Verification and certification report form for CDM project activities

(Version 02.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title and UNFCCC reference number of the project activity	Nairobi River Basin Biogas Project UNFCCC reference number : 6549
Version number of the verification and certification report	03
Completion date of the verification and certification report	25/05/2019
Monitoring period number and duration of this monitoring period	3; 31/12/2016 to 30/12/2018 (first and last day included)
Version number of the monitoring report to which this report applies	3
Crediting period of the project activity corresponding to this monitoring period	31/12/2012 to 30/12/2022 (inclusive of both the days)
Project participants	Kenya (host): Sustainable Energy Strategies Ltd. Germany: atmosfair gGmbH
Host Party	Kenya
Applied methodologies and standardized baselines	AMS I.E. (version 04) Switch from Non-Renewable Biomass for Thermal Applications by the User
Mandatory sectoral scopes linked to the applied methodologies	1 : Energy industries (renewable - / non-renewable sources)
Conditional sectoral scope(s) linked to the applied methodologies	-
Estimated amount of GHG emission reductions or GHG removals for this monitoring duration in the registered PDD	93,734 t CO_2e
Certified amount of GHG emission reductions or GHG removals for this monitoring period	6,746 t CO_2e
Name and UNFCCC reference number of the DOE	E-0052: Carbon Check (India) Private Ltd.
Name, position and signature of the approver of the verification and certification report	Vikash Kumar Singh, Compliance Officer 

SECTION A. Executive summary

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Purpose, general description and location of the project activity:

The Project Participant has commissioned the DOE, Carbon Check (India) Private Ltd. (CCIPL) to perform an independent verification of the CDM Project Activity "Nairobi River Basin Biogas Project" (UNFCCC reference number 6549) in Kenya (hereafter referred to as "Project Activity"). The Project Activity involves construction and operation of domestic biogas units which are fed with cow dung to produce renewable biogas used for cooking and water heating purpose. The project activity saves greenhouse gas emissions by replacing non-renewable biomass with renewable biogas. The project activity is designed to generate emission reductions by installation of the biogas units in the Kiambu county in Kenya.

This report summarises the findings of the verification of the project, performed on the basis of paragraph 62 of the CDM Modalities & Procedures, as well as criteria given to provide for consistent project operations, monitoring and reporting and the subsequent decisions by the CDM Executive Board. Verification is required for all registered CDM project activities intending to confirm their achieved emission reductions and proceed with request for issuance of CERs. This report contains the findings and resolutions from the verification and a certification statement for the certified emission reductions.

Verification is the periodic independent review and ex-post determination of both quantitative and qualitative information by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period.

Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

The objective of this verification was to verify and certify emission reductions reported for the "Nairobi River Basin Biogas Project" in the host country "Kenya" for the period 31/12/2016 to 30/12/2018 (including both the days).

The purpose of verification is to review the monitoring results and verify that the monitoring methodology was implemented according to the monitoring plan and monitoring data, and used to confirm the reductions in anthropogenic emissions by sources, is sufficient, definitive and presented in a concise and transparent manner. CCIPL's objective is to perform a thorough, independent assessment of the registered project activity.

In particular, the monitoring plan, monitoring report and the project's compliance with relevant UNFCCC and host Party criteria are verified in order to confirm that the component project/s has/have been implemented in accordance with the previously registered/included component project design and conservative assumptions, as documented. It is also confirmed if the monitoring plan is in compliance with the registered PDD and the approved monitoring methodology.

Scope:

The scope of the verification is:

- To verify the project implementation and operation with respect to the registered PDD
- To verify the implemented monitoring plan with the registered PDD or approved revised PDD and applied baseline and monitoring methodology.
- To verify that the actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan.
- To evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement.

- To verify that reported GHG emission data is sufficiently supported by evidence.

The verification shall ensure that the reported emission reductions are complete and accurate in order to be certified.

Verification process:

The verification comprises a review of the monitoring report over the monitoring period from 31/12/2016 to 30/12/2018 and based on the registered PDD in part of the monitoring parameters and monitoring plan, emission reduction calculation spreadsheet, monitoring methodology and all related evidence provided by project participant.

On-site visit and stakeholders' interviews are also performed as part of the verification process.

Conclusion:

The verification team assigned by the DOE concludes that the PDD (Version 2.4, dated 11/06/2012) /B04/ and the Monitoring report (version 3, dated 17/05/2019) /2/, meets all relevant requirements of the UNFCCC for CDM project activities including article 12 of the Kyoto Protocol and paragraph 62 of CDM Modaliteid & Procedures, the modalities and procedures for CDM (Marrakesh Accords) and the subsequent decisions by the COP/MOP and CDM Executive Board. The verification has been conducted in-line with the CDM VVS for project activities, version 02.0 /B01-1/ requirements.

The project activity was correctly implemented according to selected monitoring methodology, monitoring plan and the registered PDD. The monitoring system was installed, maintained in a proper manner, while collected monitoring data allowed for the verification of the amount of achieved GHG emission reductions. Through the review and on site visit the verification team confirms that the project activity has resulted in the 6,746 tCO_2e emission reductions during the third monitoring period.

CCIPL as a DOE is therefore pleased to issue a positive verification opinion expressed in the attached Certification statement.

SECTION B. Verification team, technical reviewer and approver

B.1. Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interviews	Verification findings
1.	Team Leader / Verifier / Technical Expert	IR	Agarwalla	Sanjay Kumar	CCIPL	X	X	X	X
2	Local Expert	ER	Muriuki	Job N	CCIPL		X	X	

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	IR	Anand	Amit	CCIPL
2.	Approver	IR	Singh	Vikash Kumar	CCIPL

SECTION C. Application of materiality

C.1. Consideration of materiality in planning the verification

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the potential risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Human Error Human error in the monitoring surveys recording	Medium	Since the monitoring surveys related to the usage are to be conducted by monitoring personnel, it needs to be checked if the personnel responsible for conducting monitoring surveys are trained in conducting surveys and appropriately record such results. The questions in the questionnaire need to be appropriately interpreted by the monitoring personnel and then need to be conveyed accordingly to the survey participants.	The recording of the monitoring surveys is directly linked to the emission reductions based on the parameter N_y used for calculations. The verification audit plan for the project included checking the following during the on-site visit to mitigate the risk: 1. The training records of the personnel conducting the survey (if any). 2. Interview with the personnel conducting the survey. 3. Review of monitoring questionnaire The verification team mitigated the risk by checking the training records /12/ of the personnel during the on-site visit. These records have been provided to the verification team by the PP. Verification team also checked the monitoring questionnaires /16/ and found them to be acceptable. Further, data was crosschecked with the ER calculation spreadsheet /4/. Verification team, based on the above, confirms that the risk is appropriately mitigated.
2.	Human Error Recording and reporting of the information in the monitoring database.	Medium	Since the installation of the biogas plants related data is recorded manually into the monitoring database. This includes details related to the user, location and commissioning date.	The recording of the biogas plants related data is directly linked to the emission reduction calculations based on the parameter N_y used for calculations. The verification audit plan for the project included checking the following during the on-site visit to mitigate the risk: 1. The training records of the personnel recording and reporting the information in the monitoring database . 2. Interview with the recording and reporting the information in the monitoring database.

				3. Review of the monitoring database The verification team mitigated the risk by interviewing the personnel responsible for recording and reporting the information in the monitoring database and reviewed the monitoring database and also compared with the hard copy records of the installation. Verification team based on the interviews and reviews confirms that the personnel are well familiar with the process of recording and reporting the commissioning and installation records. The cross checks were also made with the ER spreadsheet to the check the reported data /4/. Verification team confirms that the human error risk is appropriately mitigated.
3.	Human Error Recording and reporting of the information in emission reduction spreadsheet.	Medium	Since the information in the emission reduction spreadsheet is recorded manually, there is a human error risk involved while recording the values.	The recording of data in the emission reduction spreadsheet is directly linked to the emission reductions and involves a risk of reporting erratic values due to Human Error. The verification audit plan for the project included checking the following during the on-site visit to mitigate the risk: 1. Interviews with the personnel recording/reporting values in the ER spreadsheet. 2. Review of the ER spreadsheet. 3. Crosscheck of the ER spread sheet with the other source documents. The verification team mitigated the risk by interviewing the personnel responsible for recording and reporting the information in the ER spreadsheet /4/ and reviewed the ER spreadsheet /4/ and also crosschecked with the survey records and monitoring database. Verification team based on the interviews and reviews confirms that the personnel are well familiar with the process of recording and reporting the monitored data. Verification team confirms that the human error risk is appropriately mitigated.
4.	Information System Use of spreadsheets without adequate controls related to data changes/updates, version tracking, traceability, security	Medium	Since, the emission reduction calculations are presented in the ER spreadsheet and monitoring database and sampling survey records are also reported in a	The spreadsheets have been used for reporting ER calculations. To check that adequate controls related to data changes/updates, version tracking, traceability, security are followed, following details were checked in the documents and during the site

			spreadsheet, it needs to be checked if appropriate controls have been established. Otherwise, it could lead to material errors, omissions or misstatements.	visit: 1. Interview with the relevant personnel to ensure that roles and responsibilities according to section B.7.2 of the PDD are being followed. 2. Data and information flow procedures to be followed as per PDD and MR. 3. Check the established controls on the spread sheets used. Verification team mitigated the risk by conducting interviews with personnel responsible for activities as provided in PDD and MR. Monitoring head is responsible for administering the electronic data storage, and data review. The data changes/updates are being maintained by monitoring head and a version tracking system is maintained for the ER spreadsheet. Further, the traceability and security of the spreadsheet is being maintained by keeping a protected copy of the files in the PP's network. The data and information flow requirements are being followed as stated in the PDD and the MR. Interviews with the monitoring personnel were conducted to confirm the established procedures. Verification team confirms that the information system risk is appropriately mitigated.
5.	Sampling Risk that the sample not being true representative of the population.	Low	The project activity's monitoring plan involves surveying users of the biogas units installed as a part of the project activity. There is a risk that the sample chosen is not a true representative of the population.	The sampling done as a part of monitoring surveys is directly linked to the emission reductions based on the parameter N_y used for calculations. The verification audit plan for the project included checking the following during the on-site visit to mitigate the risk: 1. Review of the sampling procedures including checking the sample number generator. Verification team checked the procedure of sampling, including the calculations and the sample number generator /13/ for the project activity. Verification team confirms that the sampling risk is appropriately mitigated.

C.2. Consideration of materiality in conducting the verification

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The threshold of materiality was evaluated based on §13 of "Guideline: Application of materiality in verifications" Version 02.0 /B04/. It was concluded that the materiality threshold applicable to the project activity based on actual emission reductions achieved is 5% of 6,746 tCO_2e which is equal to 337 tCO_2e.

At the beginning of the verification the verification team leader has assessed the nature, scale and complexity of the verification tasks by carrying out a strategic analysis of all activities relevant to the project activity. The team leader has collected and reviewed the information relevant to assess that the designated verification team is sufficiently competent to carry out the verification and to ensure that it is able to conduct the necessary risk analysis. As explained above, the potential sources of error were:

Human error: In the monitoring surveys recording; Recoding and reporting of the information in the monitoring data base; Recording and reporting of the information in ER spread sheet

Information System: Use of spread sheets without adequate controls related to data changes / updates, version tracking, traceability and security

Sampling: Risk that the sample not being representative of the population

Mitigation of Human error risks: The verification team mitigated the risk by checking the training records /12/ of the personnel during the on-site visit. These records /12/ have been provided to the verification team by the PP. Verification team also checked the monitoring questionnaires /16/ and found them to be acceptable. Interviews with the responsible personnel for recording and reporting the information in the monitoring data base were conducted during the on-site visit and confirmed that the personnel were well familiar with the process of data recording and reporting. Further, data was crosschecked with the ER calculation spreadsheet /4/. Verification team, based on the above, confirms that the risk is appropriately mitigated.

Mitigation due to error in Information system: The risk due to error in information system was mitigated by conducting interview with the personnel responsible for activities. The data changes/updates are being maintained by monitoring head and a version tracking system is maintained for the ER spreadsheet. Further, the traceability and security of the spreadsheet is being maintained by keeping a protected copy of the files in the PP's network. The data and information flow requirements are being followed as stated in the PDD and the MR. Interviews with the monitoring personnel were conducted to confirm the established procedures. Verification team confirms that the information system risk is appropriately mitigated.

Mitigation due to error in Sampling: Verification team checked the procedure of sampling, including the calculations and the sample number generator /13/ for the project activity. Verification team confirms that the sampling risk is appropriately mitigated.

As no material errors, omissions or misstatements could be found, a reasonable level of assurance is achieved.

SECTION D. Means of verification

D.1. Desk/document review

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The verification was performed primarily based on the review of the Monitoring report /1/ and the supporting documentation. This process included review of data and information presented to verify their completeness and review of the monitoring plan and monitoring methodology. Documents reviewed or referenced during the verification are listed in Appendix 3 below.

D.2. On-site inspection

Duration of on-site inspection: 26/03/2019 to 27/03/2019				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	An assessment of the implementation and operation of the registered project activity as per the registered PDD	Kenya, visit to sample biogas units	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki
2.	A review of information flows for generating, aggregating and reporting the monitoring parameters	Kenya, PP site office	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki
3.	Interviews with relevant personnel to determine whether the operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD	Kenya, PP site office	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki
4.	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	Kenya, PP site office	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki
5.	A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology and corresponding tool(s), where applicable	Kenya, PP site office	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki
6.	A review of calculations and assumptions made in determining the GHG data and emission reductions	Kenya, PP site office	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki
7.	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	Kenya, PP site office	26/03/2019 to 27/03/2019	Sanjay Kumar Agarwalla Job N Muriuki

D.3. Interviews

No.	**Interviewee**			**Date**	**Subject**	**Team member**
	Last name	**First name**	**Affiliation**			
1.	Machnik	Denis	Atmosfair gGmbH	26/03/2019 to 27/03/2019	Project implementation and operation, monitoring procedure, data and information flow, Survey records, Sales/Distribution records, CER calculation and completeness of monitoring report, Electronic Monitoring system, Sampling Plan, QA/QC Procedures, Quality Assurance – Management and operating	Sanjay Kumar Agarwalla, Job N Muriuki

					system	
2.	Karanja	David	Sustainability Energy Strategies Ltd.	26/03/2019 to 27/03/2019	Project implementation and operation, monitoring procedure, data and information flow, Survey records, Sales/Distribution records	Sanjay Kumar Agarwalla, Job N Muriuki
3.	Ngunje	Douglas	Mason (Stakeholder)	27/03/2019	Employment status due to project implementation	Sanjay Kumar Agarwalla Job N Muriuki
4.	Wangai	Mathew	Mason (Stakeholder)	27/03/2019	Employment status due to project implementation	Sanjay Kumar Agarwalla Job N Muriuki

D.4. Sampling approach

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The total population size of the biogas units under this monitoring period are 704. The monitoring parameter required to be monitored through the sampling plan is “Statistically adjusted drop out from total population of units in period y” (DOy).

Simple random sampling was applied by the PP for selection of the monitoring samples with 95/5 confidence/precision which is deemed acceptable as per the registered PDD for biennial monitoring. Please refer to the Section E.6.3 of this report on detailed assessment on sampling plan opted by the PP.

DOE used sampling during verification for checking the operational status of the biogas units. PP had calculated the drop-out rate based on its 53 monitoring samples. Considering that the achieved annual emission reductions for the project activity are less than 100,000 tCO_2e, applying paragraph 33 (a) of the sampling standard, version 07 /B07/, a sample size of 8 HHs was chosen (with no discrepant records). A sample size of 8 was required, based on an AQL of 0.5 % and UQL of 20 %, producer risk 10 % and consumer risk 20 %. Acceptance number (c) thus determined for the sample is 0. It was observed that out of the 8 samples, all the 8 samples were found to be operational which matched with the PP’s records and hence no discrepant records were observed with the published MR /1/ and ER sheet /3/ and thus c=0. Thus, PP’s set of records has been accepted in line with § 32 of the sampling standard, version 07 /B07/.

D.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	01	-	-
Compliance of the project implementation and operation with the registered PDD	-	-	-
Post-registration changes	-	-	-
Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines	-	-	-
Compliance of monitoring activities with the registered monitoring plan	02	-	-
Compliance with the calibration frequency requirements for measuring instruments	-	-	-
Assessment of data and calculation of emission reductions	-	01	-

or net removals			
Assessment of reported sustainable development co-benefits	-	-	-
Global stakeholder consultation			
Others (please specify)	-	-	-
Total	03	01	-

SECTION E. Verification findings

E.1. Compliance of the monitoring report with the monitoring report form

Means of verification	Document Review, Interview
Findings	CL 01 had been raised and successfully resolved. Please refer to Appendix 4.
Conclusion	Verification Team confirms that the latest available version of monitoring report template (06.0) /B03/ has been used by the PP and the MR /2/ is in compliance of the monitoring report with the relevant form and instructions therein. CCIPL had made the version 1, dated 22/02/2019 of the Monitoring report /1/ covering the monitoring period from 31/12/2016 to 30/12/2018 publicly available on 04/03/2019 through its dedicated interface on the UNFCCC CDM website before undertaking the site visit for the verification from 26/03/2019 to 27/03/2019. This confirms compliance with the §352 and §353 of CDM VVS for project activities, version 02.0 /B01-1/.

E.2. Remaining forward action requests from validation and/or previous verifications

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This is the 3rd periodic verification of the project activity. There are not any forward action requests from validation or previous verification of the project activity..

E.3. Compliance of the project implementation and operation with the registered project design document

Means of verification	Document Review, Interview
Findings	-
Conclusion	The project activity includes construction and operation of biogas units using cow dung. The biogas thus produced is used for cooking purpose in the households. There were no changes observed during OSV from the technology stated during the validation. CCIPL by means of an on-site inspection and document review, assessed that all physical features (technology, project equipment, and monitoring) of the registered PDD are in place and that the project participants have operated the project as per the registered PDD. In accordance with § 356 (c) of CDM VVS for project activities, version 02, information (data and variables) provided in the monitoring report that are different from that stated in the registered PDD /B04/, have been assessed. The assessment is summarized below:

Parameter	Ex-ante value in the PDD	Actual operation for the reported monitoring period	Assessment by the verification team
Adjusted total number of biogas units deployed until monitoring period y of end users who confirmed that non-renewable biomass	In 2015 – 3,000 numbers In 2016 – 3,125 numbers	Upto 2018 – 704 numbers (and the value of N_y calculated after adjusting the operational time period is	Verification team noted that the actual number of biogas units installed under the project for the monitoring period is much less than the value estimated in the PDD

was displaced/substituted (N_y)		672.92) /4/	which is deemed acceptable as it does not lead to increase of emission reductions.
Statistically adjusted drop out from total population of units in period y (DO_y)	1%	0 %	The monitored ex-post value of DO_y for the current monitoring period is less than the ex-ante estimated value in the PDD (i.e. the operational units in this MP is 100% which is more than that considered in the PDD as 99%). Although the decrease in drop out rate (i.e. increase in operational units) leads to higher emission reductions, this is deemed acceptable to the verification team, as it is based on actual monitoring data based on sampling. The relevant monitoring survey documents and the calculations were verified during the OSV interviews and found to be appropriate.

It was confirmed through the monitoring database /7/ that the project activity involves installation of 704 biogas units till the end of the monitoring period. During the reported monitoring period survey, it was found that out of the total samples of 53 households, all of them were operational.

The total annual installed thermal capacity during the monitoring period was 2.336 MW /4/ which is less than 45 MW_{th} and thus the project activity remains under the small scale limit /B02/.

The biogas units have been distributed at different locations in Kiambu county in Kenya. As confirmed through the monitoring database provided in the ER spread sheet, first unit for the project was commissioned on 30/06/2010 and last unit on 08/09/2018 /5/. All the biogas units that were checked during verification site visit were found to be working and the unique identification was traceable through the agreement copies with the respective end users /6/.

CCIPL's verification team considers the project description to be complete and accurate.

In summary, the monitoring period is reasonable and the operation of the project activity is in accordance with the registered PDD. The verification team took cognizance of §338 (b)(i), §354, §355 and §356 of CDM VVS for project activities, version 02 /B01-1/.

E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines

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Not applicable

E.4.2. Corrections

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Not applicable

E.4.3. Change to the start date of the crediting period of the project activity

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The Board had approved the change of the start of crediting period prior to the submission of the request of the issuance for this monitoring period. The start date of crediting period was changed from 01/06/2012 to 31/12/2012 as visible on the project page at UNFCCC web site (https://cdm.unfccc.int/Projects/DB/RWTUV1340886479.47/view)

E.4.4. Inclusion of a monitoring plan

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Not applicable

E.4.5. Permanent changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other applied standards or tools

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Not applicable

E.4.6. Changes to the project design

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Not applicable

E.4.7. Changes specific to afforestation and reforestation project activities

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Not applicable

E.5. Compliance of the registered monitoring plan with the methodology including applicable tools and standardized baselines

Means of verification	Document Review, Interview
Findings	-
Conclusion	The verification team is able to confirm that the monitoring plan contained in the registered PDD /B04/ is in accordance with the approved methodology applied by the project activity, i.e. AMS I.E (version 04) /B02/. The verification team took cognizance of §357, 358 and §359 of CDM VVS for project activities, version 02 /B01-1/.

E.6. Compliance of monitoring activities with the registered monitoring plan

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD /B04/. This conclusion has been made based on assessment below in section E.6.1, E.6.2 and E.6.3 below.

E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

Means of verification	Document Review, Interview
Findings	-
Conclusion	Verification team confirms that the Data and parameters fixed ex ante are in compliance with the registered PDD and monitoring plan /B04/. Please refer to the **Annex 1** for assessment of each parameter. The verification team took cognizance of §360 of CDM VVS for project activities, version 02 /B01-1/.

E.6.2. Data and parameters monitored

Means of verification	Document Review, Interview
Findings	CL 02 and CL 03 were raised and successfully closed. Please refer to Appendix 4.

Conclusion	Verification team confirms that the Data and parameters monitored are in compliance with the registered PDD and monitoring plan /B04/. Please refer to the **Annex 2** for assessment of each of the monitoring parameters. Assessment of Data information flow: The biogas unit population was arranged chronologically by the PP and each unit was assigned a serial number for sampling. A random number generator was used to generate random numbers and the unit with the same serial number were sampled from population for monitoring. 1. The verification team checked the random numbers generated and verified that the samples selected for monitoring were adhering to the same random numbers in the population. 2. The verification team checked the survey records and verified that the records mentioned in the ER spread sheet for were consistent with the primary records. 3. The verification team interviewed personnel involved in monitoring survey and found them competent. Thus, it is confirmed that the verification team assessed the data / information flow from the point of monitoring to emission reduction calculation and found no gap in the same. The verification team took cognizance of §360, §361, §363 and §364 of CDM VVS for project activities, version 02 /B01-1/.

E.6.3. Implementation of sampling plan

Means of verification	Document Review, Interview
Findings	-
Conclusion	The total population of the biogas units installed are 704 in the current monitoring period. The monitoring parameter required to be monitored through the sampling plan is the “Statistically adjusted drop out from total population of units in period y” (DO_y). Simple random sampling was applied for selection of the monitoring samples with 95/5 confidence/precision which is deemed acceptable as per the registered PDD /B04/ for biennial monitoring. The calculated sample size was 50 assuming 96.67% operation rate (i.e. 3.33% drop out rate). This is acceptable to the verification team considering that during the last periodic verification, the drop out rate was 0%. Assuming 95% response rate, the sample size was calculated as 53 which is deemed acceptable /4/. The actual samples covered during the monitored period were also 53. Calculation procedure of the sample size was checked by the verification team and found to be in accordance with the registered PDD /B04/ and the Sampling Standard /B07/. The monitoring parameter was collected following a specially designed survey form. It was found that the desired 95/5 confidence/precision was met (section E.6.2 above may be referred for more details). Further the verification team used sampling during verification for checking the operational status of the biogas units. PP had calculated the drop-out rate based on its 53 monitoring samples. Considering that the achieved annual emission reductions for the project activity are less than 100,000 tCO_2e, applying paragraph 33 (a) of the sampling standard, version 07 /B07/, a sample size of 8 HHs was chosen (with no discrepant records). A sample size of 8 was required, based on an AQL of 0.5 % and UQL of 20 %, producer risk 10 % and consumer risk 20 %. Acceptance number (c) thus determined for the sample is 0. It was observed that out of the 8 samples, all the 8 samples were found to be operational which matched with the PP’s records and hence no discrepant records were observed with the published MR /1/ and ER sheet /3/ and thus c=0. Thus, PP’s set of records has

	been accepted in line with § 32 of the sampling standard, version 07 /B07/. Verification team confirms that the sampling approach applied by the PP is in accordance with the registered PDD /B04/ including the Guidelines: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 /B06/ and Standard: Standard for sampling and surveys for CDM project activities and programme of activities, version 07.0 /B07/.

E.7. Compliance with the calibration frequency requirements for measuring instruments

Means of verification	Document Review, Interview
Findings	-
Conclusion	No measuring equipment was used for the monitoring.

E.8. Assessment of data and calculation of emission reductions or net removals

In line with the requirement of § 372 of CDM VVS for project activities, version 02.0, the verification team has reviewed the Monitoring report and ER spread sheet to check the arithmetic calculation of the emission reductions. The equation used for the calculation is compared with those provided in the registered PDD /B04/ and the applied methodology AMS-I.E, version 04 /B02/ and found to be correct.

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	Document Review, Interview
Findings	CAR 01 is raised. Please refer to Appendix 4 for futher details.
Conclusion	The equations for baseline emissions, as provided in the monitoring report /1/ and confirmed with the registered PDD /B04/ and the methodology AMS-I.E, version 04 /B02/, are: $ER_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel}$ Where: $B_y = N_y \times B_y \text{ (net per unit)} \times (1\text{-}DO_y)$ $B_y \text{ (net per unit)} = B_y \text{ (gross per unit)} \times LE_{NRB}$ Where: ER_y = Emission reductions during the year y in tCO_2e B_y (gross per unit) = Quantity of fuelwood and woodfuel consumption for charcoal that is substituted or displaced in tonnes (fixed ex ante as 4.482 tonnes/year/household) B_y (net per unit) = Quantity of fuelwood and woodfuel consumption for charcoal that is substituted or displaced in tonnes including potential leakages (fixed ex ante as 4.257 tonnes/year/household) LE_{NRB} = Net to gross adjustment factor for leakage (0.95 default value) $f_{NRB,y}$ = Fraction of non renewable woody biomass used in the absence of the project activity in year y (fixed ex ante as 96.2%) $NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (fixed ex ante as 0.015 TJ/tonne) (IPCC default for wood fuel, 0.015 TJ/tonne) $EF_{projected\_fossilfuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumer (Default value of 81.6 tCO_2/TJ). N_y = Adjusted total number of biogas units deployed until year y of end users who confirmed that non-renewable biomass was displaced/substituted (monitored values is 672.92) DO_y = Statistically adjusted drop out from total population of units in period y (monitored value of 0 %)

	From the above equation and the parameter values, ER_y = 6,746 tCO_2e The verification took cognizance of § 372 of CDM VVS for project activities, version 02.0) /B01-1/.

E.8.2. Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

Means of verification	Document Review, Interview
Findings	-
Conclusion	There are no project emissions identified in the monitoring methodology /B02/ and the PDD /B04/.

E.8.3. Calculation of leakage GHG emissions

Means of verification	Document Review, Interview
Findings	-
Conclusion	A default (0.95) Net to gross adjustment factor to account for leakages (LE_{NRB}) has been considered by the project and thus it is in line with the requirement of monitoring methodology /B02/ and the PDD /B04/.

E.8.4. Summary calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	Document Review, Interview
Findings	-
Conclusion	Verification team confirms that all parameters are used correctly in the calculations, all results are verifiable and transparent, all assumptions are described and based on verifiable evidence and calculations are done in accordance with the pre-defined formulae from registered PDD /B04/. The total number of CERs achieved during the monitoring period is 6,746 tCO_2e. In summary, verification team confirms that actual emission reduction is lower than the estimate of the registered PDD for the current monitoring period.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	Document Review, Interview
Findings	-
Conclusion	The ex ante estimated value of the emission reductions for the monitoring period as per the registered PDD is 93,734 tCO_2e and the actual emission reductions achieved for the monitoring period is 6,746 tCO_2e. Verification team confirms that actual emission reduction is lower than the estimate of the registered PDD for the current monitoring period. The verification team took cognizance of §372 of CDM VVS for project activities, version 02 /B01-1/.

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	Document Review, Interview
Findings	-
Conclusion	Verification team confirms that actual emission reduction is lower than the estimate of the registered PDD for the current monitoring period.

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	Document Review, Interview
Findings	-
Conclusion	CER achieved upto 31st Dec 2012 = 0 tCO_2e.

	CER achieved from 1st Jan 2013 = 6,746 tCO_2e

E.9. Assessment of reported sustainable development co-benefits

Means of verification	Not applicable
Findings	-
Conclusion	Not applicable

E.10. Global stakeholder consultation

Means of verification	Not applicable (this is not first MP)
Findings	-
Conclusion	Not applicable (this is not first MP)

SECTION F. Internal quality control

>>

The final verification report passed a technical review before being submitted to the UNFCCC Executive Board. The technical review is performed by a technical reviewer qualified in accordance with CCIPL's qualification scheme for CDM validation and verification.

SECTION G. Verification opinion

>>

Carbon Check (India) Private Ltd. (CCIPL) has performed the third periodic verification of the registered CDM Project Activity “Nairobi River Basin Biogas Project” having UNFCCC reference number as 6549.

The verification team assigned by the DOE concludes that the project activity as described in the registered PDD (Version 2.4, date 11/06/2012) /B04/ and the Monitoring report (version 3, dated 17/05/2019) /2/, meets all relevant requirements of the UNFCCC for CDM project activities including article 12 of the Kyoto Protocol and paragraph 62 of CDM M & P, the modalities and procedures for CDM (Marrakesh Accords) and the subsequent decisions by the COP/MOP and CDM Executive Board. The verification has been conducted in-line with the CDM VVS for project activities, version 02.0 requirements /B01-1/.

Verification methodology and process:

The Verification team confirms the contractual relationship signed on 20/12/2018 between the DOE, Carbon Check (India) Private Ltd. and the Project Participant, (atmosfair gGmbH). The team assigned to the verification meets the CCIPL’s internal procedures including the UNFCCC requirements for the team composition and competence. The verification team has conducted a thorough contract review as per UNFCCC and CCIPL’s procedures and requirements.

The verification has been performed as per the requirements described in the CDM VVS for project activities, version 02.0 and constitutes the review and completion of the following steps:

- Reviewing the registered PDD (version 2.4, date 11/06/2012), including the monitoring plan and the corresponding validation report /B04/;
- Publication of the MR (version 1, 22/02/2019) /1/ on the UNFCCC website on 04/03/2019
- Desk review of the validation report, MR and other relevant documents including documents related to the projects activities in emission reductions
- Review of the applied monitoring methodology (AMS I.E version 04) /B02/;
- Review of any CMP and EB decisions, clarifications and guidance /B05/;
- On-site assessment (26/03/2019 – 27/03/2019)
- Resolution of CARs and CLs raised during verification
- Issuance of Verification Report

The project activity was correctly implemented according to selected monitoring methodology, monitoring plan and the registered PDD. The monitoring system was installed, maintained in a proper manner, while collected monitoring data allowed for the verification of the amount of achieved GHG emission reductions. Through the review and on site visit the verification team confirms that the project activity has resulted in the 6,746 tCO_2e emission reductions during the third monitoring period.

Verified emission reductions for the project activity: 6,746 tCO_2e.

The break-up of emission reduction up-to 31/12/2012 and 01/01/2013 onwards as verified during the course of verification are as below:

Item	Emission reductions up to 31 December 2012	Emission reductions from 1 January 2013 onwards
Emission reductions (t CO_2e)	0	6,746

CCIPL as a DOE is therefore pleased to issue a positive verification opinion expressed in the attached Certification statement.

SECTION H. Certification statement

>>

Carbon Check (India) Private Ltd., the DOE, has performed the verification of the registered project activity "Nairobi River Basin Biogas Project" having UNFCCC Registration Number 6549. The project activity involves installation of domestic biogas units which are fed with cow dung to produce renewable biogas used for cooking and water heating purpose. The project activity is saving greenhouse gas emissions by replacing non-renewable biomass with renewable biogas.

The project activity is designed to generate emission reductions by installation of the biogas units in the Kiambu county in Kenya. The PP is responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions. It is DOE's responsibility to express an independent verification statement on the reported GHG emission reductions from the project activity. The DOE does not express any opinion on the selected baseline scenario or on the validated and registered PDD. The verification is carried out in-line with the requirements of CDM VVS for project activities.

The verification was performed to identify the compliance with implementation and monitoring requirements, and to verify the actual amount of achieved emission reductions, through obtaining evidence and information on-site that included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.
The verification is based on:

- PDD version 2.4 dated 11/06/2012 and the corresponding validation report;
- Approved monitoring methodology AMS I.E "Switch from Non-Renewable Biomass for Thermal Applications by the User", version 04;
- Monitoring reports versions 1, version 2 and version 3 dated 22/02/2019, 18/04/2019 and 17/05/2019 respectively.

This statement covers verification period from 31/12/2016 and 30/12/2018 (including both the dates).

The DOE has raised three clarification requests and one corrective action request, all of which have been resolved by the PP.

The DOE considers necessary to give reasonable assurance that reported GHG emission reductions were calculated correctly on the basis of the approved baseline and monitoring methodology and the monitoring plan contained in the registered PDD are fairly stated.

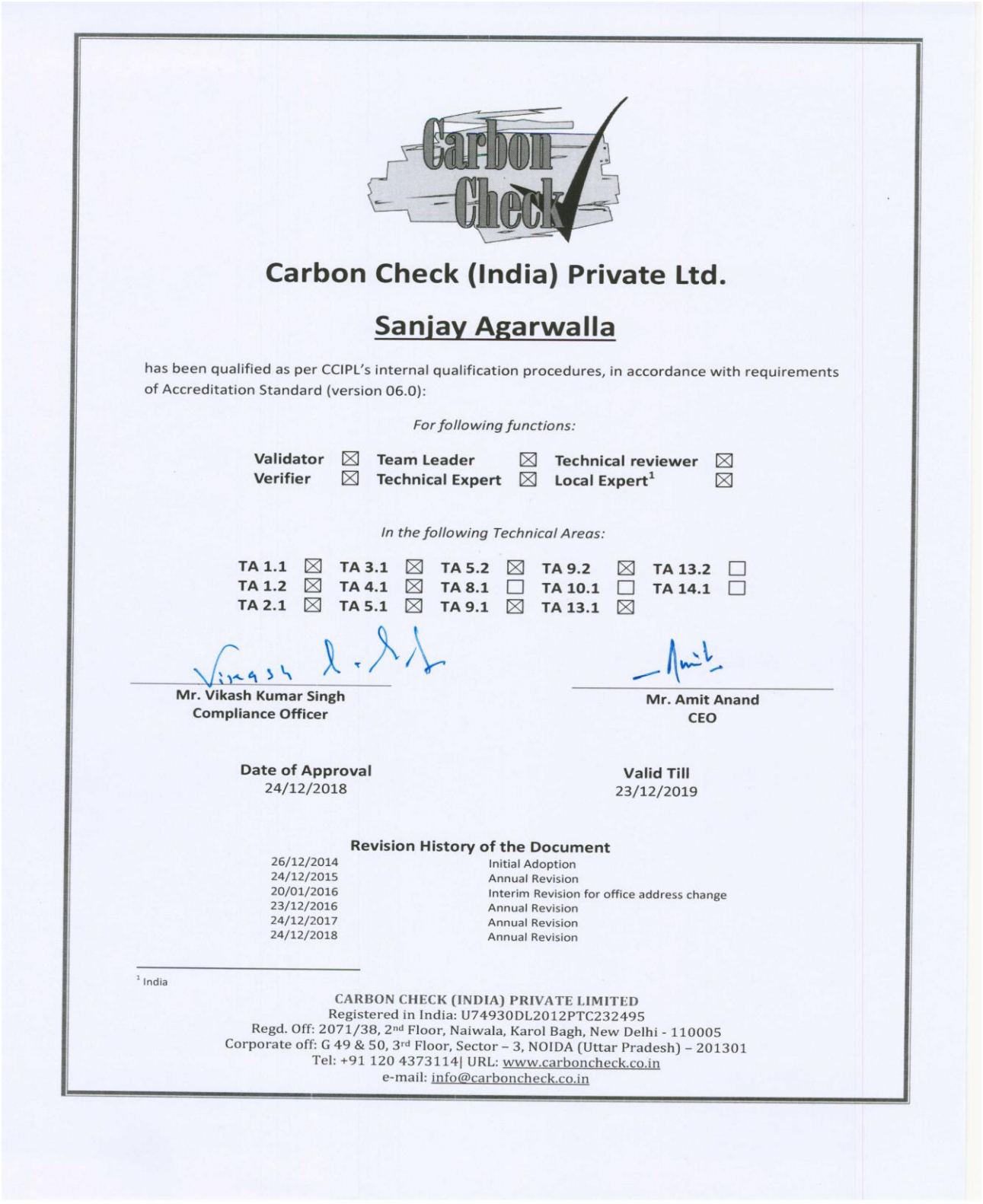
The DOE, hereby certifies that the project activity, achieved emission reductions by sources of GHG equal to 6,746 tCO_2 equivalent and all monitoring requirements have been fulfilled and is substantiated by an audit trail that contains evidence and records. The break-up of emission reduction up-to 31/12/2012 and 01/01/2013 onwards as verified during the course of verification are as below:

Item	Emission reductions up to 31 December 2012	Emission reductions from 1 January 2013 onwards
Emission reductions (t CO_2e)	0	6,746

Appendix 1. Abbreviations

Abbreviations	Full texts
AQL	Acceptable Quality Limit
CL	Clarification Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CAR	Corrective Action Request
CCIPL	Carbon Check (India) Private Ltd.
CER	Certified Emission Reduction
CL	Clarification Request
CME	Co-ordinating and Managing entity
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent
DR	Document review
DOE	Designated Operational Entities
DVR	Draft Verification Report
EB	CDM Executive Board
EF	Emission Factor
EI	External individual
FA	Final Approval
FAR	Forward Action Request
FVR	Final verification Report
GHG	Greenhouse gas(es)
I	Interview
IPCC	Intergovernmental Panel on ClimateChange
IR	Internal resource
PP	Project Participant
OSV	On Site Visit
QC/QA	Quality control/Quality assurance
RMP	Revised Monitoring Plan
TA	Technical Area
TR	Technical Review
UNFCCC	United Nations Framework Convention on Climate Change
UQL	Unacceptable Quality Limit
VVS	Validation and Verification Standard

Appendix 2. Competence of team members and technical reviewers



Carbon Check

Carbon Check (India) Private Ltd.

Sanjay Agarwalla

has been qualified as per CCIPL's internal qualification procedures, in accordance with requirements of Accreditation Standard (version 06.0):

For following functions:

Validator	☒	Team Leader	☒	Technical reviewer	☒
Verifier	☒	Technical Expert	☒	Local Expert[1]	☒

In the following Technical Areas:

TA 1.1	☒	TA 3.1	☒	TA 5.2	☒	TA 9.2	☒	TA 13.2	☐
TA 1.2	☒	TA 4.1	☒	TA 8.1	☐	TA 10.1	☐	TA 14.1	☐
TA 2.1	☒	TA 5.1	☒	TA 9.1	☒	TA 13.1	☒		

Mr. Vikash Kumar Singh
Compliance Officer

Mr. Amit Anand
CEO

Date of Approval
24/12/2018

Valid Till
23/12/2019

Revision History of the Document

26/12/2014	Initial Adoption
24/12/2015	Annual Revision
20/01/2016	Interim Revision for office address change
23/12/2016	Annual Revision
24/12/2017	Annual Revision
24/12/2018	Annual Revision

[1] India

CARBON CHECK (INDIA) PRIVATE LIMITED
Registered in India: U74930DL2012PTC232495
Regd. Off: 2071/38, 2nd Floor, Naiwala, Karol Bagh, New Delhi - 110005
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Carbon Check (India) Private Ltd.

Amit Anand

has been qualified as per CCIPL's internal qualification procedures, in accordance with requirements of Accreditation Standard (version 07.0):

For following functions:

Validator	☒	**Team Leader**	☒	**Technical reviewer**	☒		
Verifier	☒	**Technical Expert**	☒	**Local Expert**[1]	☒		

In the following Technical Areas:

TA 1.1	☒	**TA 3.1**	☒	**TA 5.2**	☐	**TA 9.2**	☐	**TA 13.2**	☐
TA 1.2	☒	**TA 4.1**	☐	**TA 8.1**	☒	**TA 10.1**	☐	**TA 14.1**	☒
TA 2.1	☐	**TA 5.1**	☐	**TA 9.1**	☐	**TA 13.1**	☒		

Mr. Vikash Kumar Singh
Compliance Officer

Date of Approval	Valid Till
24/12/2018	23/12/2019

Revision History of the Document	
26/12/2014	Initial Adoption
24/12/2015	Annual Revision
20/01/2016	Interim Revision for office address change
23/12/2016	Annual Revision
24/12/2017	Annual Revision
24/12/2018	Annual Revision

[1] India, South Africa

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e-mail: info@carboncheck.co.in

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	atmosfair	1. Webhosted Monitoring report 2. Monitoring report	Version 1, dated 22/02/2019 Version 2, dated 18/04/2019	PP
2	atmosfair	Final Monitoring report	Version 3, dated 17/05/2019	PP
3	atmosfair	Emission reduction calculation spread sheet corresponding to /1/	-	PP
4	atmosfair	Emission reduction calculation spread sheet, corresponding to /2/	-	PP
5	atmosfair	Evidence for the commissioning of the first biogas unit on 09/10/2010	Version 3, dated 17/05/2019	PP
6	atmosfair	Evidence for unique identification of the biogas units (agreement copies)	-	PP
7	atmosfair	Evidence for the total number of biogas units distributed during the monitoring period for the determination of the monitoring parameter "N_y"	-	PP
8	atmosfair	Evidence for determination of the monitoring parameter "DO_y" during the monitoring period	-	PP
9	atmosfair	Copies of the monitoring survey records for the monitoring period including "traceable check" evidence of the units visited during sampling	-	PP
10	atmosfair	Evidence for the biogas units technical specifications	-	PP
11	atmosfair	Sample biogas units sales receipt	-	PP
12	atmosfair	Training records	-	PP
13	atmosfair	Evidence for random number generator	-	PP
14	atmosfair	Sample agreement copies with the end users	-	PP
15	atmosfair	Copy of the monitoring manual for the project activity		PP
16	atmosfair	Copy of the monitoring questionnaires	-	PP
/B01/	UNFCCC	1. CDM validation and verification standard for project activities, version 02.0 2. CDM project standard for project activities, version 02.0 3. CDM project cycle procedure for project activates, version 02.0	http://cdm.unfccc.int/	Others
/B02/	UNFCCC	Applied baseline and monitoring methodology, AMS-I.E, version 04	http://cdm.unfccc.int/	Others
/B03/	UNFCCC	Instructions for filling out the monitoring report form for CDM project activities, version 06.0	http://cdm.unfccc.int/	Others
/B04/	UNFCCC	Registered PDD (version 2.4 dated 11/06/2012), and corresponding validation report.	http://cdm.unfccc.int/	Others
/B05/	Web sites	Websites: http://cdm.unfccc.int/	--	Others
/B06/	UNFCCC	Guidelines: Sampling and surveys for CDM project activities and programmes of activities, version 04.0	http://cdm.unfccc.int/	Others
/B07/	UNFCCC	Standard: Standard for sampling and surveys for CDM project activities and programme of activities, version 07	http://cdm.unfccc.int/	Others
/B08/	UNFCCC	Guideline on the application of Materiality in verifications, version 02.0	http://cdm.unfccc.int/	Others

Appendix 4. Clarification requests, corrective action requests and forward action requests

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

FAR ID	xx	**Section no.**	E.2	**Date:** DD/MM/YYYY
Description of FAR				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 2. CL from this verification

CL ID	01	**Section no.**	E.1	**Date:** 05/04/2019
Description of CL				
In section A.1 of the published MR, the dates for the current monitoring period are incorrectly stated. Also in some sections of the MR, "second" or "first" MP is stated whereas the current MP is third.				
Project participant response				**Date:** 17/04/2019
The dates for the current monitoring period have been restated correctly in A.1. Also the MP is now correctly referred to as the third MP throughout the MR.				
Documentation provided by project participant				
- *MR_Kenia CDM 6549_MP3_V2_DM_16042019*				
DOE assessment				**Date:** 04/05/2019
PP has submitted revised MR stating correct monitoring period. The CL is closed.				

CL ID	02	**Section no.**	E.6.2	**Date:** 05/04/2019
Description of CL				
PP has not provided the sample size, precision and the monitoring parameter "DO_y" calculations in the ER spread sheet. Also the submitted ER spread sheet is showing erroneous values (not matching with the MR). PP is requested to submit the ER spread sheet without any circular reference.				
Project participant response				**Date:** 17/04/2019
The ER spread sheet has been updated and the new version now includes the spread sheets 'Sample size + Precision MP3' and 'DOy MP3'. The first includes the calculation of the sample size and precision based on the amount of biogas systems installed until the end of MP3 and a 95% confidence level and 5 % Precision. The later includes the calculation of the dropout rate (DOy) based on the results from the monitoring campaign. Values in the ER and the MR have been cross-checked and updated where necessary to be consistent.				
Documentation provided by project participant				
- *03 and 04_Kenya_MP3_CER calculation_DM_V2_16042019* - *MR_Kenia CDM 6549_MP3_V2_DM_16042019*				
DOE assessment				**Date:** 04/05/2019
PP has provided the sample size, precision and the monitoring parameter "DO_y" calculations in the revised ER spread sheet with correct calculation of the ERs without having any circular reference. The CL is closed.				

CL ID	03	**Section no.**	E.6.2	**Date:** 05/04/2019
Description of CL				
PP needs to confirm the total number of biogas units distributed till the end of monitoring period along with evidence (which has been inconsistently stated in between the MR and ER spread sheet).				
Project participant response				**Date:** 17/04/2019
The number of biogas units distributed until the end of the monitoring period is 704. The adjusted number of biogas units is 673. Evidence is given in 'Ny MP3' and 'Database MP3' in the ER spread sheet. The MR has been updated and is now consistent with the information in the ER spread sheet.				
Documentation provided by project participant				

- *03 and 04_Kenya_MP3_CER calculation_DM_V2_16042019* - *MR_Kenia CDM 6549_MP3_V2_DM_16042019*
DOE assessment **Date:** 04/05/2019
The total number of biogas units distributed and recorded by the PP till the end of this monitoring period is 704. This has been cross checked by the verification team during the on-site visit document review. This has been consistently stated in the MR and ER spread sheet submitted. Hence the CL is closed.

Table 3. CAR from this verification

CAR ID	01	**Section no.**	E.8.1	**Date:** 05/04/2019
Description of CAR				
During the on-site visit interviews and review of the survey forms, it was found that all the 53 samples were operational. PP needs to clarify the monitoring parameter "DOy" reported as 1.88% in the MR and also used for ER calculation.				
Project participant response				**Date:** 17/04/2019
DOy has been stated incorrectly in the MR and ER calculation. Both documents have been updated and now correctly state DOy with a value of 0%.				
Documentation provided by project participant				
- *03 and 04_Kenya_MP3_CER calculation_DM_V2_16042019* - *MR_Kenia CDM 6549_MP3_V2_DM_16042019*				
DOE assessment				**Date:** 04/05/2019
PP has submitted revised MR and ER spread sheet with correction in the monitoring parameter "DOy" value as 0%. This has been cross checked with the survey records and found to be correct. The closure of this CAR has resulted in increase of emission reductions from 6.335 to 6,746 tCO2. The CAR is closed.				

Table 4. FAR from this verification

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

Annex 1: Assessment of data and parameters fixed ex-ante at the time of validation

Parameter	Quantity of fuelwood and woodfuel consumption for charcoal that is substituted or displaced in tonnes (B_y)
Data unit:	tonnes/year/household
Default values used:	4.257
Purpose of data	Baseline emissions calculation
Source and Verification of the source	The value of this parameter is fixed ex-ante /B04/.

Parameter	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non renewable biomass using survey methods ($\mathbf{f_{NRB,y}}$)
Data unit:	Fraction
Default values used:	0.962
Purpose of data	Baseline emissions calculation
Source and Verification of the source	The value of this parameter is fixed ex-ante /B04/.

Parameter	Net calorific value of the non-renewable woody biomass that is substituted ($\mathbf{NCV_{biomass}}$)
Data unit:	TJ/tonne
Default values used:	0.015
Purpose of data	Baseline emissions calculation
Source and Verification of the source	The value of this parameter is fixed ex-ante /B04/.

Parameter	Emission factor for the substitution of non-renewable biomass by similar consumers ($\mathbf{EF_{projected\_fossilfuel}}$)
Data unit:	tCO_2/TJ
Default values used:	81.6
Purpose of data	Baseline emissions calculation
Source and Verification of the source	The value of this parameter is fixed ex-ante /B04/.

Annex 2: Assessment of data and parameters monitored

Monitoring Parameter Requirement	Assessment/ Observation by the DOE
Data / Parameter: (as in monitoring plan of PDD):	Adjusted total number of biogas units deployed until monitoring period y of end users who confirmed that non-renewable biomass was displaced/substituted (N_y)
Measuring frequency/Time Interval:	Continuous monitoring and recording
Reporting frequency:	Yearly
Reported value:	672.92 The total number of units commissioned until period y has been calculated from the end user agreements where owner and location of the biogas unit is stated. $N_y = \sum_{i=1}^{y} n_i \cdot OT_{adjusted,i,y}$ Where n_i = Number of units commissioned in period i $OT_{adjusted,i,y} = \begin{cases} 1 & ,i < y \\ \frac{d_{average,y}}{mp_{length}} & ,i = y \end{cases}$ Where $OT_{adjusted,i,y}$ = Adjustment factor for reduced operational time of appliances deployed in period y $d_{average,y}$ = Average number of days that appliances deployed in period y have been operational in period y as determined by respective commissioning dates mp_{length} = Length of monitoring period y From the above equation and the respective commissioning dates of the individual biogas units, the values of N_y are calculated as 672.92 for the monitoring period. The calculation has been checked by the verification team in the emission reduction spread sheet and found to be correct /4/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Details of monitoring equipment:	Sales database
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	An electronic sales database has been maintained for the project activity.
Calibration frequency /interval: Is it monitoring methodology /CDM EB guidance / local or national standards / manufacturers specification	NA
Is the calibration interval in line with the	NA.

monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	
Company performing the calibration(internal or external calibration):	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	Yes, the value of parameter has been cross-checked with the monitoring database and sample households and the hard copy records were also checked during the OSV.
How were the values in the monitoring report verified?	NA
Does the data management (from data generation to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reductions and all necessary QA/QC processes are in place.
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA

Monitoring Parameter Requirement	Assessment/ Observation by the DOE
Data / Parameter: (as in monitoring plan of PDD):	Statistically adjusted drop out from total population of units in period y (**DO_y**)
Measuring frequency/Time Interval:	Annual
Reporting frequency:	Annual
Reported value:	0 %
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Details of monitoring equipment:	Value obtained from the monitoring survey of samples
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	NA
Calibration frequency /interval: Is it monitoring methodology /CDM EB guidance / local or national standards / manufacturers specification	NA.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD	NA. QA/QC procedures stated in MR comply with PDD.

does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	
Company performing the calibration(internal or external calibration):	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been cross-checked with other available data?	Yes, reported data in MR has been compared with monitoring survey report and the ER sheet
How were the values in the monitoring report verified?	The values in the monitoring report were compared against the values in ER sheet
Does the data management (from data generation to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reductions and all necessary QA/QC processes are in place. The confidence/precision applicable is 95/5. Standard error of proportion is calculated by using the formulae $\sqrt{}$(1-f)*pq/n; where, f = sampling fraction p = sample proportion q=1-p n = sample size This is deemed correct in line with paragraph 31, Appendix 4 of Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 /B06/. The Relative precision has been calculated using the formulae z * standard error of proportion /fraction of operational stoves. This is deemed correct in line with paragraph 38 and 39, Appendix 4 of Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 /B06/. The precision achieved by the samples is calculated to be 0 %, which is less than the required precision of 5 % and hence deemed acceptable.
In case only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	NA.

Annex 3 Assessment of Monitoring parameters monitored through sampling/surveys

<table>
<tr><th>Sl. No.</th><th>Checklist Questions</th><th>Assessment</th></tr>
<tr><td>1.</td><td>Does the Monitoring Report apply sampling for determination of ex-post monitoring parameters?</td><td>Yes, there are ex-post monitoring parameters determined through the sampling effort.</td></tr>
<tr><td>2.</td><td>Is the applied sampling plan in accordance with the sampling plan proposed in the registered PoA-DD/ PDD?</td><td>Yes, the applied sampling plan is in accordance with the sampling plan proposed in the approved revised PoA-DD.</td></tr>
<tr><td>3.</td><td>List the parameters determined through sampling and respective parameters of interest.</td><td>Parameters determined through sampling and respective parameters of interest are:
<table>
<tr><th>Parameter</th><th>Description of Parameter</th><th>Parameter of Interest</th></tr>
<tr><td>DO_y</td><td>Statistically adjusted dropout from total population of units in period y.</td><td>Proportion</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Is the sample size calculated in accordance with the formula presented in the registered PoA-DD/PDD?</td><td>Yes, the sample size calculated is in accordance with the formula presented in the registered PDD</td></tr>
<tr><td>5.</td><td>Are the assumptions used for calculation of sample size appropriate and correct?

P.S.: Provide assessment on appropriateness of value of proportion (p), standard deviation (STDEV) or variance (v) used for calculation of sample size.</td><td>Simple random sampling was applied for biennial monitoring with 95/5 confidence/precision. The same is deemed acceptable as per the PDD.

The standard deviation (STDEV) or variance (v) used for calculation of sample size is found to be appropriate. All assumptions for the calculation of sample size were used from the previous monitoring period.</td></tr>
<tr><td>6.</td><td>What are the sample sizes obtained for the parameters being monitored? Is the determined sample size deemed adequate for the parameter of interest being monitored?

P.S.: If the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 shall be chosen when the parameter of interest is a proportion. If the parameter of interest is a numeric mean value (i.e. not a proportion or percentage) the Student’s t-distribution shall be used if the resulting sample size is less than 30.</td><td>It was found that with the monitored samples, the desired confidence/precision was met. The number of samples for the parameter covered during the monitoring activity is as given below:
<table>
<tr><th>Parameter</th><th>Samples covered during monitoring</th></tr>
<tr><td>DOy</td><td>53</td></tr>
</table></td></tr>
<tr><td>7.</td><td>Has reliability specification been applied to determine the sampling requirements for each individual parameter value determined through a</td><td>It was found that for the parameter, the confidence/precision was met (95/5).</td></tr>
</table>

	sampling effort? P.S.: If there is more than one parameter to be estimated in a CDM project activity, then a sample size calculation should be done for each of them. Then either the largest number for the sample size is chosen for the sampling effort with one common survey, or the sampling effort and survey is repeated for each of the parameters. A random sub-sample within the common survey is allowed as long as: (i) the reliability specification (e.g. 90/10 confidence/precision for small-scale CDM project activities and 95/10 for large scale CDM project activities) is achieved for each individual parameter; and (ii) the random sub-sample is consistent with the design of the survey and the corresponding sample size calculation.	
8.	Is the assumed response rate reasonable (appropriate and correct) for the determination of samples to be surveyed?	Yes, the assumed response rate is reasonable (appropriate and correct) for the determination of samples to be surveyed for the parameter of interest.
9.	Is the sample selected by PP for determination of the monitored parameters unbiased (random) and representative?	Yes, verification based on review of Microsoft excel random number generator as provided by the PP confirms that sample selected by the CME for determination of the monitored parameters are random. It can be considered as representative of the population.
10.	Has minimum target level of precision been achieved based on estimates from the actual samples?	Yes, the minimum target level of precision been achieved based on estimates from the actual samples. The achieved precision is 0%. This has been checked and confirmed by reviewing Survey database provided by the PP.
11.	In case the minimum target level of precision has not been achieved based on estimates from the actual samples, please specify the approach adopted by PP to reach the required precision and also justify the appropriateness of the adopted approach in accordance with the applied methodology or paragraph 17 of Sampling and surveys for CDM project activities and programmes of activities (Version 07.0).	Not applicable since as assessed above the target level of precision has been achieved.
12.	Has VT applied acceptance sampling to verify that the results of sampling efforts undertaken by PP for determination of ex-post parameters. If yes, please provide a detailed justification of the approach adopted including information on (but not limited to): (a) Selected AQL Level (b) Selected UQL Level (c) Selected Consumer Risk Level (d) Selected Producer Risk Level (e) Sample Size chosen for acceptance sampling (f) Acceptance number (c)	In line with paragraph 25 of the Sampling Standard, the verification team has applied a sampling approach for on-site visits as part of verification. Now as the PP had applied sampling approach, the verification team has chosen acceptance sampling for the parameters in accordance with paragraph 27 of the sampling standard /B07/. DOE used sampling during verification for checking the operational status of the biogas units. PP had calculated the drop-out rate based on its 53 monitoring samples. Considering that the achieved annual emission reductions for the project activity are less than 100,000 tCO_2e, applying paragraph 33 (a) of the sampling standard, version

	Approach adopted by VT to in case value of greater than c discrepant records were observed in the sample	07 /B07/, a sample size of 8 HHs was chosen (with no discrepant records). A sample size of 8 was required, based on an AQL of 0.5 % and UQL of 20 %, producer risk 10 % and consumer risk 20 %. Acceptance number (c) thus determined for the sample is 0. It was observed that out of the 8 samples, all the 8 samples were found to be operational which matched with the PP's records and hence no discrepant records were observed with the published MR /1/ and ER sheet /3/ and thus c=0. Thus, PP's set of records has been accepted in line with § 32 of the sampling standard, version 07 /B07/.
13.	Are the procedures for the selected survey and data collection method unambiguously defined and do they adequately provide for minimizing non-sampling errors?	Verification team based on on-site inspection interviews and review of documented procedure confirms that the selected survey and data collection method is unambiguously defined. This also adequately ensure minimizing non-sampling errors.
14.	Have potential sources of bias inherent in the selected data collection method, such as self-selection and under-coverage, been anticipated? Have mechanisms for mitigating these been considered?	Review of sampling records, documented procedure and on-site inspection interviews with the personnel who conducted surveys does not reveal any sources of biasness in the selected data collection.
15.	Is the quality control and assurance strategy adequate?	Verification team based on review of provided documents and on-site inspection interviews confirms that the quality control and assurance strategy is adequate.
16.	Are the proposed skill sets, qualifications and experience of the personnel/institutions engaged to conduct the standardized tests/data collection exercise adequate?	For the monitoring parameter, data were collected following a specially designed survey form. The verification team has confirmed the ability of the personnel who conducted the surveys during the on-site visit.
17.	Does the PP have a process in place to ensure data quality is maintained to a high standard? This should include: a) Are the personnel trained and experienced? b) What is the level of supervision and guidance provided to staff? c) Is there a standardized system for data entry and analysis to produce final result? d) Is there a system or process in place to minimize the introduction of errors? e) Is there a system in place to ensure all collected data is processed; f) Are quality checks performed on data entered, for example range checks, g) inconsistency checks, checking of subsamples of data by supervisors; h) is there a system to check for errors, record and report errors reported and document the remedial action taken; i) What is the level of security and type of backup processes to guarantee data integrity, for example methods to prevent fraud and accidental deletion?	Verification team based on review of provided documents and on-site inspection interviews confirms the following: ✓ the personnel involved in the surveys are trained and experienced. ✓ there exists a standardized system for data entry. ✓ there exist a system or process in place to minimize the introduction of errors. ✓ there a system in place to ensure all collected data is processed. ✓ there exists a quality checks of data entered.

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Document information

Version	*Date*	*Description*
02.1	11 January 2018	Editorial revision to correct the numbering of appendices in the instructions.
02.0	31 October 2017	Revision to align with the requirements of the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.

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