purpose no FARs is raised. No such issues were identified for this project. This was confirmed from table 4-1 of the POA validation reports/VAL/

During the on-site visit and the desk review process, the audit team reviewed different information from the operational system of the project, surveys reports, communications and other internal reports and records in order to identify changes or incidents during the operation of the project.

No events or situations occurred in the monitoring period that impacted the applicability of the methodology and monitoring plan.

There is no outstanding issue from the previous three monitoring periods, No FARs raised during the previous monitoring period.

5.4. Post registration changes

Post registration changes (PRC) is not applicable for this monitoring period, but during the first monitoring period PRC was observed with respect to CPA inclusion for CPA-1.CME has gone for corrections that do not affect project design and the post registration changes are in Appendix 1 of the CDM project standard. Project proponent submitted the revised CPA-DD and emission reduction sheet for CPA-1 and which was approved and by UNFCCC along with the issuance.

Under CPA-1 corrections in the ecological zones of biogas digesters implemented were required. Out of the 20,000 digesters (10,011 in terai, 9,873 in hills and 116 in remote hill) reported during registration. As verified by verification team it was noted that there have been some cross posting of ecological zones in the spreadsheet communicated during the registration of the PoA/CPA inclusion. Hence a correction was proposed for CPA-1 for which the number and identity of the digesters will remain the same however, they are distributed as 10,955 in Terai, 8,940 in Hills and 105 in Remote Hills. The rearrangement of the digesters across the ecological zones was presented in section B.1 (CPA-1) above. The re-arrangement of the digesters involve any changes in the CPA threshold and scale of the CPA. However, there was a slight revision in the ex-ante emission estimation (from 61,510 tCO_2 e to 61,889

tCO_2e) as the rearrangement of the digesters triggered the revision in emission reduction in each ecological zone category.

5.5. Compliance with the GS Monitoring plan

The monitoring system and all applied procedures are completely in compliance to the registered monitoring plan. Regarding the compliance with the monitoring plan, the verification team reviewed if:

- The monitoring of reductions in GHG emissions resulting from the proposed CDM Programme of Activity (PoA)/CPA were implemented in accordance with the monitoring plan contained in the registered POA-DDs/CPA-DDs.
- The monitoring plan and the applied methodologies had been properly implemented and followed by the project participants.
- All parameters stated in the monitoring plan and Sustainability monitoring plan, the applied methodologies and relevant CDM EB decisions and GS requirments had been sufficiently monitored and updated.
- The responsibilities and authorities for monitoring and reporting were in accordance with the responsibilities and authorities stated in the monitoring plan.

The monitoring system and all applied procedures are in compliance with the monitoring plan contained in the registered PoA-DDs, CPA-DDs and the applied methodology AMS-I.E. ver.04, based on the information included in the final monitoring reports (CDM and GS).

Thus, it is concluded by verification team that the monitoring plan as stipulated in registered PoA-DDs, and is observed to be followed in the project and the description of the monitoring system provided in the Monitoring Reports/MR/ is verified during onsite observation, verification of plant records/BUS//ISO/and interview with the involved personnel in operation and maintenance of the CPA (s) and found to be appropriate by verification team. Thus monitoring system and all applied procedures are completely in compliance to the registered GHG and Sustainability monitoring plans.

5.6. Compliance with the monitoring methodology

The monitoring system is in compliance with the applied monitoring methodology AMS-I.E. ver.04 i.e. “Switch from Non-Renewable Biomass for thermal applications by the user”).

The verification team reviewed whether the registered monitoring plan was in accordance with the applied methodology and if any other monitoring aspect of the CPA (s) that is not specified in the methodology was identified.

- The verification team confirmed that the monitoring plan of the validated CDM Programme of Activity (PoA) and CPA is in accordance with the applied

approved methodology AMS-I.E. ver.04 ("Switch from Non-Renewable Biomass for thermal applications by the user") based on the following reasons:

- During the desk review monitoring parameters included in the applied methodology were compared with the ones included in the monitoring plan of the registered PoA-DD and CPA-DD, and they were found consistent.
- During the verification process no need was identified for revision of the monitoring plan.
- No other relevant aspects for monitoring not included in the methodology were identified.
- No deviations from the monitoring methodology were identified during the verification process.

Thus, it is concluded by verification team that the monitoring report and emissions reduction calculations are in line with the requirements of the validated monitoring plan as well as with the applied methodology. Thus, the reporting procedures correctly reflect the requirements of the monitoring plan.

5.7. Monitoring of Carbon (GHG) parameters

During the verification all relevant monitoring parameters (as listed in chapter D.7.1 of the CPA-DD) have been verified with regard to the appropriateness of the applied measurement / determination 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 project specific verification checklist (Annex I- Verification Protocol).

After appropriate corrections were carried out by the project participant it can be confirmed that all monitoring parameters have been measured / determined without material misstatements and in line with all applicable standards and relevant requirements.

The following data and parameters fixed ex ante or at renewal of crediting period were checked by the verification team to be in line with registered CPA-DD (s):

(1) Net calorific value of the non-renewable biomass that is substituted; **$NCV_{biomass}$**

(2) Emission factor for the projected fossil fuel consumption in the baseline; **$EF_{projected\_fossil\ fuel}$**

(3) Fraction of biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using nationally approved methods; **fNRB,y**

(4) Number of digesters in each size category (in m^3) and region (Terai, Hill and, if available, Remote Hill or Mountain) implemented under the CPA; **$N_{s,r}$**

(5) Quantity of woody biomass that is substituted or displaced in tonnes per year and appliance; **$Q_{NRBrepl}$** and

And there is only single ex-post monitoring parameter required to be monitored is which is "The share of digesters operational (based on the total number implemented using non renewable biomass)"; **P** as per registered monitoring plan in POA-DD and CPA-DD (s). This monitoring parameter is calculated as the weighted average value across all ecological zones as sourced from the annual biogas users' survey. CPA wise results of BUS are as follows:

CPA Details	*Value(s) of monitored parameter*[3]	*Source of data*
CPA-1 (BUS 2016/17)	74.97	BUS Report 2016/17: CPA-1
CPA-2 (BUS 2016/17)	83.06	BUS Report 2016/17: CPA-2
CPA-3 (BUS 2016/17)	82.92	BUS Report 2016/17CPA-3
CPA-4 (BUS 2016/17)	87.87	BUS Report 2016/17: CPA-4

Verification team checked the Biogas User Survey (BUS) report for each CPA and confirmed that the value of the monitored parameter is correctly calculated and used for emission reduction calculations.

5.8. Monitoring report(s)

The GS monitoring report is submitted for verification along with CDM monitoring report submitted to UNFCCC EB for issued CERs during this 4th verification. The CME/PP/CPA implementer has carried out the requested corrections so that it can be confirmed that the GS monitoring report is complete and transparent and in accordance with the registered POA-DD/CPA-DD (s) and other relevant requirements. Final monitoring report/MR/ is submitted for the issuance request.

5.9. Sampling

5.9.1. Implementation of the sampling plan

The Biogas Users Survey (BUS) intends to monitor the key parameters that were envisaged as monitoring parameters while designing the Program of Activities for individual CPA (s). For the GS PoA verification, the 4 CPA's are included. Such parameter mainly includes identification of non-operational biogas plants and assessment of non-renewable source of biomass and the sustainability monitoring parameters as per the GS passport

[3] weighted average value across all ecological zones i.e. Terai; Hill and Mountain or Remote Hill in Nepal.

☐	No sampling approach has been used by the PP to determine the monitored parameters
☒	A sampling approach has been taken for the following monitored parameter(s):

Parameter	Sampling approach [1)]	Sampling Type [2)]	Population	Sample Size
P% - The share of digesters operational and SD Moinitoring parameters	StRS	PS	CPA1- 20000	135
			CPA2-19927	135
			CPA3 -19959	135
			CPA4 -19970	135

[1)] *Sampling Approaches:*

SiRS: *Simple Random Sampling*
StRS: *Stratified Random Sampling*
SS: *Systematic Sampling*
CS: *Cluster Sampling*
MSS: *Multi-stage Sampling*

[2)] *Sampling Types:*

PS: *Parameter Sampling*

Using the equation as provided in the monitoring plan for the PoA-DD, a minimum sample size of 54 is required but with 75% response rate the PP is supposed to take sample of 72 households for each CPA. But the CME took the value ”pi” the expected proportion of the biodigeters working in each of the ecological zones from previous verification results and arrived the value of required samples for each CPA and it is . varied from 106 to 116 for the CPAs. But PP increased the samples and took 135 samples homogeneously for each of the 8 CPAs to arrive at the share of digester based on the requirements mentioned in “Standard for Sampling and surveys for CDM project activities and programmes of activities (version 07.0)” for stratified sampling.

he samples are allocated in two different ways to maintain the representativeness. First, samples are allocated proportionally to ecological belts and development regions based on proportion of biogas installed in these two areas and Secondly, sample are allocated to size of biogas (2, 4, 6, 8, 10 m^3). First the samples were allocated proportionately to the cluster and later the distribution of samples among different sizes of the digesters was ensured. It represents the proportion of biogas digester implemented under the CPA (s) of the PoA. The verification team checked the BUS report to confirm the correctness of the samples for all CPA’s involved in the current monitoring period.

The sample size is calculated from the total population of biogas units with 90/10 confidence/precision level. The same is in line with EB 86 Annex 4. The sampling plan is assessed as part of the BUS report for all the CPA’s i.e. CPA-1; CPA-2; CPA-3 and CPA-4. The survey of 2016-17 was carried out by an independent third party, The verification team has checked the sampling approach through the onsite visit

interview and also by going through the methodology followed by the surveying entity i.e. Sustainable Energy and Technology Management P. Ltd. (SETM) .

Thus the sample size calculation is in line with the sampling requirements of EB 86 annex 4 as well as with annex 4 of the registered PoA DD. Verification team noted that all biogas digesters sold are registered under BSP Nepal database and their performance is monitored through field surveys of a random sample of the installed households. The biogas production of biogas plants is not metered. Through a sample survey, the number of systems out of order has been determined and the performance ratio is calculated by taking the percentage of the sold biogas digesters that are still operating. This is in compliance with the requirements of registered PoA-DD and CPA-DD hence was accepted by DOE.

5.9.2. Sampling approaches during verification

During the on-site verification, a sampling approach has been used to verify the reported values all the SD monitoring parameters. The verification team sampled the biogas digesters.

☐	No sampling approach has been used by the VT to verify the monitored parameters
☒	A sampling approach has been applied by the VT for the following monitored parameter(s):

Parameter	Sampling approach [1)]	Sampling Type [2)]	Population	Sample Size
P% - The share of digesters operational and SD monitoring parameters	SiRS	AS	CPA1- 135	26
			CPA2-135	24
			CPA3 -135	21
			CPA4 -135	25

[1)] *Sampling Approaches:*

SiRS: *Simple Random Sampling*
StRS: *Stratified Random Sampling*
SS: *Systematic Sampling*
CS: *Cluster Sampling*
MSS: *Multi-stage Sampling*

[2)] *Sampling Types:*

AS: *Acceptance Sampling*
PS: *Parameter Sampling*
COM: *Full data check at higher data aggregation levels and sampling at original data levels*

During the on-site verification, a sampling approach has been used by the verification team to verify the reported values for the monitored parameters of P% - The share of digesters operational, with reasonable efforts from the original data level to the reporting level. The BUS report for each CPA is the basis.

Based on the Standard for "Sampling and surveys for CDM project activities and programmes of activities" Version 07.0, with a AQL and UQL 0.5% and 20% respectively with 10% producer risk and consumer risk the sample paragraph 30 the acceptance number 0, the size of the sample for each CPA required is 11. The Verification team analysed the webhosted monitoring report and on the basis of the data provided in it and considering the travel time and based on the prevailing climatic conditions, the VT decided to check around 18-20 households for each CPA (i.,e more than 12% of PPs sample size, but with a combination of sample of sampled and non - sampled households.). Also the host country, Nepal being a least developed country (http://unctad.org/en/Pages/ALDC/Least%20Developed%20Countries/UN-list-of-Least-Developed-Countries.aspx) the sampling taken for verification by the DOE is in line with paragraph 31 of the Standard for "Sampling and surveys for CDM project activities and programmes of activities" Version 07.0,

Accordingly to have an effective travel schedule, the VT handpicked the VDCs (Village development Council) with maximum samples (first three for each CPA) of PP and superimposed on the map of Nepal and the districts with more VDCs representing the PP samples are selected in such way that the sample of all CPAs are covered and also care is taken to cover a Terai district and a hill district for each CPA. The non-sample households for each CPA representing different VDC (other than the sampled VDC is selected) in a hill district and a Terai district which comes along the route of sampled districts.

Thus for each CPA, VT visited sample households in one VDC each to represent Terai and hill district and non- sample households in a different VDC to represent Terai and hill district. Apart from that one remote hill district was also selected to representation of all CPAs. Also as this is combined site visit with other 4 CDM project activities implemented by the same PP and same technology. The VT randomly picked some households which are accessible during the travel (sample as well as non-sampled) apart from the originally selected VDCs to ensure further randomness

During the on site visit out of 178 samples taken for CDM monitoring, 93 samples represent GS Monitoring. Out of the 93 samples 79 are operational. Thus 84.9% of the households found to be working as per the site visit information which more than overall operational status of 82.02% presented by PP. During the time of the sample survey, if the digester is not found working (even for minor repairs) it is considered as not operational. However during the site visit it was observed the non-operational digesters as mentioned in the survey report was found working (after the repairs). Also the information captured at the time of survey was crossed checked by having discussion with the user for the PP samples and found correct. Thus overall operational status at the time of user survey is lesser than the overall operational status as verified by the VT. Also during the interview with program officer it was observed that the government is having plans to reconstruct / refurbish more than

3000 non-functional digesters per year for the next 3 years. Already the plan is implemented during the last fiscal year.

As a per the registered CPA DD the CPA implementer has to conduct biennial monitoring but they have done annual monitoring and adequately considered 135 samples, 63 more than the required 72 for each CPA as per registered PoA-DD. The section 2.5 of the BUS (Biogas User Survey) 2016 for each of the CPAs are checked and found that the sampling error calculated by the survey agency is less than 10% for all the CPAs, which is the acceptable as the PP took 90/10 confidence level. Thus VT concluded that the sampling requirements are adequately met and accepted the results as presented in the monitoring BUS reports, and the same is recorded in the monitoring report with a reasonable level of confidence.

5.10. ER Calculation

The CER sheets submitted for issuance request in CDM cycle during the 4th periodic verification is presented for verification by the PP for GS CER verification for this monitoring period without affecting the material information. During the verification mistakes in the ER calculation were identified. Corresponding findings were raised. A revised ER calculation was prepared by the PP and presented to the verification team. All raised issues were addressed appropriately so that all corresponding CARs could be closed out. Thus it is confirmed that the ER calculation is overall correct.

The equations for baseline emissions, as provided in the monitoring report and confirmed with the registered CPA-DDs and the applied methodology are:

$$ER_y = B_y \cdot f_{NRB.y} \cdot NCV_{biomass} \cdot EF_{projected.fodssilfuel}$$

Where,

ERy = Emissions Reductions during the year y

B_y = Quantity of woody biomass that is substituted or displaced

$f_{NRB.y}$ = fraction of non-renewable biomass

$NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted

$EF_{projected.fossilfuel}$ = Emission factor for substitution of non-renewable woody biomass by similar consumers.

with:

$B_y = N_{sr} \times P \times Q_{NRBrepl.}$

Where,

N_{sr} = the number of appliances

P = Performance of digesters as the share of digesters implemented that is actually operational, determined through survey methods (%)

$Q_{NRBrepl.}$ = Average quantity of biomass replaced per appliance and year

B_y being multiplied by the net to gross adjustment factor of 0.95 results in emission reductions as

The following are the CER achieved vintage wise during the verified monitoring period

Year	2016	2017	Total
	tCO_2e	**tCO_2e**	**tCO_2e**
CPA-1	20929	28999	49928
CPA-2	23103	32012	55115
CPA-3	23102	32010	55112
CPA-4	24493	33940	58433
Total	**91627**	**126961**	**218588**

5.11. Quality Management

Quality Management procedures/QC/BUB/IMS/ISO/ for collection and compilation of data, data storage and archiving, maintenance and training of personnel/TRG/ in the framework of this GS-CDM Programme of Activity (PoA) have been defined and all these parameters were cross checked during onsite visit and interview of client, site personnel and contractors/IM01/. Quality Management system manual/ISO/ and QC Manual/QC/ were checked. The QMS manual is found integrated with ISO system. The procedures defined can be assessed as appropriate for the purpose. No significant deviations thereof have been observed during the verification.

The monitoring system covers:

1. organizational structure/ORG/;
2. internal audits procedures/IMS/;
3. training plan/TRG/;
4. handling data procedures;
5. data collection, analysis and calculation procedures/SUR/;
6. data checking and storage procedures/SUR/;
7. roles and responsibilities.

The verification team was able to check the consistency of the procedures during the site visit interviews and document review during the site visit which includes:

a) Plant Completion report; Database maintained by BSP Nepal for all the Bio dgiesters;

b) Biogas plant owners/user's booklet issued by AEPC;

c) Managementsystem certificate;

d) Field Trip Report Quality Control and Monitoring Department by BSP Nepal;

e) Training provided by AEPC person and consultant team (responsible for BUS Reports) to the enumerators;/TRG/

f) Quality Standard manual prepared by BSP Nepal for the construction of Bio digester in Nepal;

g) Contract for the operation of the AEPC/NRREP NSP/RSC signed between AEPC and BSP Nepal for conducting the service of National Service provider for AEPC;

h) Biogas User's Survey for the 2016-17 applicable for CPA-1 to CPA-4;

i) Survey Questionnaire used by survey agency for the BUS Reports;

j) Quality Standard manual prepared by BSP Nepal for the construction of Bio digester in Nepal dated 2010 (Given to the companies and or end user)

Thus, it is concluded that the GHG data monitoring system are assessed as appropriate and all the monitoring procedures have been fully integrated in the project participant's quality management system.

5.12. Actual emission reductions during the first commitment period and the period from 1 January 2013 onwards

The MR(s) include(s) actual ER values achieved up to 31 December 2012 and actual values achieved from 1 January 2013 onwards as follows:

Table 5-2: Emission reductions before and after the end of 2012

	until 2012-12-31 [1)]	from 2013-01-01 [1)]	Sum
Emission reductions [tCO_{2e}]	-	**218588**	**218588**

[1)] Both days included

5.13. Comparison with ex-ante estimated emission reductions

The CDM MR in section H.5 includes a comparison of the calculated actual emission reductions with the ex-ante calculated values in the registered PoA-DD and CPA-DD.

The calculated value was found to be less than the ex-post determined value, thus no further justification was required. However, this marginal variation is due to

change in the operational status of the Bio digesters in CPA-1 CPA-2, CPA-3, CPA-4 (2016/17). Verification team has checked the results of the all four Biogas Users' Survey reports conducted for these CPA's for the current monitoring period to confirm that the emission reduction as presented for CPA-1, CPA-2 CPA-3 and CPA-4 are correct and accurate.

5.14. Contribution to Sustainable Development

This section gives a detailed DOE assessment and opinion of the PoA's contribution to sustainable development during this monitoring period, as outlined in the sustainability monitoring plan of the project GS Passport. The Sustainable development parameters are monitored as indiated in the below table.

Table 5-1: Assessment of monitored SD Indicators:

No	Indicator	Parameter	Value	DOE verification Opinion on improvement/changes of key sustainable development indicators and mitigation measures
1	Air Quality	Reduction in smoke	CPA 1:99.% CPA 2: 100% CPA 3: 100% CPA 4: 98.29%	The BUS report submitted by the PP is checked by the verification team which is the basis for the arrived results. The Annual Survey is conducted from a sample of 135 households and the survey team enquired about the quality of air inside the kitchen and the responses are recorded in the survey During the on-site visit the VT randomly selected 93 households (both surveyed and non-surveyed) and enquired about the air quality and concluded that the project completely reduced the smoke and suspended air particles after the implementation of the biogas plant when compared with traditional cooking. All households indicated that smoke is reduced in kitchen and eye irritation is not there. Therefore, the conclusions of the monitoring team are deemed to be correct. The sampling plan for the indicator is annual by recording the experience during the BUS
02	Soil Condition	Use of bio slurry manure	CPA 1: 99% CPA 2: 95.12 CPA 3: 100% CPA 4: 99.1%	The BUS report submitted by the PP is checked by the verification team which is the basis for the arrived results. The Annual Survey is conducted from a sample of 135 households and the survey team enquired about the application of the slurry and the responses are recorded in the

				survey During the on-site visit the VT randomly selected 93 households (both surveyed and non-surveyed) and enquired about the usage of the slurry, and concluded that due to the implementation of the project, the entire slurry is used as organic manure in the field, most of the respondents indicated they are using as manure on the fields and some respondents (who have less agricultural fields/ lands or no lands) indicated that they used to sell the slurry as manure for others to use it as manure. The sampling plan for the indicator is annual by recording the actual disposal during the BUS
03	Livelihood of the Poor	Sanitation Access	Toilet constructed along with biogas unit CPA 1: 79.41% CPA 2: 95.45 CPA 3: 97.32% CAP 4: 93.16	The BUS report submitted by the PP is checked by the verification team which is the basis for the arrived results. The Annual Survey is conducted from a sample of 135 households and the survey team enquired about the sanitation and the responses are recorded in the survey During the verification, the users without any toilet access before the construction of biogas indicated that they wanted to have a toilet along with the biogas digesters. Those had toilet connected the toilet with the bio digesters and a few could not connect it because of the location of toilet and digesters. Thus the project improved the sanitation of the end users. The sampling plan for the indicator is annual recording based on the actual practice during the BUS.
04	Access to affordable and clean energy services	Continued Operational status of the bio digesters	CPA 1: 74.97% CPA 2: 83.06% CPA 3: 82.92% CPA 4: 87.87%	The BUS report submitted by the PP is checked by the verification team which is the basis for the arrived results. The Annual Survey is conducted from a sample of 135 households and the survey team enquired about the operational status and physically checked the units and the responses are recorded in the survey During the verification the VT found that out of the 93 digesters 79 were found working and 14 were non-operational due to various reasons, thus around 84.94% of the

				digesters were operational during the time of verification. Thus the value of the parameter arrived by the PP is correct. Also during the verification interviews the households indicated that the operation of the stoves itself similar to the LPG stoves, click of the knob they start the cooking. It is continuously monitored through the data base and the information will be analysed from the survey results and the presented at the time of GS monitoring report preparation During site visit the beneficiaries indicated that during rainy reason it is difficult for them to litter the firewood. Thus due to this project they are having good access to the clean and affordable energy.
05	Quality of Employment			Not Monitored for retrospective Labeling as the employment and labour work was over once the digesters are installed Hence not applicable.

The verification team can confirm that no changes to the registered SD parameters have occured that may have an impact on Gold Standard qualification of this project activity

The verification team can also confirm that the project has achieved the mitigation/compensation measures as per the registered monitoring plan

5.15. Overall Aspects of the Verification

All necessary and requested documentation was provided by the project participants so that a complete verification of all relevant issues could be carried out.

Access was granted to all installations of the plant(s) as requested, which are relevant for the project performance and the monitoring activities.

No issues have been identified indicating that the implementation of the single component project activity and the steps to claim emission reductions are not compliant with the GS/UNFCCC criteria and relevant guidance provided by the COP/CMP and the CDM EB (clarifications and/or guidance).

5.16. Grievances

The CME/PP/ CPA implementer has given telephone numbers of the AEPC office to all the users and other stakeholders also the biogas promoters association regional offices to contact directly and record their grievances.

Also in APEC website a provision for online contact and complaint logging is available and the contact information of the officials concerned is given. During the site visit the households indicated that the during the warranty period the biogas companies were responsible for repair works and attended well. The majority of grievances were minor repair works which were attended in First in First Out basis by the local trained personnel along with the spares. The same is verified from the continuous grievance input database maintained.

Thus the CME is having a grievance addressable mechanism to respond to the stakeholders concern.

5.17. Hints for next periodic Verification

No FARs was raised during the course of this (fourth) verification.

6. VERIFICATION AND CERTIFICATION STATEMENT

Alternative Energy Promotion Centre (AEPC) has commissioned the TÜV NORD JI/CDM Certification Program to carry out the 4th periodic verification of the PoA: "Nepal Biogas Support Program-PoA", (UNFCCC PoA 9752 / GS 3110) with regard to the relevant requirements for GS/CDM project activities. The project reduces GHG emissions due to installation of biogas plants and decreased fuel wood consumption. This verification covers the emission reductions achieved by all the CPAs in its corresponding monitoring periods:

CPA No.	***Monitoring period (MP):***	
CPA:1 CPA:2, CPA 3 and CPA 4	***From:***	***To:***
	01/08/2016	31/07/20177

In the course of the verification 3 Corrective Action Requests (CAR) and 3 Clarification Requests (CL) were raised and successfully closed. No FARs have been raised to improve the monitoring system in the future. The verification is based on the draft monitoring report(s), revised monitoring report(s), the monitoring plan as set out in the registered CPA-DD(s), the validation report, emission reduction calculation spread sheet and supporting documents made available to the TÜV NORD JI/CDM CP by the project participant.

As a result of this verification, the verifier confirms that:

- all operations of the project are implemented and installed as planned and described in the validated project design document.
- the monitoring plan is in accordance with the applied approved GS/CDM methodology.
- the monitoring system is in place and functional. The project has generated GHG emission reductions.
- the project contributes to sustainable development

As the result of the 4th periodic verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the PoA has achieved emission reductions in the above mentioned reporting period as follows:

Emission reductions: **218,588** **tCO_{2e}**

New Delhi, 29/10/2018

Prakash Kumar Mishra
TÜV NORD JI/CDM Certification Program
Verification Team Leader

Essen, 29/10/2018

Rainer Winter
TÜV NORD JI/CDM Certification Program
Final Approval

7. REFERENCES

Table 7-1: Documents provided by the project participant(s)

No.	Author	Title	References to the document	Provider
1	CME	Contract for the operation of the AEPC/NRREP NSP/RSC signed between AEPC and BSP Nepal for conducting the service of National Service provider for AEPC includes annex detailed work plan including financial proposal.	**/AEPC/**	CME
2	CME	Database maintained by BSP Nepal for all the Bio-digesters including CPA-1 to CPA-4	**/BSPDB/**	CME
3	CME	Biogas User's Survey for the year 2016-17 for CPA-1 to CPA-4.	**/BUS/**	CME
4	CME	• Biogas plant owners/user's booklet issued by AEPC. • Plant Handover form signed by Bio digester owner.	**/BUB/**	CME
5	CME	• Construction progress report issued by BSP Nepal to AEPC ref. no. BSPN/SA&D/2016/059 dated 05 August 2017. • Plant completion progress report by BSP Nepal	**/CR/**	CME
6	CME	Emission reduction right transfer/sales agreement between Bio digester owner and Construction company.	**/ERS/**	CME
7	CME	• Emission reduction sheet w.r.t to GS MR dated 21/02/2018 version 1.0. • Emission reduction sheet w.r.t to MR dated 06/09/2018 version 2.0 • Emission reduction sheet w.r.t to GS MR dated 18/10/2018 version 3.0 •	**/ER/**	CME
8	CME	ISO 9001:2008 Certificate no ET/ISO/1606/1238 by Eurotech to BSP Nepal issued 20/06/2016 and valid till 19/06/2019	**/ISO/**	CME
9	CME	ISO based internal Monitoring i.e.	**/IMS/**	CME

<table>
<tr><th>No.</th><th>Author</th><th>Title</th><th>References to the document</th><th>Provider</th></tr>
<tr><td></td><td></td><td>Field Trip A sample of Construction Progress report submitted by the BSP-Nepal to AEPC is provided</td><td></td><td></td></tr>
<tr><td>10</td><td>CME</td><td>• CDM Monitoring report of the POA project titled “Nepal Biogas Support Program-PoA” dated 21/02/2018 version 1.0.
• CDM Monitoring report of the POA project titled “Nepal Biogas Support Program-PoA” dated 31/07/2018 version 2.0 CDM Monitoring report of the POA project titled “Nepal Biogas Support Program-PoA” dated 20/09/2018 version 3.0.
• GS monitoring report for the PoA titled Nepal Biogas Support Program GS 3110 version 02 dated 18/02/2018
• GS monitoring report for the PoA titled Nepal Biogas Support Program GS 3110 version 02 dated 06/09/2018
• GS monitoring report for the PoA titled Nepal Biogas Support Program GS 3110 version 03 dated 18/10/2018
•
Details of the CPA’s included in the current monitoring period is given as:
<table>
<tr><th>Ref</th><th>CPA Title</th><th>Inclusion date</th></tr>
<tr><td>9572-0004</td><td>Nepal Biogas Support Program - CPA 4: 19,970 digesters.</td><td>08 May 14</td></tr>
<tr><td>9572-0003</td><td>Nepal Biogas Support Program - CPA 3: 19,959 digesters.</td><td>08 May 14</td></tr>
<tr><td>9572-</td><td>Nepal Biogas</td><td>08 May</td></tr>
</table></td><td>/MR/</td><td>CME</td></tr>
</table>

No.	Author	Title	References to the document	Provider
		Program - CPA 2: 19,927 digesters 9572-0001 Nepal Biogas Support Program- CPA 1: 20,000 digesters. 31 Jan 13		
11	CME	Organisation Chart for the personnel involved in the GHG monitoring system.	**/ORG/**	CME
12	DOE	Still and video photographic evidences during the site visit	**/Photo/**	DOE
13	CME	Plant Completion report (generated by Oracle software) by BSP Nepal which includes GPS co-ordinates, technical details of digesters; details of end user/owner, construction date, total cost, subsidy no.; plant code/unique ID.	**/PCR/**	CME
14	CME	Quality Standard manual prepared by BSP Nepal for the construction of Biodigester in Nepal dated 2010 (Given to the companies and or end user)/	**/QC/**	CME
15	CME	Survey Questionnaire used by survey agency for the BUS Report for CPA-1 CPA-2 CPA-3 CPA-4 CPA-5, CPA-6, CPA-7 and CPA-5.	**/SUR/**	CME
16	CME	Training provided by AEPC person and consultant team (responsible for BUS Reports) to the enumerators (Annex-4 of the BUS Report).	**/TRG/**	CME
17	CME	Quality Standard manual prepared by AEPC and Survey agency Nepal for the Survey construction of Biodigester in Nepal dated May 2017	**/TS/**	CME
18	UNFCCC	AMS-I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User, version 04	**/AMS/**	UNFCCC
19	DOE	TÜV NORD JI / CDM CP Manual (incl. CP procedures and forms)	**/CPM/**	DOE
20	CME	Revised CPA-DD and revised emission reduction sheet ver.15	**/CPA-1/**	CME

No.	Author	Title	References to the document	Provider
		dated 05/09/2014 for CPA no.1 w.r.t post registration changes (PRC)		
21	IPCC	1. 1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book 2. 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book	**/IPCC/**	IPCC
22	KP	Kyoto Protocol (1997)	**/KP/**	KP
23	UNFCCC	Decision 3/CMP. 1 (Marrakesh – Accords)	**/MA/**	UNFCCC
24	UNFCCC	Monitoring report form for CDM programme of activities (Version 02.0) (CDM-PoA-MR-FORM)	**/MRT/**	UNFCCC
25	CME	Registered POA-DD and included CPA-DDs for CDM project: "Nepal Biogas Support Program-PoA" , UNFCCC PoA project reference no 9572	**/PoA/**	UNFCCC
26	UNFCCC	CDM Project Standard programme of Activities (Version 01.0)	**/PS/**	UNFCCC
27	UNFCCC	Clean development mechanism project cycle procedure programme of Activities (Version 01.0)	**/PCP/**	UNFCCC
28	UNFCCC	Guidelines for sampling and surveys for CDM project activities and programme of activities (version 04.0)	**/SS/**	UNFCCC
29	CME	• Validation report for CDM PoA: "Nepal Biogas Support Program-PoA", UNFCCC PoA project reference no 9572 dated 31/01/2014. • Validation reports for all CPAs included in the current monitoring period	**/VAL/**	UNFCCC
30	CME	Previous Verification Documents (MR, ER sheets Final Verification Report)	**/VER/**	UNFCCC
31	UNFCCC	CDM Validation and Verification Standard for programme of Activities (Version 01.0)	**/VVS/**	UNFCCC

Table 7-2: List of interviewed persons

No.	Interviewee			Date	Subject	Team member
	Last name	**First name**	**Affiliation**			
1.	Pokhrel	Prem Kumar	Climate Change Expert AEPC	24/05/2018 to 06/06/2018	Project Implementation MR, CER sheets Sampling Monitoring Aspects, logistics, Communications with Biogas end users and Biogas companies Focal point for verification	G Ezhilarasu & Prakash Kumar Mishra (4th to 6th June 2018)
2	Manandhar	Rassu	Program Officer AEPC	27/05/2018 to 06/06/2018	Sampling , Internal quality Documentation, Sampling Record keeping Customer complaints	G Ezhilarasu & Prakash Kumar Mishra (4th to 6th June 2018)
3	Dhakel	Nawa Raj	Director AEOC	06/06/2018	Finance obligations, Down times, training schedules, sampling, repairs Government policies	G Ezhilarasu & Prakash Kumar Mishra 6th June 2018 only
4	Prakash	Aryal	Senior Officer AEPC	24/05/2018 And 06/06/2018		
5	Karki	Saroj Bdr	Quality Control Offcier AEPC	25/05/2018	QA/QC Procedures	G Ezhilarasu
6	Aryal	Shekar	NEDCO Chief Advisor	25/05/2018	Construction, Agreements, complaint management Repairs, User trainings, spares availability, interactions with the end users, scheduled inspections	G Ezhilarasu
7	Khakda	Kamal Bdr	MBN, Executive Chairman			
8	Dalal	Padam Kumar	DEU Biogas. MD			
9	Mahato	Pitarbo	MTR Biogas MD			
10	Bhakthi	Phani Narayanan	NBPA Biogas MD			
11	Mandal	Narayan	RAS Biogas MD			
12	Shrestha	Vivek	AEC Biogas MD			
13	Neupane	Bibek Kanta	Sustainable Energy and Technology Management P. Ltd.	05/06/2018 Telephonic	Survey / Sampling design Sample selection Bus survey reports Training QA/QC,	G Ezhilarasu & Prakash Kumar Mishra

			(SETM) Program Coordinator		Data Transfer	
14	Coordinators From Biogas companies and Villagers		Guides	24/05/2018 to 05/06/2018	Presence of maintenance team General Usage Route Maps	G Ezhilarasu & Prakash Kumar Mishra (4th to 5th June 2018)
15	Various End Users (170 households)		Sampled and non-sampled house holds	24/05/2018 to 05/06/2018	Status of Biogas and its usage, Energy used for cooking, Problems faced for maintenance and availability of trained personnel, down times, (if any), reasons for non-usage, cattle availability , household numbers, spares availability etc	G Ezhilarasu Prakash Kumar Mishra (4th to 5th June 2018)

[1)] Means of Interview: (**T**elephone, **E**-Mail, **V**isit)

ANNEX

A1: Verification Protocol

A2: Statements of Competence of involved Personnel

ANNEX 1: PERIODIC VERIFICATION CHECKLIST – MONITORED PARAMETERS

Table Annex-1: (Project specific) GHG Verification Checklist:

Checklist Item (incl. guidance for the verification team)	**Refe-rence**	**Verification Team Comments** (Means and results of assessment)	**Draft Concl.**	**Final Concl.**
A. P%		The share of digesters operational (based on the total number implemented using non-renewable biomass).		
a) Measurement / Determination method ***(VVS, §§ 389-393)*** *Describe how the monitoring parameter was measured / determined. Focus primarily on the original data level (ODL) but also describe the applied data aggregation trails (from ODL to data aggregation level zero (DAL0)).* *Check if relevant equipment has been exchanged and if in cases of failures / downtimes of standard equipment other measurement / determination methods have been used. Furthermore, verify the frequency of measurements as per the requirements.* *Assess whether the measurement / determination method is in line with the registered monitoring plan of the PDD and the applied methodology.*	/IM01/ /POA-DD/ /AMS/ /MR/ /BUS/	*Description:* The GS monitoring report took the share of bio-digesters operational during monitoring period directly from the CDM verified monitoring report. As per the POA-DD section E.7 and CPA-DD for all CPA's the Percentage of digesters implemented that is operational will be monitored annually on sample basis. The same is reported in Annual Biogas Users' Survey. As verified from the Biogas Users' Survey/BUS/ for the year 2016-17 submitted by the PP, it was confirmed that the Percentage of digesters implemented that is operational is appropriately calculated and CDM Monitoring report is submitted along with the verification report for issuance request, *Verifier´s action:* The operational status of the biogas digesters taken the CDM monitoring report and it is materially same as the values mentioned in the verified CDM MR report. Both the MRs are checked by the VT *Conclusion:*	~~CAR 1~~	OK

Checklist Item (incl. guidance for the verification team)	**Refe-rence**	**Verification Team Comments** (Means and results of assessment)	**Draft Concl.**	**Final Concl.**
		Thus the value considered for ER calculations is correct. However CAR1 is raised to ensure greater clarity.		
b) Accuracy and QA/QC Procedure ***(VVS, §§ 394-400)*** *In case of measured (or estimated) values, check whether the accuracy of equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan or if significant inaccuracies occur; in this case, make sure that the most conservative assumptions theoretically possible have been made for calculating ERs.* *Describe whether all applicable QA/QC procedures are met. Assess further if the calibration of the monitoring equipment has been carried out in line with the latest EB guidance.* *Include calibration dates and information in validity of the installed monitoring equipment in the table in Annex 2.*		*Description:* Not applicable as no measuring equipment is used to determine the parameter P *Verifier´s action:* *Conclusion:*	OK	OK
c) Correctness ***(VVS, §§ 389-393)*** *Determine whether the value given in the monitoring report is correct or determined in a conservative manner.* *In case of conservative approaches used in lieu of the*	/IM01/ /POA-DD/ /AMS/ /DB/ /BUS/	☒ Correct ☐ Not correct (initial assessment) *Description:* The BUS report was basis for the estimating the share of bio digesters that were operational during the monitoring period.. *Verifier´s action:* Desk review of verified MR and annual biogas users' survey	OK	OK

Checklist (incl. guidance for the verification team) Item	Refe-rence	Verification Team Comments (Means and results of assessment)	Draft Concl.	Final Concl.
monitoring as per registered MP detailed assessment of the conservativeness of the approach used should be given. *In case of mistakes / deviations pl. provide details and descriptions of the CARs raised.*	/MR/	conducted for all the CPA's included in the current monitoring period were checked *Conclusion:* The values applied for the monitoring period is correct.		

Table Annex-2: (Project specific) SD Verification Checklist:

Checklist (incl. guidance for the verification team) Item	Refe-rence	Verification Team Comments (Means and results of assessment)	Draft Concl.	Final Concl.
A. Air Quality		Users' perception on smoke.		
a) Measurement / Determination method ***(VVS, §§ 389, 393, GS Annex I, GS Annex AC, GS Annex G)*** *Describe how the monitoring parameter was measured / determined. Focus primarily on the original data level (ODL) but also describe the applied data aggregation trails (from ODL to data aggregation level zero (DAL0)).* *Check if relevant equipment has been exchanged and if in cases of failures / downtimes of standard equipment other measurement / determination methods have been used. Furthermore, verify the*	/IM01/ /GSP/ /AMS/ /MR/ /BUS/	*Description:* The project is expected to reduce the smoke and improve the air quality in households across all CPAs as per the GS passports. The same is monitored through the sample survey and accordingly the BUS taken for the year 2016-2017 indicates that the following percentage of users indicated that the project achieved reduction in smoke CPA 1:99.% CPA 2: 100% CPA 3: 100% CPA 4: 98.29% *Verifier´s action:* The monitoring report and BUS reports are checked along with GS passports. The survey is taken as per the procedure mentioned in the GS passport and question 5.1 is specifically included for the purpose in the survey questionnaire. Also the	OK	OK

Checklist Item (incl. guidance for the verification team)	**Refe-rence**	**Verification Team Comments** (Means and results of assessment)	**Draft Concl.**	**Final Concl.**
frequency of measurements as per the requirements. *Assess whether the measurement / determination method is in line with the registered monitoring plan of the PDD and the applied methodology.*		verification team during the site visit prepared a specific checklist list and almost all the users are indicated that the project reduces smoke and women users indicated that the project implementation eradicated smoke from kitchen and there by eye irritation. . *Conclusion:* Thus parameter improvement in air quality is assessed as positive,		
B. Soil Condition		**Use of slurry as fertilizer**		
a) Measurement / Determination method ***(VVS, §§ 389, 393, GS Annex I, GS Annex AC, GS Annex G)*** *Describe how the monitoring parameter was measured / determined. Focus primarily on the original data level (ODL) but also describe the applied data aggregation trails (from ODL to data aggregation level zero (DAL0)).* *Check if relevant equipment has been exchanged and if in cases of failures / downtimes of standard equipment other measurement / determination methods have been used. Furthermore, verify the frequency of measurements as per the requirements.* *Assess whether the measurement / determination method is in line with the registered monitoring plan of the PDD and the applied methodology.*	/IM01/ /GSP/ /AMS/ /MR/ /BUS/	*Description:* The project is expected to improve the soil condition due to the use of bio slurry as fertilizer. The same is monitored through the sample survey and accordingly the BUS taken for the year 2016 -2017 indicates that the following percentage of users indicated that the slurry is used as humus in agricultural fields CPA 1: 99%, CPA 2: 95.12, CPA 3: 100%, CPA 4: 99.1% *Verifier´s action:* The monitoring report and BUS reports are checked along with GS passports. The survey is taken as per the procedure mentioned in the GS passport and question 5.8 is specifically included for the purpose in the survey questionnaire. Also the verification team during the site visit prepared a specific checklist list and majority of users indicated that they are using the slurry as humus in the agriculture fields and there is a reduction in the usage of chemical fertilizers. The tiny farmers and landless users indicated that they used to sell the slurry to other farmers for agricultural usage as humus.	OK	OK

Checklist Item (incl. guidance for the verification team)	**Refe-rence**	**Verification Team Comments** (Means and results of assessment)	**Draft Concl.**	**Final Concl.**
		Conclusion: Thus parameter improvement in soil condition is assessed as positive,		
C. Livelihood of the Poor		**Improved access to sanitation services**		
a) Measurement / Determination method ***(VVS, §§ 389, 393, GS Annex I, GS Annex AC, GS Annex G)*** *Describe how the monitoring parameter was measured / determined. Focus primarily on the original data level (ODL) but also describe the applied data aggregation trails (from ODL to data aggregation level zero (DAL0)).* *Check if relevant equipment has been exchanged and if in cases of failures / downtimes of standard equipment other measurement / determination methods have been used. Furthermore, verify the frequency of measurements as per the requirements.* *Assess whether the measurement / determination method is in line with the registered monitoring plan of the PDD and the applied methodology.*	/IM01/ /GSP/ /AMS/ /MR/ /BUS/	*Description:* The project is expected to improve the sanitation access of the users due to the construction of toilets along with the bio-digesters. The same is monitored through the sample survey and accordingly the BUS reports taken for the year 2016 -2017 indicates that the following percentage of users indicated that the project improved the sanitation access CPA 1: 79.41% CPA 2: 95.45 CPA 3: 97.32% CAP 4: 93.16 *Verifier´s action:* The monitoring report and BUS reports are checked along with GS passports. The survey is taken as per the procedure mentioned in the GS passport and question 5.13, 5.14 and 5.15 is specifically included for the purpose in the survey questionnaire. Also the verification team during the site visit prepared a specific checklist list and users told that the toilets are constructed along with the bio digesters if they don't have prior and if the toilet was already there they connected the toilet to the digesters and a very few users indicated that the due to the location and position of the old toilets and digesters they were not able to connect the toilet and digesters for practical difficulties. The majority of the users were off the opinion that the	OK	OK

Checklist Item (incl. guidance for the verification team)	**Refe-rence**	**Verification Team Comments** (Means and results of assessment)	**Draft Concl.**	**Final Concl.**
		open defecation is considerably reduced. *Conclusion:* Thus parameter improvement in livelihood of the poor is assessed as positive,		
D. Access to affordable and clean energy services		**Households using biogas plants**		
a) Measurement / Determination method ***(VVS, §§ 389, 393, GS Annex I, GS Annex AC, GS Annex G)*** *Describe how the monitoring parameter was measured / determined. Focus primarily on the original data level (ODL) but also describe the applied data aggregation trails (from ODL to data aggregation level zero (DAL0)).* *Check if relevant equipment has been exchanged and if in cases of failures / downtimes of standard equipment other measurement / determination methods have been used. Furthermore, verify the frequency of measurements as per the requirements.* *Assess whether the measurement / determination method is in line with the registered monitoring plan of the PDD and the applied methodology.*	/IM01/ /GSP/ /AMS/ /MR/ /BUS/	*Description:* The project is expected to provide clean and continuous energy supply for cooking purposes across all CPAs as per the GS passports. The same is monitored through the sample survey and accordingly the BUS reports taken for the year 2016 -2017 indicates that the following percentage of users indicated that the project achieved continuous usage of the biogas stove, CPA 1: 74.97% CPA 2: 83.06% CPA 3: 82.92% CPA 4: 87.87% *Verifier´s action:* The monitoring report and BUS reports are checked along with GS passports. The survey is taken as per the procedure mentioned in the GS passport and question 1.2 is specifically included for the purpose in the survey questionnaire. Also the verification team during the site visit prepared a specific checklist list and the majority of the biogas digesters are in operation for during the monitoring period. The users indicate that they are getting affordable energy and the operations of the stove are similar to that of the LPG stoves and by click of the knob they are able to lit the stoves. Apart from that they are able		

Checklist (incl. guidance for the verification team) **Item**	**Refe-rence**	**Verification Team Comments** (Means and results of assessment)	**Draft Concl.**	**Final Concl.**
		to do other livelihood activities like farming, dairying, and poultry from the time they used to spend for collecting firewood earlier. . *Conclusion:* Thus parameter access to affordable and clean energy services is assessed as positive,		

ANNEX 2: CALIBRATION DATES AND VALIDITY OF INSTALLED MONITORING EQUIPMENT

Monitoring equipment	Related monitoring parameter as per applicable registered monitoring plan	Serial number	Type	Accuracy or accuracy class	Previous calibration (last calibration before start of this monitoring period)	Calibration date(s) during this monitoring period	Validity of calibration (s)	Delay in calibration : yes/no	Period of delayed calibration
Not applicable No equipment is used for monitoring.	-	-	-	-	-	-	-	☐ No ☐ Yes	From: To:

ANNEX 3: STATEMENTS OF COMPETENCE OF INVOLVED PERSONNEL

TÜV NORD Certification

Statement of Competence

Appointment and authorization according to the procedures of the TÜV NORD JI/CDM Certification Program

Mr. Ezhilarasu G.

SCHEME	STATUS	VALID UNTIL
CDM	Senior Assessor (Validation, Verification)	2020-02-06
VCS / ISO 14064-2	Senior Assessor	2020-02-06

Authorization status for technical areas within sectoral scopes:

CODE	TECHNICAL AREA
1.2	Renewables
3.1	Energy demand
13.1	Solid waste and wastewater
13.2	Manure

130 – Rev. 5, Date: 2018-01-04

130_S01-VA060-F20_2018-01-04_rev5.doc S01-VA060-F20 rev3 / 2012-10-25

TÜV NORD Certification

Statement of Competence

Appointment and authorization according to the procedures of the TÜV NORD JI/CDM Certification Program

Mr. Manojkumar Borekar

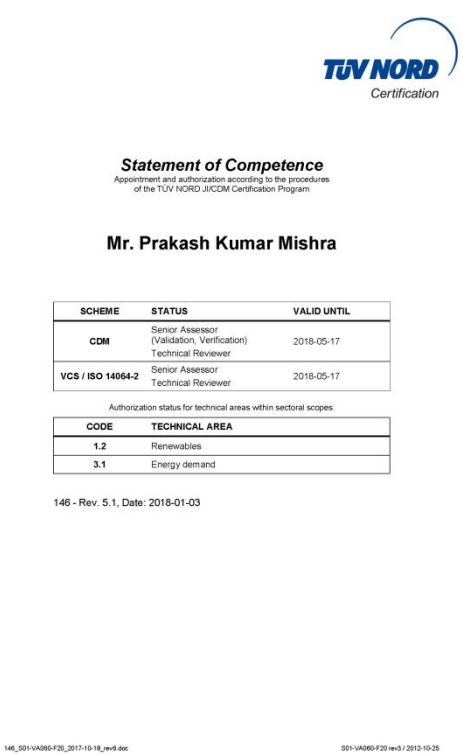
SCHEME	STATUS	VALID UNTIL
CDM	Senior Assessor (Validation, Verification)	2018-12-02
VCS / ISO 14064-2	Senior Assessor	2018-12-02

Authorization status for technical areas within sectoral scopes:

CODE	TECHNICAL AREA
1.1	Thermal Energy Generation
1.2	Renewable Energies
3.1	Energy Demand
4.1	Cement and lime production
4.2	Paper
9.2	Iron, steel and Ferro-alloy production
13.1	Waste Handling and Disposal

038 – Rev.4, Date: 2016-04-07

038_S01-VA060-F20_2016-04-07_rev4 S01-VA060-F20 rev3 / 2012-10-25



TÜV NORD Certification

Statement of Competence

Appointment and authorization according to the procedures of the TÜV NORD JI/CDM Certification Program

Mr. Prakash Kumar Mishra

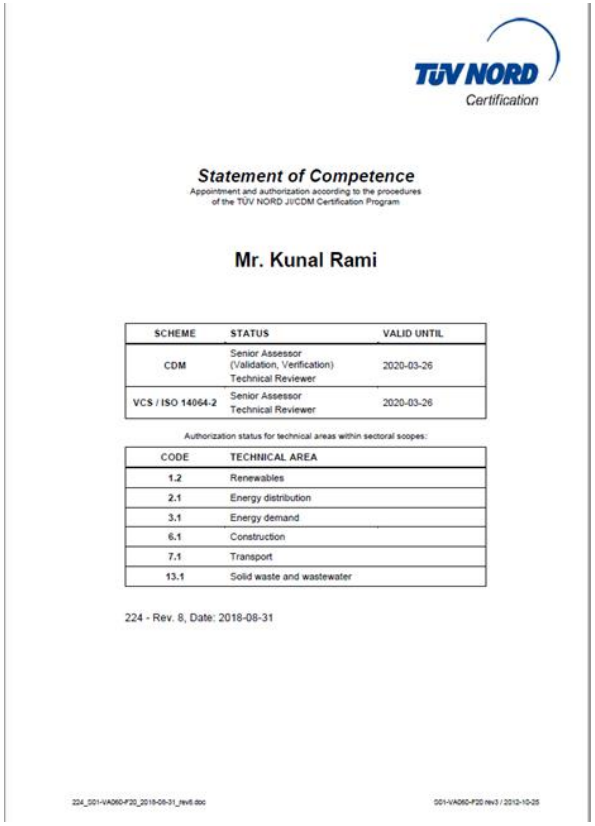
SCHEME	STATUS	VALID UNTIL
CDM	Senior Assessor (Validation, Verification) Technical Reviewer	2018-05-17
VCS / ISO 14064-2	Senior Assessor Technical Reviewer	2018-05-17

Authorization status for technical areas within sectoral scopes:

CODE	TECHNICAL AREA
1.2	Renewables
3.1	Energy demand

146 - Rev. 5.1, Date: 2018-01-03

146_S01-VA060-F20_2017-10-18_rev5.doc S01-VA060-F20 rev3 / 2012-10-25



TÜV NORD Certification

Statement of Competence

Appointment and authorization according to the procedures of the TÜV NORD JI/CDM Certification Program

Mr. Kunal Rami

SCHEME	STATUS	VALID UNTIL
CDM	Senior Assessor (Validation, Verification) Technical Reviewer	2020-03-26
VCS / ISO 14064-2	Senior Assessor Technical Reviewer	2020-03-26

Authorization status for technical areas within sectoral scopes:

CODE	TECHNICAL AREA
1.2	Renewables
2.1	Energy distribution
3.1	Energy demand
6.1	Construction
7.1	Transport
13.1	Solid waste and wastewater

224 - Rev. 8, Date: 2018-08-31

224_S01-VA060-F20_2018-08-31_rev8.doc S01-VA060-F20 rev3 / 2012-10-25

TÜV NORD Certification

Statement of Competence

Appointment and authorization according to the procedures of the TÜV NORD JI/CDM Certification Program

Mr. Stefan Winter

SCHEME	STATUS	VALID UNTIL
CDM	Senior Assessor (Validation, Verification) Technical Reviewer	2020-07-27
VCS	Senior Assessor (Validation, Verification) Technical Reviewer	2020-07-27

Authorization status for technical areas within sectoral scopes:

CODE	TECHNICAL AREA
1.1	Thermal energy generation
1.2	Renewables
2.1	Energy distribution
3.1	Energy demand
4.1	Cement and lime production
4.2	Paper
5.2	Caprolactam, nitric and adipic acid
9.1	Aluminium and magnesium production
9.2	Iron, steel and Ferro-alloy production
13.1	Solid waste and wastewater
13.2	Manure

163 – Rev. 5, Date: 2017-07-20

163_001-VA060-F20_2017-07-20_rev5 001-VA060-F20 rev3 / 2012-10-25

TÜV NORD Certification

Statement of Competence

Appointment and authorization according to the procedures of the TÜV NORD JI/CDM Certification Program

Mr. Rainer Winter

SCHEME	STATUS	VALID UNTIL
CDM	Senior Assessor (Validation, Verification) Technical Reviewer	2019-07-01
JI	Senior Assessor Technical Reviewer	2019-07-01
VCS / ISO 14064-2	Senior Assessor Technical Reviewer	2019-07-01

Authorization status for technical areas within sectoral scopes:

CODE	TECHNICAL AREA
1.1	Thermal Energy Generation
1.2	Renewables
4.1	Cement and lime production
4.2	Paper
5.1	Chemical Industry
5.2	Caprolactam, nitric and adipic acid
8.1	Mining/mineral production
9.1	Aluminium and magnesium production
9.2	Iron, steel and Ferro-alloy production
11.1	Emissions of fluorinated gases
11.2	Refrigerant gas production
12.1	Chemical industry
13.1	Solid waste and wastewater

003 - Rev. 10, Date: 2016-07-01