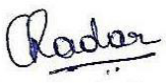
Verification and certification report form for GS project activities

BASIC INFORMATION	
Title and GS reference number of the project activity	HomeBiogas Programme in Kenya – VPA1, (GS12064)
GS Version	GS4GG
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the verification and certification report	3
Completion date of the verification and certification report	20/03/2025
Monitoring period number and duration of this monitoring period	Monitoring period no: 3 Duration: 01/01/2024 to 30/11/2024 (Inclusive of both days)
Version number of the monitoring report to which this report applies	03
Crediting period of the project activity corresponding to this monitoring period	01/03/2022 – 28/02/2027
Project participants	Home Biogas LTD
Host Party	Kenya
Applied methodologies and standardized baselines	GS Methodology: Methodology for Animal Manure Management and Biogas Use for Thermal Energy Generation V.1.1
Sectoral scopes	Sectoral Scope 01, & 13
Estimated SDG Impact (for the monitoring period)	

SDG Goal	SDG Impact	Estimated Annual Average
13: Climate Action (mandatory)	Amount of GHG Emission reduction	124,535 tCO_2e
1: No Poverty	Proportion of population living in households with access to basic services	100%
2: Zero Hunger	Number of farmers adopted practices promoted by the project	15,000
3: Good health and well being	Percentage of project population using polluting fuels	0% (87.5% reduction)
SDG 5: Gender Equality	Average time saving associated with cooking time and fuel collection	3.55 Hrs

	7: Affordable and Clean energy	Number of beneficiaries: Households	15,000 Nos
	8: Decent work and economic growth	Total Number of Jobs	60
	15: Life on Land	Total non-renewable wood fuel saved	29,941 tonnes /year
SDG Impact Certified	**SDG Goal**	**SDG Impact**	**Achieved Value**
	13: Climate Action (mandatory)	Amount of GHG Emission reduction	21,251 tCO_2e
	1: No Poverty	Proportion of population living in households with access to basic services	100%
	2: Zero Hunger	Number of farmers adopted practices promoted by the project	3,714 Nos
	3: Good health and well being	Percentage of project population using polluting fuels	10.78% (76.8% reduction)
	SDG 5: Gender Equality	Average time saving associated with cooking time and fuel collection	3.12 Hrs
	7: Affordable and Clean energy	Number of beneficiaries: Households	3,714 Nos
	8: Decent work and economic growth	Total Number of Jobs	64
	15: Life on Land	Total non-renewable wood fuel saved	5,849 tonnes /year
Name of the VVB	4K Earth Science Private Limited		
Name, position and signature of the approver of the verification and certification report	Chandrakala R  Managing Director		

SECTION A. Executive summary

4K Earth Science Private Limited (4KES) has been commissioned by "HomeBiogas LTD" to perform an independent verification of its registered GS VER project "HomeBiogas Programme in Kenya – VPA1", (GS ID 12064) for the reported GHG emission reductions for the given monitoring period 01/01/2024 - 30/11/2024 (both dates included). The GS VER projects must undergo independent third-party verification and certification of emission reductions as the basis for issuance of Verified Emission Reductions (VERs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the approved GS PoA DD & VPA DD and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete.
- The actual monitoring systems & procedures and monitoring report conforms with the requirements of the approved monitoring plan and the approved monitoring methodology;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.

Scope:

The scope of the verification is the independent and objective review and ex post determination of the monitored reductions in GHG emission by the project activity. The verification is based on review of monitoring report, supporting information and

(a) The registered GS POA DD & VPA DD;
(b) Previous verification reports, deviation requests, requests for revision of monitoring plan if applicable
(c) GS4GG Transition Annex if applicable
(d) The registered monitoring plan.
(e) Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board
(f) Applicable GS4GG guidance
(g) CDM Validation and Verification Standard (VVS)
(h) GS Validation and Verification Standard (VVS)
(i) All information and references relevant to the project activity's resulting in emission reductions.
(j) Information related to monitoring of SD parameters.

The project is assessed against the requirements of the Gold Standard for Global Goals requirements and related rules and guidance.

4KES has based on the recommendations in the latest version of CDM Validation and Verification Standard, GS Validation and Verification Standard, employed a rule-based approach in the verification, focusing on the identification of significant reporting risks and the reliability of project monitoring.

Description of project:

The proposed project activity involves the installation of biogas units, provided by HomeBiogas, at rural households in Kenya. These biogas units, with a gas tank volume of 2.5 m^3 and a digester volume of 5.5 m3 (total system volume 8 m^3), offer a clean and sustainable source of renewable energy for cooking. The project's objective is to distribute these biogas systems to approximately 50,000 households, replacing traditional wood stoves and reducing CO_2 emissions associated with wood burning. Furthermore, these biogas systems use animal manure as a feedstock, preventing CH_4 emissions from the disposal of animal waste in pits.

The implementation of these biogas units commenced on February 1, 2022, with an expected gas production start date of 20-25 days after installation. The installation will take place progressively throughout the year, and a project database will be maintained to track installation and commissioning dates for each unit, each assigned a unique identification number to avoid duplication during monitoring surveys.

Before the project's implementation, a baseline survey was conducted on 225 rural households in the project areas. The survey revealed that the beneficiaries predominantly used inefficient traditional cook stoves, primarily fuelled by firewood, with occasional use of charcoal and LPG. The use of firewood not only contributes

to deforestation but also leads to indoor air pollution, directly or indirectly affecting the health of women and children. This indoor air pollution is a significant global health issue, with 3.8 million premature deaths annually attributed to illnesses related to indoor air pollution caused by inefficient solid fuel use for cooking. The causes of these deaths include pneumonia (27%), strokes (18%), ischemic heart disease (27%), chronic obstructive pulmonary disease (20%), and lung cancer (8%). Women, who are more exposed to indoor pollution while cooking, face a higher risk.

Methodology:

4KES follows a rule-based verification approach, wherein, as a first step, the contract review is undertaken as per latest version of CDM Accreditation Standard. Subsequently, after the contract is signed, the Gold Standard Verification work plan of the project activity is made available at Gold Standard registry in accordance with Gold Standard rules.

A desk review of the project documentation is undertaken, which is followed by a on-site audit by the local expert of verification team in accordance with the latest version of GSGG Principles & Requirements, Version 1.2 /5/. The verification protocol is filled by the verification team that is based on standard auditing practices and GS VVS, validated VPA-DD, applied methodology, applied standardized baseline and/or tools and recent decisions. The verification protocol provides transparent means to record the observations and compliances by the verification team members and the nonconformities, if any. The verification protocol is an internal document, and is available on request. Following are the major milestones for the verification under consideration. The verification protocol provides transparent means to record the observations and compliances by the verification team members and the nonconformities (CARs/CLs), if any. The verification protocol is an internal document, and is available on request. After successful closure of findings (CARs/CLs), the draft verification report is prepared which went through Independent technical review as per 4KES internal procedures and the TR comments were given for any gaps in audit findings. After closure of the TR comments, final verification report is prepared then followed by final approval for the decision made. The approved verification report is given to PP which shall be submitted for request for issuance.

4K Earth Science Private Limited confirms that the monitoring system is in place and the emission reductions are calculated without material misstatements.

Based on the information seen and evaluated we confirm that the implementation of the project has resulted in 21,251 tCO2e (round down) emission reductions during period 01/01/2024 - 30/11/2024.

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 VVB or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interviews	Verification findings
1.	Team Leader (GS Approved Auditor)	IR	Acharya	Swati S	Central	X	X	X	X
2	Technical Expert (1.1 & 13.1) (GS Approved Auditor)	IR	S	Stalin	Central	X	X	X	X
3	Verifier	IR	S	Sriram	Central	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 VVB or outsourced entity)
1.	Technical reviewer (1.1 & 13.1)	EI	Kandari	Sanjay	Central
2	Approver	IR	R	Chandrakala	Central

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 risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Wrong data collection/ misinterpretation of household situation	Low	It's not complicated monitoring process. Appropriate trainings are conducted for the monitoring personnel.	By means of acceptance sample survey
2	Transfer of data from sampling survey sheet to ER sheet	Low	Possible human error during transfer of data to monitoring database	Thorough cross-check required on the transfer of data from survey sheets to the monitoring database sheet
3	Error in ER calculations	High	The sample size was large, hence increasing the chances of error in ER calculation	The ER calculations were checked for accuracy.

C.2. Consideration of materiality in conducting the verification

The prescribed thresholds for materiality, as per §326 of CDM VVS for PA,

Prescribed range of ERs/annum	>500,000	300,000-500,000	<300,000	SSC PAs	MSC PAs
Prescribed Threshold	0.5%	1.0%	2.0%	5.0%	10.0%

The identified/selected materiality threshold for the project activity under current monitoring period is 2% as project activity is large scale project activity with ER <300,000 tCO2e

	MR Version (Draft)	MR Version (Final)
Emission reductions/annum	20,328 tCO_2e	21,251 tCO_2e
Identified Threshold	2.0%	2.0%

In the draft PD & ER sheet, there were errors in the date format of gas production data for digesters in the database. These errors have been corrected in the final version, leading to a higher number of project technology-days. As a result, the emission reduction has increased. For further clarity, please refer to CL-02.

The impact of errors observed during verification for each monitoring parameter on the emission reduction calculation is provided below:

Parameter	Verification approach	Error identified	Corrected	Extrapolated error for population size (Qty and %)	Within Threshold

Parallel use of traditional stoves	Acceptance sample survey & random verification of reports of village level volunteers	No error identified.	NA	No impact	Yes
$U_{p,y}$ -	Acceptance sample survey	No error identified.	NA	No impact	Yes
NLT,y	Acceptance sample survey	No error identified	NA	No Impact	Yes
$MS\%i,y$ -	Acceptance sample survey	No error identified	NA	No Impact	Yes
Nb,p,y	Verification of database and number of days calculation in ER sheet	No error identified	NA	No Impact	Yes
LEp,y	Assessment of PD justification	No error identified	NA	No Impact	Yes
Pp,i,y -	Verification of KPT data	No error identified	NA	No Impact	Yes

SECTION D. Means of verification

D.1. Desk/document review

The verification is performed primarily as a desk review of the documents submitted at various stages of assessments. The review is performed by assessment team using verification protocols (checklists). The assessment team cross-checked the information provided in the MR and information from sources other than those used, if available, and also conducts independent background investigations. 4KES conducted a desk review, involving but not limited to,

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;
- A review of calculations and assumptions made in determining the GHG data and emission
- reductions;
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

The list of documents reviewed is included in the section ‘Appendix 3’ of this report.

D.2. On-site inspection

Site visit was conducted by the VVB for this Verification of GS project.

Verification team has used the following means for its assessment and to justify that they are sufficient for the purpose of verification. Along with desk review, audit team has conducted on-site audit interview as follows:

- A complete desk review of the MR, as well as all applicable country legal requirement and supportive evidences have been checked by the verification team.
- An assessment of the implementation and operation of the GS Program of Activity as per the validated PoA DD & VPA-DD and also the specific claims of the CME & Implementing Entity.

- Verification team has performed interview with PP in order to check implementation, project boundary, current situation, evaluation of data management, QA/QC system, monitoring and metering equipment, monitoring procedures, calibration etc.
- Verification team also interviewed end-user to crosscheck the implementation details and other monitoring details.
- Cross checks between information provided by interviewed personnel (i.e., by checking sources) to ensure that no relevant information has been omitted.

- Cross-check evaluation, for information received from interviews, under the scope of all information and references provided in MR and supporting documents.

Details of interviewees, topics covered and additional information are presented in the below section "D.3 Interviews"

Duration of on-site inspection: 27/12/2024 to 30/12/2024				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	Opening Meeting	Office	27/12/2024	Swati S Acharya Stalin S
2	Visit to beneficiaries' households	Project Location	27/12/2024 to 30/12/2024	Swati S Acharya Stalin S
3	Document Review & Closing Meeting	Office	30/12/2024	Swati S Acharya Stalin S

D.3. Interviews

No.	Interviewee			Date	Subject
	Last name	First name	Affiliation		
1.	Muthoni	Daniel	Homebiogas	27/12/2024 to 30/12/2024	- Roles and responsibilities - End user agreement - Technical details - Baseline - Monitoring requirement - General governance and implementation - Monitoring database management
2.	Muthoni	George	Homebiogas		
3.	Lahav	Muli	Homebiogas		
4	Muli	Everlyne	Homebiogas		
5	Majumdhar	Abanish	Kosher Climate	27/12/2024 to 30/12/2024	- Issues in the MR - Data Analysis - ER Calculation
End users					
No	**Name & Gender**	**Occupation**	**Location & ID No**	**Date**	**Subject**
1.	Kelvin Ruo Njuguna (M)	Farmer	Mararo, Gatundu north, 10220434	27/12/2024	- Verification of PP survey data - Awareness about ownership of VERs - Working condition of digesters - SDG parameters verification
2.	Naomi Waithara Kamau (F)	Farmer	Mataara, Gatundu north, 10220373	27/12/2024	
3.	Gabriel Mwiruri Gathuka (M)	Farmer/Businessman	Kaari, Gatundu north, 10220842	27/12/2024	
4.	Eunice Njeri Nganga (F)	Farmer	Kamonyi, Gatundu north, 10231947	27/12/2024	
5.	Judy Nyambura Gakau (F)	Farmer	Gatitu B, Gatundu South, 10231230	27/12/2024	
6.	Patrick Muniu Ngei (M)	Farmer	Kiiga, Gatundu South, 10220097	28/12/2024	
7.	Lucy Njoki Ngeca (F)	Farmer	mums Garden, Gatundu South, 10220168	28/12/2024	
8.	Jane Wangui Njue (F)	Farmer	Magomano, Gatundu	28/12/2024	

			South, 10220545		
9.	Isaac Mwangi Kimani (M)	HR/Farmer	Kimunyu, Gatundu South, 10230784	28/12/2024	
10.	David Kihara (M)	Farmer	Githumu, Kandara, 10231018	29/12/2024	
11.	Samuel Mwangi (M)	Farmer	Kiunyu, Kandara, 10231510	29/12/2024	
12.	Jane Njoki Macharia (F)	Farmer/Businessman	Kagumo, Mathioya, 10232454	29/12/2024	
13.	Joseph nt Njeru (M)	Farmer	Kanduri, 10231075	29/12/2024	
14.	Humery Kathuri (M)	Farmer	Ndiuri, 10230567	29/12/2024	
15.	Gilbert Ntwiga (M)	Farmer/Electrician	Kariene, 10221793	30/12/2024	
16.	Susan Kithinji (F)	Farmer/Teacher	Kachoro, 10221926	30/12/2024	
17.	Angelika Karimi (F)	Farmer/Businessman	Ontulili, 10221900	30/12/2024	
18.	Purity Karambu Bundi (F)	Farmer	Kisima, 10231667	30/12/2024	

Verification team cross verified parameters which are monitored through acceptance samples survey. Apart from acceptance sample survey, the verification team asked additional questions to the households. The additional questions asked by the verification team and the general reply received from the stakeholders are given below:

Questions asked to biogas users

Questions asked by verification team	Summary of Response by Stakeholders/end users
Since when you are using the biogas?	Verification team received varied responses from each household based on the implementation date. This is crosschecked with the project database and found no discrepancy.
Is biodigester is in operational condition?	All end users confirmed the biogas system in operating condition now.
Are you aware that the project claims emission reduction and the ownership of the ERs are with CME/implementer?	All the end users aware that the all the rights of emission reduction are with CME/HomeBiogas. They also confirmed about the agreement signed with CME/ Home Biogas for giving away the emission reduction rights to CME /HomeBiogas
Is there any repairs done to your biogas system or replaced?	Few households confirmed some minor repairs were done. However, they confirmed that does not affect the biogas generation.
If you have any issue with the device/project, you contact whom?	All households confirmed that they have the contact details of the village volunteer and for any requirement they can easily contact village volunteer.
Is indoor smoke reduced due to the use of Biogas?	All the households confirmed reduction in the indoor smoke and thereby reduction in health issues ie, eye related issues, respiratory issues.
Do you have any issue with the project?	No households mentioned any issues with the project.
Are they still want to use the traditional stoves?	People are happy with the biogas as it is clean cooking technology and they don't want to use traditional stoves.

Do they know the procedure or any protocol to report the non-usage in case of repair required?	Yes. They all have the contact numbers to report the any repairs.

D.4. Sampling approach

The sampling approach is conducted according to the "Guidelines for Sampling and Surveys for CDM Project Activities and Programme Activities". VVB had planned to apply the acceptance sampling. Verification team carried out the random sampling from the PP's records and check (using its professional judgment) the acceptability of the data for each record in the PP's sample records against VVB records i.e. Data checked during the site visit. The VVB has determined acceptance sample size based on the "Table. Sample size and acceptance number based on AQL, UQL, and producer and consumer risks" of standard "Sampling and surveys for CDM project activities and programmes of activities" version 09.0.

Using acceptance sampling approach, VVB checked the survey records from PP's survey with the VVB interview records.

For the determination of VVB's acceptance sample size, verification team has selected the following using its professional judgment:
1. Acceptable quality level (AQL) – 0.5%
2. Unacceptable Quality Level (UQL) – 20%
3. Producer risk - 5%
4. Consumer risk - 10%

VVB team has determined acceptance sample size based on the "Table. Sample size and acceptance number based on AQL, UQL, and producer and consumer risks" of standard "Sampling and surveys for CDM project activities and programmes of activities" version 09.0. From the above factors, the VVB determined the minimum sample size (n) as 18 and acceptance number as 1. VVB randomly selected the households from the survey sheet. Hence the acceptability of the survey data for each PP's records were checked during the site visit.

The result of the survey is given below:

VVB Sample size	No of PP's record beyond unacceptable level	Accepted
18	1	18

The following emission reduction parameters were verified though acceptance sample survey:

- Parallel use of traditional stoves
- Usage rate for technologies in project scenario p in year y
- Annual average number of animals of type LT
- Fraction of manure handled in baseline animal manure management system j

Also, the following SDG parameters are checked during the acceptance sample survey:
- Number of farmers adopted practices promoted by the project
- Percentage of project population using polluting fuels
- Average time saving associated with cooking time and fuel collection

Verification team interviewed the selected sample end users user to check the data reported by PP. Verification team found no error in the PPs survey records for any of the parameter. Hence verification team accepts all the data determined through sample survey by PP.

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	-	-	-
Remaining forward actions requests	-	-	-
Compliance of the project implementation and operation with the validated VPA-DD	1		-
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	2	2	-
Compliance with the calibration frequency requirements for measuring instruments	-	-	-
Assessment of data and calculation of SDGs	-	-	-
Stakeholder Inputs & Legal Dispute	-	1	-
Crediting Period.	-	-	-
Total	3	3	0

SECTION E. Verification findings

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

Means of verification	The project is transferred to GS4GG, and PP used GS monitoring report template, version 1.1 which is a valid version at the time of verification. All the sections of the form were filled as per the GS4GG guidelines and gave all the relevant details.
Findings	CL-02 is raised and closed satisfactorily
Conclusion	The monitoring report is prepared based on the Version 1.1 GS4GG monitoring report template which is valid at the time of assessment. All sections of the MR is filled correctly.

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

No FARs raised in the previous validation/verification report or in the performance review report.

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

Means of verification	The project's primary objective is to provide biogas units to approximately 50,000 households. These biodigesters, each with an 8m3 capacity (including a 2.5 m^3 gas tank), will be customized to suit the specific needs of each family. Manufactured by HomeBiogas and of balloon type, the gas tank has a volume of 2.5 m^3, while the digester, excluding gas storage, measures 5.5 m^3, making for a total system volume of 8 m^3. Implementation of the biogas units commenced on February 1, 2022, and it is anticipated that they will begin producing biogas for consumption within approximately 20-25 days after installation. The installation process will take place incrementally throughout the year, with a comprehensive project database established to monitor the installation and commissioning dates of each unit. To ensure easy identification during monitoring surveys and prevent double counting, each constructed biogas unit will be assigned a unique identification number. In baseline situation, households uses traditional fire wood stove which is inefficient. In the project situation the biogas are used for cooking and hence completely avoiding the usage of traditional stoves which results in savings in non-renewable biomass. Thereby, it avoids the related CO_2 emission from the avoidance of non-renewable biomass in cooking. The project leads to reduction of 21,251 tCO_2 during the monitoring period.

	The verification team determined the conformity of the actual project activity and its operation with the validated project design document. Verification team has, by means of a desk review and on-site audit, assessed that all physical features of the GS project activity proposed in the validated VPA-DD. The verification team has checked the information in the monitoring report and compared against the approved validated VPA-DD During the on-site audit, the verification team has checked the project locations, implementation, technology applied, project equipment, and monitoring system against the information in the approved validated VPA-DD. Interviews with operational personnel and households and random samplings have been carried out.
Findings	CL-02 is raised and closed satisfactorily
Conclusion	The verification team has reviewed the project database and end user agreements. The verification team has checked with end users about all physical locations of the biogas unit on sample basis and found that the details are correctly matching with the monitoring report and monitoring details provided in the ER calculation sheet. The type of the biogas unit provided and the locations are consistent with the validated VPA-DD. Thus, the verification team has concluded that the project activity was implemented and operated as validated VPA-DD. The verification team, based on the on-site visit and document review, was able to conclude that the project activity has been commissioned and implemented as per the validated VPA-DD and that all physical features of the project are in place.

E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents[1]

No temporary deviation from the registered monitoring plan is sought in this verification.

E.4.2. Corrections

No correction is sought in this verification.

E.4.3. Changes to the start date of the crediting period

There is no change in start date of the crediting period.

E.4.4. Inclusion of a monitoring plan

Monitoring plan was already included in the validated VPA-DD. Hence, not applicable.

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

No permanent changes or deviation in the registered monitoring plan is sought.

E.4.6. Changes to the project design

No change in project design is sought in this verification.

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

Not applicable

[1] Other standards, methodologies, methodological tools and guidelines (to be) applied in accordance with the applied(selected) methodologies are collectively referred to as the other (applied) methodological regulatory documents).

E.5. Compliance of the registered monitoring plan with applied methodologies, applied standardized baselines, and other applied methodological regulatory documents

Means of verification	The verification team checked compliance of project monitoring plan with the applied methodology "Methodology for Animal Manure Management and Biogas Use for Thermal Energy Generation" V.1.1 /7/
Findings	No finding
Conclusion	All parameters stated in the monitoring plan and the applied methodology has been fulfilled in the current monitoring report. All baseline emission parameters has been verified and found satisfactory. The discussion regarding each parameter has been elaborated in the further sections of this report. The monitoring plan as mentioned in the validated VPA-DD is in accordance with the applied methodology. In the opinion of the verification team the monitoring report complies with the requirement of the validated VPA-DD and applied methodology (Gold Standard Methodology: "Methodology for Animal Manure Management and Biogas Use for Thermal Energy Generation" V.1.1 in the context of the project activity.

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

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

Means of verification

The verification team has checked the ex-ante parameters and data stated in MR and compared with section B.6.2 of the validated VPA-DD whether all parameters fixed ex-ante for the crediting period have been applied correctly.

Parameter	Assessment
Avoidance of double counting or double claiming among project participants	PD provided declaration confirming there is no double counting involved in this project. As the PP is the manufacture of digesters and there is no other party involved in the project, there is no possibility of double counting. Hence, there is no double counting is expected. Hence, the details provided by PD are correct
Avoidance of double counting or double claiming with other mitigation actions	The device from this project will not be included in any other project as each project device has provided with unique ID number. So there is no chance of double counting of the project device with any other project. Also, this project is not registered in any other mechanism and will not be applying to any other mechanism in future. The same is confirmed form the declaration from the CME. Hence, the details provided by CME are correct
Regulatory framework for provision of animal waste management and thermal energy services.	The verification team through secondary research confirms there is no national, sub-national and local regulations or guidance available for animal waste management and thermal energy services. Hence, the details provided by PD are correct
Project technology description	The project technology descriptions provided in section A.3 of the VPA-DD are cross verified from the manufacturer's specification and found to be correct. Hence, acceptable.
Expected technical life of project technology	The expected life time of biodigester (15 years) is confirmed through manufacturer specification. Hence acceptable.
Baseline scenario survey results	The data and information determined through baseline survey sheet is checked through baseline survey sheet and found to be correct. The detailed assessment is provided in section D.5.3 of validation report.

	GWP_{CH4}	The Global warming potential of methane (28) is as per the IPCC AR5 report is applicable. Hence, this is appropriate
	$MS\%_{Bl,j}$	This value is based on the baseline survey. The same is verified from the baseline survey sheet and crosschecked during the site visit. As per the baseline survey result, the values are given below: <table><tr><th>Parameter</th><th>dairy cow</th><th>Market Swine</th></tr><tr><td>MS%Bl,,liquid/slurry/Pit-storage</td><td>99.11%</td><td>99.11%</td></tr><tr><td>MS%, Daily Spread</td><td>0.89%</td><td>0.89%</td></tr></table> Hence the value provided by CME is appropriate.
	$VSrate,LT$	This value is based on the IPCC Default Value from table 10.13A of chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2019 IPCC Guidelines for National Greenhouse Gas Inventories. The value considered by PD are: Dairy Cow: 15.2 kg VS / (1000 kg animal mass) / day Market Swine: 8.7 kg VS / (1000 kg animal mass) / day As verified from IPCC, the value is found to be correct.
	$B_{0,L,T}$	This value is based on the IPCC Default Value from table 10.16 of chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2019 IPCC Guidelines for National Greenhouse Gas Inventories. The value considered by PD are: Dairy Cow: 0.13 m3 CH4/kg-dm Market Swine: 0.29 m3 CH4/kg-dm As verified from IPCC, the value is found to be correct.
	$MCFj,k$	This value is based on the IPCC Default Value from table 10.17 of chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2019 IPCC Guidelines for National Greenhouse Gas Inventories. The value considered by PD are: <table><tr><th>Parameter</th><th>dairy_cow</th><th>Market_Swine</th></tr><tr><td>MCF,liquid/slurry/Pit-storage</td><td>62.0%</td><td>62.0%</td></tr><tr><td>MCF,daily spread</td><td>1.0%</td><td>1.0%</td></tr></table> As verified from IPCC, the value is found to be correct.
	$EFb,i,CO2$	The CO2 emission factor of baseline fuel are taken by PD is as per the default value provided by methodology. The value considered are: Wood – 112 tCO_2/TJ Charcoal – 165.22 tCO_2/TJ LPG – 63 tCO_2/TJ As verified from IPCC, the values are found to be correct.
	$EFb,f,nonCO2$	The non-CO_2 emission factor of baseline fuel are taken by PD is as per the default value provided by methodology. The value considered are: Wood – 9.46 tCO2/TJ Charcoal – 44.83 tCO2/TJ LPG – 0.17 tCO2/TJ As verified from IPCC, the values are found to be correct.

	$EFb,i,CO2$	The CO2 emission factor of project fuel are taken by PD is as per the default value provided by methodology. The value considered are: Wood – 112 tCO_2/TJ Charcoal – 165.22 tCO_2/TJ LPG – 63 tCO_2/TJ As verified from IPCC, the values are found to be correct.
	$EFb,f,nonCO2$	The non-CO_2 emission factor of project fuel are taken by PD is as per the default value provided by methodology. The value considered are: Wood – 9.46 tCO2/TJ Charcoal – 44.83 tCO2/TJ LPG – 0.17 tCO2/TJ As verified from IPCC, the values are found to be correct.
	$NCVb,i$	The net calorific value of baseline fuel are taken by PD is as per the default value provided by methodology. The value considered are: Wood – 0.0156 TJ/ton Charcoal – 0.0295 TJ/ton LPG – 0.0473 TJ/ton As verified from IPCC, the values are found to be correct.
	$NCV\mathrm{p},i$	The net calorific value of baseline fuel are taken by PD is as per the default value provided by methodology. The value considered are: Wood – 0.0156 TJ/ton Charcoal – 0.0295 TJ/ton LPG – 0.0473 TJ/ton As verified from IPCC, the values are found to be correct.
	Pb,i,y	Average fuel consumption for an individual baseline technology is determined through Kitchen Performance Test and through baseline survey. The fuel wood consumption and charcoal consumption are determined through KPT. CME selected 48 households randomly for the KPT (in which 39 households uses fuel wood as primary fuel and 9 households use charcoal as primary fuel). The sample size required is calculated as per the 90/30 confidence/precision requirements. As per this, the minimum sample size required is 5. However, CME conducted KPT at 48 households. Hence, the sample size selected is appropriate. The result achieved required precision level. Hence, value determined by CME is found to be appropriate. The LPG consumption is determined through baseline survey. The baseline survey sheet is checked and value is found to be correct.
	$f_{NRB,i,y}$	PD chose to ex-ante option for the fNBR. The assessment on appropriateness of the value (0.8249) is given in section D.5.3 of the VPA validation report.
Findings	No finding	
Conclusion	The values of ex ante fixed parameters have been verified from the VPA-DD. Same has been crosschecked with the source mentioned in the VPA-DD and found to be consistent. The verification team confirms that the values used/applied are correct and justified. Also, the ex-ante values have been correctly applied in the calculation of emission reductions.	

E.6.2. Data and parameters monitored

Means of verification	The verification team has determined whether the approved monitoring plan has been properly implemented and followed by the PP that the monitoring has been carried out in accordance with the approved monitoring plan; and determined whether all parameters including project emission parameters, baseline emission parameters and leakage parameters used for emission reduction calculation stated in the registered monitoring plan are monitored or used appropriately as per the VPA-DD. During the verification all monitoring parameters listed in Section D.2 of MR were compared with section B.7.1 of the validated VPA-DD have been verified with regard to the: (i) appropriateness of the applied measurement / determination method, (ii) the correctness of the values applied for ER calculation, (iii) the accuracy, and applied QA/QC measures. The monitored values are assessed as follows: **Avoidance of double counting or double claiming among project technology end users:** CME signed agreement with all end users confirming that the carbon rights are transferred to CME and there will not be any double counting of the stove with any other project. The end user agreement is checked randomly (2% of total population) and confirmed the signing of end user agreement. Also, during site visit the assessment team checked with end user regarding the awareness of the carbon transfer rights and found that all end users are aware of the same. Also, every biogas units have unique ID number. Also manufacture and implementor are same in this project and hence not other party involved. From verification of the following carbon mechanism registry, it is also confirmed that the project is not registered under any other carbon mechanism: CDM: https://cdm.unfccc.int/Projects/projsearch.html VCS: https://registry.verra.org/ GCC: https://projects.globalcarboncouncil.com/ ICR: https://www.carbonregistry.com/ Cercarbono: https://www.ecoregistry.io/projects Hence, there is no possibility of double counting. Moreover, this shall be monitored whenever project technology is sold or otherwise disseminated. The project is not sold or disseminated since the start date. Further, verification team also confirmed that the project is not double counted by checking the declaration on no double counting/31/ provided by PD. **Regulatory framework for provision of animal waste management and thermal energy services.:** As verified from the online information, it is found that no regulatory framework for provision of animal waste management and thermal energy services are available in Kenya **Up,y:** Weighted average usage rate in project scenario p during year y is determined through annual sample survey. As per the annual sample survey conducted, 100% households uses biogas stoves. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. As per GS standard, PP has followed the below mandatory requirement to determine the usage rate of the biogas units during the monitoring period as per validated PDD, • The stoves used within last 30 days is defined as the devices are in 'Use' and if the stove is not used for last 30 days is considered as 'non-use'. This definition is found to be appropriate. • PP conducted annual household survey on sample basis and the following are considered during survey, Kitchen observation by surveyor, Interviewed the primary cook, Photos of the cooking area is taken, GPS coordinates of the household has been noted down. The survey sheets & photos are checked and found to be appropriate. The usage survey details are cross verified through

	acceptance sample survey during the stie visit and the survey result found to be appropriate. The verification team also conducted interview with monitoring staff and found they are aware of the requirements and monitored appropriately. • Verification checks done randomly by Homebiogas though physical visit & telephone to the sample households confirms recorded responses are correct. This is confirmed through interview with representative of CME, consultant and the implementer organisation. CME also followed the Good Practices: • CME provided detailed training to all its monitoring staffs on the conducting usage survey. This is confirmed through verification of training records. During site visit the HomeBiogas team also confirmed that the random checks were conducted during the survey to confirm the procedure followed by the monitoring staff are correct. • CME provided trainings to all Biogas users on the usage of the biogas stove at the start of the project. This is confirmed during the interview with end users. • PP also conduct awareness campaign to end users regularly to encourage use of biogas stove. The same is confirmed through verification of records of awareness campaign and interview with the end users. Hence, it is confirmed PP followed the mandatory monitoring requirement & good practice requirement as per the section 2.2 & 2.3 of the Usage rate guideline. Also, verification team surveyed 19 households in it randomly and confirmed that the value provided by CME is correct and all the biogas systems are in operating condition. Verification team verified records which reveals that the biogas units are in operating conditions. No error is found in the PP data. Hence the value (100%) considered by PP is found to be correct. However, the PP has considered 90% usage rate as defined in the validated PDD which is conservative and acceptable to the verification team **Annual average number of animals of type LT in year y:** The parameter 'Annual average animal population in a household (number of heads of dairy cow & Swine) " is monitored through annual sample survey by the CME. The monitoring survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. Verification team cross checked the all the samples survey sheet of the CME and found that all the all the values are consistent with ER calculation sheet. Also, verification team surveyed 18 households in it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data. Hence the average value considered by CME (i.e., Dairy Cow – 3.49 Market Swine- 0.294): is found to be correct and acceptable **Fraction of manure handled in project animal manure management system i**: This parameters are monitored through annual monitoring survey during the monitoring period by the CME. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. Verification team cross checked the all the samples survey sheet of the CME and found that all the all the values are consistent with ER calculation sheet. Also, verification team surveyed 18 households in it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data. Based on the monitored values CME has calculated about MSi,y is 81% percentage of dung is fed it to the digester .Hence the value considered by CME are found to be correct and acceptable. **Nb,p,y :** Number of project technology-days included in the project database for each project scenario in year y is determined from the Project database as the sum of the number of project technology units times the calendar days during the year y that they were present at the end user locations. This is calculated annually and hence in line with the monitoring frequency mentioned in PDD. The calculation is checked and

	found to be correct. Hence, the Number of project technology-days considered by PP (ie, 952,474 days) is found to be correct. **LEp,y:** Leakage assessment provided by CME is assessed and found to be acceptable. The assessment is provided within two years form the last assessment and hence in line with the monitoring frequency mentioned in the PDD. The detailed assessment of leakage is provided in section E.8.3 of this report.
Findings	CL-01, CL-03, CAR-01 & CAR-02 are raised and closed satisfactorily
Conclusion	From the above assessment, the verification team able to confirm that the monitoring has been carried out in accordance with the validated VPA-DD /3/. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD/3/. The monitored data for the parameters has been verified by checking the procedure for information flow and found to be complete and consistent.

SDG 1- No Poverty

Means of verification	The parameter of No poverty appropriately able to monitor the following value **Proportion of population living in households with access to basic services: 100%** These values have been accessed from the project database maintained by the CME which is updated at regular interval. The percentage of operating bio digestor in the monitoring period is determined through the monitoring survey conducted by the CME. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. The sampling approach for monitoring survey is explained in Section above and section E.3.4.3 which is appropriate and acceptable to verification team. As per monitoring survey the percentage of operating digestor is found 100%. Verification team checked the installation of bigas digestors through Application forms, commissioning records VER ownership agreements and found that the value applied by the CME is correct Also, verification team surveyed 18 households in it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data
Findings	No finding raised
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

SDG 2- No Hunger

Means of verification	The parameter of no hunger appropriately able to monitor the following value **Number of farmers adopted practices promoted by the project: 3,714** These values have been accessed from the project database maintained by the CME which is updated at regular interval. The total no of household using the digested slurry as fertilizer as per the training provided in the monitoring period is determined through the monitoring survey conducted by the CME. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. The sampling approach for monitoring survey is explained in Section above and section E.3.4.3 which is appropriate and acceptable to verification team. Also, verification team surveyed 18 households in

	it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data.
Findings	No finding raised.
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

SDG 3- Good health and well being

Means of verification	The parameter of Good Health and well-being appropriately able to monitor the following value **Percentage of project population using polluting fuels – 10.78% (76.8% reduction)** The Percentage of project population still using polluting fuels in the monitoring period is determined through the monitoring survey conducted by the CME. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. The sampling approach for monitoring survey is explained in Section above and section E.3.4.3 which is appropriate and acceptable to verification team. As per monitoring survey the 10.78% households still using fuel wood for cooking. Also, verification team surveyed 18 households in it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data.
Findings	No finding raised.
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

SDG 5- Gender equality

Means of verification	The parameter of Gender equality appropriately able to monitor the following value **Average time saving associated with cooking time and fuel collection– 2.93 hours (3.12 hours reduction)** The time associated with fuel wood collection and cooking time in the monitoring period is determined through the monitoring survey conducted by the CME. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. The sampling approach for monitoring survey is explained in Section above and section E.3.4.3 which is appropriate and acceptable to verification team. As per monitoring survey average of 0.01 hours per day spend in fuel wood collection and 2.926 hours spent in cooking. Also, verification team surveyed 18 households in it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data.
Findings	CL-01 is raised and closed satisfactorily
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

SDG 7 - Affordable and Clean energy

Means of verification	The parameter of Affordable and Clean energy appropriately able to monitor the following value **Number of beneficiaries: Households -3,714** These values have been accessed from the project database maintained by the CME which is updated at regular interval. The percentage of operating bio digestor in the monitoring period is determined through the monitoring survey conducted by the CME. The survey was conducted in November 2024, which falls within one year of the previous survey conducted in January and February 2024. Therefore, it complies with the monitoring frequency specified in the PDD. The sampling approach for monitoring survey is explained in Section above and section E.3.4.3 which is appropriate and acceptable to verification team. As per monitoring survey the percentage of operating digestor is found 100%. Verification team checked the installation of bigas digestors through Application forms, commissioning records CER ownership agreements and found that the value applied by the CME is correct Also, verification team surveyed 18 households in it randomly and confirmed that the value provided by CME is correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data
Findings	No finding raised in this context
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

SDG 8 - Decent work and economic growth

Means of verification	The parameter of Decent work and economic growth appropriately able to monitor the following value • Total number of jobs: 64 These values are assessed through employment record maintained by the HomeBiogas and it is updated continuously and hence in line with monitoring frequency mentioned in the PDD. The employment details have been verified from the HR records of the CME and found the values applied by the CME in the current monitoring period is appropriate and acceptable
Findings	CL-01 is raised and closed satisfactorily
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

SDG 15 - Life on Land

Means of verification	The parameter of Life on Lan appropriately able to monitor the following value • Total non-renewable wood fuel saved: 5,849 tonnes The fuel wood saved during the current monitoring period is calculated based on the baseline KPT, project KPT and number of operating days. The project KPT was conducted in December 2024, which falls within two year of the previous survey conducted in March 2024. Therefore, it complies with the monitoring frequency specified in the PDD. The KPT data is verified and found to be correct. Hence, the data provided in the monitoring sheet was accepted. No error is found in the CME's data
Findings	No finding
Conclusion	Verification team confirm that the monitoring has been carried out in accordance with the validated VPA-DD. The monitoring system is in compliance with the information flow for the parameters as mentioned in monitoring plan in validated VPA-DD

E.6.2.1. Implementation of sampling plan

Means of verification	The verification team checked whether the PPs have applied a sampling approach to determine the monitored values. For the parameters determined through sampling, the verification team checked the sampling approach followed for each monitoring parameters to confirm the sampling plan mentioned in the validated VPA-DD and applied methodology. Since the group size is greater than 1000, as per the applied methodology the Minimum sample size required is 100. PD selected 120 HHs for sampling on random basis to ensure representativeness of the project population and an unbiased selection. This is confirmed through the online random selection generator screenshot provided by the client. However, due to the unavailability of some of the households during survey, PD conducted survey only 102 households. Hence, PP has selected sample size of above 100, i.e. 102 and all the survey results achieve the minimum precision level of 10%. Hence, the sample size considered for all the parameters are found to be acceptable. However few CARs and CL has been raised for clarity in the sample size and data collected. After careful examination of the survey data, verification team find the sampling plan was implemented in satisfactory way.
Findings	No finding
Conclusion	Verification team concludes the following: • The sample size considered for all the parameters (which are monitored through sampling basis) are found to be appropriate • The precision level achieved from the monitored data also confirms that the sample size considered for the monitoring is sufficient. • For usage rate, PP's sample population was selected in all the ages as per the requirement of the methodology. • The sampling plan is implemented correctly in accordance with the validated VPA-DD and the applied methodology.

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

Means of verification	Not applicable as no monitoring equipment involved.
Findings	NA
Conclusion	NA

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

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

Means of verification	The verification team has checked whether calculations of baseline GHG emissions calculation have been carried out in accordance with the formulae and methods described in the registered monitoring plan. In detail the following has been verified: Transparency: It has been checked whether the calculation of baseline emissions is fully traceable and, where used, the Excel calculation provides all calculation formulae. Parameter consistency: It has been checked whether all internal and external parameters and data used for the calculation are applied consistently in the monitoring report and the calculation spreadsheet. Correctness: It has been checked whether the applied formulae and methods for calculating baseline emissions are in accordance with the monitoring plan and the approved methodology.

Completeness: It has been checked whether all calculations are complete and without omissions

For the SDG 13, the emission reduction calculations were carried out as per the applied GS methodology.
The baseline emission involves carbon emission from

1. Fuel used for cooking among the target population

2. Animal waste management practiced in the target population

In order to determine total baseline emissions, the emissions per household are calculated as follows:

$$BE_{b,y} = BE_{ta} + BE_{awms}$$

Where:
$BE_{b,y}$ = Total Baseline emissions for baseline scenario b in year y (tCO_2e/yr)
$BETA,y$ = Baseline emissions from fuel consumption for cooking and water heating (tCO_2e/yr)
$BE_{AWMS,y}$ = Baseline emissions from animal waste handling (tCO_2e/yr)

I. **Baseline emissions from fuel consumption for cooking and heating water are calculated as follows:**

The Baseline emission from thermal application in year y shall be calculated as per the methods outlined in paragraph 3.5.12 of the methodology. As per the Thermal application method 1, based on avoided quantity of fuel consumption

$$BETA,y = \Sigma\, b,p\ (Nb,p,y \times Up,y \times (fNRB,i,y \times SEb,y,CO2 + SEb,y,non{-}CO2))$$

Where:

$BE_{TA,y}$	Baseline emissions for total project activity in year y ($tCO_2e.yr$)
$\Sigma b,p$	Sum over all relevant baseline b/project p pairs
$N_{b,p,y}$	Number of project technology-days included in the project data base for each project scenario in year y. The start date is the day a plant starts producing biogas. A default of 2 weeks may be used for the period from installation date and start date.
$U_{p,y}$	Usage rate for technologies in project scenario pin year y (fraction)
$SE_{b,y,CO2}$	Specific CO2 emission for a baseline b technology in year y (tCO2/technology*day)
$SE_{b,y,non\text{-}CO2}$	Specific non-CO2 emissions for a baseline b technology in year y (tCO2/technology*day)
$f_{NRB,I,y}$	Fraction of biomass used in year y for baseline scenario b that can be established as non-renewable biomass (fraction).

$$SE_{b,y,Co2} = \Sigma\, P_{b,i,y} \times NCV_{b,i,fuel} \times EF_{b,i,CO2}$$

$$SE_{b,y,non-Co2} = \Sigma\, P_{b,i,y} \times NCV_{b,fuel} \times EF_{b,i,non-CO2}$$

Where,

i	Index for the type of baseline/fossil fuel consumed
$P_{b,i,y}$	Average yearly consumption of baseline fuel i per househ project activity or at the renewal of each crediting pe (tonnes/household/day)
$NCV_{b,i}$	Net calorific value of the fuels i that is substituted in basel

$EF_{b,i,CO2}$	CO2 emission factor arising from use of fuels i in baseline scenario (t
$EF_{b,i,non-CO2}$	Non-CO2 emission factor arising from use of fuels in baseline scenar

Pb,i,y may be determined via KPT survey or using number of persons served per household multiplied by default fuel consumption (if the baseline stoves are the conventional types) per person per year (parameter BGTA 20) in baseline scenario.

Baseline emission from thermal application

Parameter	Unit	Firewood	Charcoal	LPG	Source
Pb,y	Tonnes/day	0.0085	0.0024	0.0000548	Baseline survey
NCVb,fuel	TJ/tonne	0.0156	0.0295	0.0473	IPCC
EFb,f,CO2	tCO2/TJ	112	165.22	63	IPCC-VOL-1-CH-1
EFb,f,non-CO2	tCO2/TJ	9.46	44.83	0.17	IPCC-VOL-1-CH-2
Np,y	day	1	1	1	Assumption
Up,y	Percentage	90%	90%	90%	Assumption
f NRB,, y	-	0.8249	0.8249		CALCULATED
$SEb,y,CO2$	tCO2/technology*day	0.015	0.012	0.000	Calculated as per IPCC default value
$SEb,y,nonCO2$	tCO2/technology*day	0.001	0.003	0.000	Calculated as per IPCC default value
BEb,y	**tCO2e/day**	**0.015**	**0.012**	**0.000**	
Ratio		**84.4%**	**3.1%**		
BEb,y (Total)	**tCO2e/day**	**0.011**			Calculated

I. Baseline emissions from Animal waste management systems

The baseline emissions, from animal waste handling have been estimated using the IPCC TIER 2 approach which requires information about the characteristics of the manure and its management systems in the baseline. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (Bo). The formulae are:

$$BE_{AWMS,y} = N_{b,p,y} \div 365 \times GWP_{CH4} \times D_{CH4} \times UF_b \times U_{p,y} \times \sum_k \sum_{j,LT} N_{LT,y} \times$$

$$\times VS_{LT,y} \times MCF_{j,k} \times MS\%_{Bl,j}$$

Where:

$BE_{AWMS,y}$	Baseline emissions in year y tCO_2e
$N_{b,p,y}$	Number of project technology-days included in the project databa scenario in year y.
U_{Fb}	Model correction factor to account for model uncertainties (0.94)[2]
$U_{p,y}$	Usage rate for technologies in project scenario pin year y (fract emission calculation at Design Certification, the ex-ante Up,y sha
GWP_{CH4}	Global Warming Potential (GWP) of CH4 applicable to the creditir

2

Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

D_{CH4}	CH4 density (0.00067 t/m3 at room temperature (20 deg celcius) and pressure)
LT	Index for all types of livestock
j	Index for animal manure management system
k	Climate region k
$Bo,_{LT}$	Maximum methane production potential of the volatile solid generated for type LT (m3 CH4/kg-dm).
$MCF_{j,k}$	Annual methane conversion factor (MCF) for the baseline animal management system j by climate region k. (%)
$N_{LT,y}$	Annual average number of animals of type LT in year y (numbers)
$VS_{LT,y}$	Volatile solids production/excretion per animal of livestock LT in year y (on mater weight basis, kg-dm/animal/year)
$MS\%_{BI,j}$	Fraction of manure handled in baseline animal manure management system

Baseline emission from manure management system

Parameter	Unit	dairy_cow	Market_ Swine	Source
Nb,p,y	day	1	1	Assumptions
UFb	%	0.94	0.94	Methodology
Up,y	%	90%	90%	Assumptions
GWPCH4	tCO2e/tCH4	28	28	https://www.goldstandard.org/project-developers/standard-documents
DCH4	t/m3	0.00067	0.00067	Methodology
BO,LT	m3 CH4/kg-dm	0.13	0.29	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1 (Table 10.16A)
$MCF_{BL,liquid/slurry/Pit-storage}$	%	62%	62%	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1 (Table 10.17)
$MCF_{BL,Daily Sprad}$	%	62%	62%	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1 (Table 10.17)
$MS_{(T,k),}$ liquid/slurry/Pit-storage	%	1%	1%	Baseline Survey
$MS_{(T,k),}$ Daily Spread	%	99.11%	99.11%	Baseline survey
$N_{LT,y}$	Nos	0.89%	0.89%	Baseline Survey
$VSrate,_{LT\ KG\ VS}$	KG VS (1000 KG ANIMAL MASS)-1 DAY-1	3.490	0.294	https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4
TAMLT (kg)	kg	15.2000	8.7000	
ndy (year)	days	260	49	Assumption
$VS_{LT,y}$	kg-dm/animal/day	1	1	Calculated
$BE_{AWMS,y}$	tCO2e/yr	3.952	0.4263	
Total	tCO2e/yr	0.01784		Calculated

	From the above equations, PP has estimated the baseline emission per household per year. Based on the actual number of functioning days, the total baseline emission has been calculated. PP has submitted the calculation in the excel sheet. The baseline calculation in the excel sheet is checked whether the calculation is in accordance with the formula given in the validated VPA-DD.
Findings	No finding
Conclusion	The verification team confirms the following: • The calculations of baseline emission have been carried out in accordance with the equations and methods described in the registered monitoring plan and applied methodology. • The emission factor applied is an ex-ante value valid for the fixed crediting period. • Any assumptions used in emission or removal calculations have been justified. • Appropriate emission factor and other reference values have been correctly applied. It can be confirmed that the baseline calculation is overall correct. • The ER calculation sheet provided is clear, transparent and the calculations provided in the sheet are reproducible. Hence, the total baseline reduction reported in the monitoring report for the monitoring period is verified to be correct and the summary is given below: **Vintage** | **BE (tCO2)** 01/01/2024 - 30/11/2024 | 27,219

For other SDGs of the project activity

Means of verification	The baseline scenario of the different SDG indictor as follows Item

Items	Baseline estimate	Assessment
SDG1- No Poverty	0%	The SDG indicator monitored is: • Proportion of population living in households with access to basic services. In the absence of the project activity there was no installation was present. Hence, the value is acceptable
SDG 2- No Hunger	0	The SDG indicator monitored is: • Number of farmers adopted practices promoted by the project In the absence of the project activity there was no biogas installation was present. Hence no households would have access to biogas slurry for land application. Hence the value considered is acceptable
SDG -3 Good health and well being	87.6%	The SDG indicator monitored is: • Percentage of project population using polluting fuels As verified from baseline survey about 87.6% households use polluting solid fuels such as fuel wood and Charcoal. Other people used the LPG which is a

			clean fuel. Hence the value considered is appropriate.
	SDG 5 – Gender equality	6.05 hours	The SDG indicator monitored is: • Average time saving associated with cooking time and fuel collection As verified from baseline survey about 6.05 hours spent by households in collection of fuel wood and cooking. Hence the value considered is acceptable
	SDG-7 Affordable and Clean energy	Zero	The SDG indicator monitored is: • Number of beneficiaries: Households As verified from baseline survey no households have the biogas disasters. Hence the value considered is acceptable.
	SDG- 8 Decent work and economic growth	Zero	The SDG indicator monitored is: • Total Number of Jobs In the baseline scenario, no jobs would have been generated. Hence the value considered is acceptable.
	SDG -15 Life on Land	0	This SDG indicator monitored is • Total non-renewable wood fuel saved As per baseline KPT, about 2.98 t fuel wood is consumed in which 92.92% is NRB. No NRB saving in baseline. Hence, the value considered is appropriate
Findings	No finding raised in this context		
Conclusion	The parameter is monitored appropriately, in accordance with the registered monitoring plan. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. All the monitored parameter values reported in the MR are found to be correct. Hence, the baseline SDG parameters reported in the monitoring report for the monitoring period is verified and found to be correct		

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

Means of verification	The verification team has checked whether calculations of baseline GHG emissions calculation have been carried out in accordance with the formulae and methods described in the registered monitoring plan. In detail the following has been verified: Transparency: It has been checked whether the calculation of baseline emissions is fully traceable and, where used, the Excel calculation provides all calculation formulae. Parameter consistency: It has been checked whether all internal and external parameters and data used for the calculation are applied consistently in the monitoring report and the calculation spreadsheet.

Correctness: It has been checked whether the applied formulae and methods for calculating baseline emissions are in accordance with the monitoring plan and the approved methodology.

Completeness: It has been checked whether all calculations are complete and without omissions

The Project emission from thermal application in year y shall be calculated as follows:

$PEy = \Sigma\ (\ b,p\ Nb,p,y \times Up,y \times (fNRB,i,y \times SEp,y,CO2 + SEp,y,non{-}CO2)$

Ey	Project emissions for total project activity in year y (tCO2e/yr)
$\Sigma b,p$	Sum over all relevant baseline b/project p pairs
Nb,p,y	Number of project technology-days included in the project database for each project scenario in year y
Up,y	Usage rate for technologies in project scenario p in year y (fraction)
$SEp,y,CO2$	Specific CO2 emissions for a project p technology in year y (tCO2/technology*day)
$SEp,y,non{-}CO2$	Specific non-CO2 emissions for a project p technology in year y (tCO2e/technology*day)
$fNRB,i,y$	Fraction of biomass used in year y for project scenario p that can be established as non-renewable biomass (fraction). The parameter $fNRB,p,y$ is excluded from the when the observed project additional fuel is fossil fuel.

$SEp,y,Co2 = \Sigma\ Pp,i,y \times NCVp,i,fuel \times EFp,i,fuel,CO2\ i$

$SEp,y,non{-}Co2 = \Sigma\ Pp,i,y \times NCVp,fuel \times EFp,i,fuel,non{-}CO2$

i	Index for the type of project/fossil fuel consumed
Pp,i,y	Average daily consumption of project fuel i per household (tonnes/household/day)
$NCVp,i,fuel$	Net calorific value of the fuel(s) i that is used in project p (TJ/tonne)
$EFp,i,fuel,CO2$	CO2 emission factor arising from use of fuels i in project scenario (tCO2/TJ)
$EFp,i,fuel,non{-}CO2$	Non-CO2 emission factor arising from use of fuels in baseline scenario (tCO2e/TJ)

Project emission from thermal application

Parameter	Unit	Firewood	Charcoal	LPG	Source
Pp,i,y	Tonnes/day	0.000187	0.000010	0.000000	Monitoring Survey & Project KPT
$NCVp,i,fuel$	TJ/tonne	0.0156	0.0295	0.0473	IPCC
$EFp,i,fuel,CO2$	tCO2/TJ	112	165.2200	63	IPCC
$EFp,i,fuel,non{-}CO2$	tCO2/TJ	9.4600	44.8300	0.1665	
Nb,p,y	day	1	1	1	Assumption
Up,y	Percentage	90%	90%	90%	Assumption
f NRB,, y	-	0.8249	0.8249		CALCULATED
$SEp,y,CO2$	tCO2/technology*day	0.0005	0.0000	0.0000	Calculated as per IPCC default value
$SEp,y,nonCO2$	tCO2/technology*day	0.0000	0.0000	0.0000	Calculated as per IPCC default value
PEy	**tCO2e/day**	**0.0003**	**0.0000**	**0.0000**	

PEy **(Total)**	**tCO2e/day**	**0.0003**	

Project Emissions from Animal Manure Management

The project emissions involve emissions from the bio-digester, which include physical leakage and incomplete combustion of biogas, as well as emissions from the animal waste not treated in the bio-digester are calculated as per the following equation:

$$PEAWMSy = PEPL,y + PEpower,y + PEtransp,y + PEstorage,y$$

$PEAWMS,y$	Project emissions in year y (t CO2e)
$PEPL,y$	Emissions due to physical leakage of biogas in year y (t CO2e)
$PEpower,y$	Emissions from the use of fossil fuel or electricity for the operatio of the installed facilities in the year y (t CO2e)
$PEtransp,y$	Emissions from incremental transportation of input manure for th digesters in the year y (t CO2e)
$PEstorage, y$	Emissions from the storage of manure (t CO2e)

Project emission from physical leakage has been calculated as below:

$$PE_{PL,y} = 0.10 \times N_{b,p,y} \div 365 \times U_{p,y} \times GWP_{CH4} \times D_{CH4} \times \sum_{k} \sum_{i\,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y}$$

PE , = Project emissions from physical leakage in year y (t CO2e) G

WP = Global Warming Potential (GWP) of CH4 applicable to the crediting period.

D = CH4 density (0.00067 t/m3 at room temperature (20 ºC) and 1 atm pressure) L

T = Index for all types of livestock

i = Index for animal manure management system

k = Climate region k

B, = Maximum methane producing potential of the volatile solid generated for animal type LT.

$MS\%$, = Fraction of manure handled in project animal manure management system i

Since,

$PE_{power,y}$= 0 tCO_2e/year (no electricity is required to operate the digester)

$PE_{transp,y}$ = 0 tCO_2e/year (no transportation is involved)

$PE_{storage,y}$ = 0 tCO_2e/year (no storage is involved)

Hence,

$PEAWMSy$ = PE_{PLy}

Project emission physical leakage				
Parameter	**Unit**	**dairy_cow**	**Market Swine**	**Source**
Nb,p,y	day	1	1	Assumption
Up,y	%	90%	90%	As per the usage survey guidance
GWPCH4	tCO2e/tCH4	28	28	https://www.goldstandard.org/project-developers/standard-documents
DCH4	t/m3	0.00067	0.00067	Methodology
BoLT,y	m3 CH4/kg VS	0.1300	0.2900	IPCC
NLT,y	Nos	3.4902	0.2941	Monitoring Survey

VSLT,y	kg dry matter/head/ year	3.9520	0.4263	https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/ 4_Volume4/19R_V4_Ch10_Livestock.pdf
MS%,i,y	%	81%	81%	Monitoring Survey
PEawms ,h	tCO2e/day	0.0024	0.000	Calculated
PEawms ,h (total)	tCO2e/day	0.0025		Calculated

In addition, the project emission form amount of dung that is not treated in the biogas unit are are calculated using the baseline emission calculation formula:

$$BE_{AWMS,y} = N_{b,p,y} \div 365 \times GWP_{CH4} \times D_{CH4} \times UF_b \times U_{p,y} \times \sum_{k} \sum_{j,LT} N_{LT,y} \times$$

$$\times VS_{LT,y} \times MCF_{j,k} \times MS\%_{Bl,j}$$

Where

MS%Bl,j is the percentage of still treated in the baseline treatment method.

1. The Project emission from thermal application in year y shall be calculated as follows:

PEy = Σ (b,p Nb,p,y × Up,y × ($fNRB,i,y$ × $SEp,y,CO2$ + $SEp,y,non-CO2$)

Ey	Project emissions for total project activity in year y (tCO2e/yr)
Σb,p	Sum over all relevant baseline b/project p pairs
Nb,p,y	Number of project technology-days included in the project database for each project scenario in year y
Up,y	Usage rate for technologies in project scenario p in year y (fraction)
$SEp,y,CO2$	Specific CO2 emissions for a project p technology in year y (tCO2/technology*day)
$SEp,y,non-CO2$	Specific non-CO2 emissions for a project p technology in year y (tCO2e/technology*day)
$fNRB,i,y$	Fraction of biomass used in year y for project scenario p that can be established as non-renewable biomass (fraction). The parameter $fNRB,p,y$ is excluded from the when the observed project additional fuel is fossil fuel.

$$SEp,y,Co2 = \Sigma\ Pp,i,y \times NCVp,i,fuel \times EFp,i,fuel,CO2\ i$$
$$SEp,y,non-Co2 = \Sigma\ Pp,i,y \times NCVp,fuel \times EFp,i,fuel,non-CO2$$

i	Index for the type of project/fossil fuel consumed
Pp,i,y	Average daily consumption of project fuel i per household (tonnes/household/day)
$NCVp,i,fuel$	Net calorific value of the fuel(s) i that is used in project p (TJ/tonne)
$EFp,i,fuel,CO2$	CO2 emission factor arising from use of fuels i in project scenario (tCO2/TJ)
$EFp,i,fuel,non-CO2$	Non-CO2 emission factor arising from use of fuels in baseline scenario (tCO2e/TJ)

Project emission from manure management system

Parameter	Unit	dairy_cow	Market_Swine	Source
Nb,p,y	day	1	1	Assumptions
UFb	%	0.94	0.94	Methodology
Up,y	%	90%	90%	Assumptions
GWPCH4	tCO2e/tCH4	28	28	GS

	DCH4	t/m3	0.00067	0.00067	Methodology
	BO,LT	m3 CH4/kg-dm	0.13	0.29	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1 (Table 10.16A)
	$MCF_{BL,liquid/slurry/Pit-storage}$	%	62%	62%	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1 (Table 10.17)
	$MCF_{BL,Daily Sprad}$	%	1%	1%	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1 (Table 10.17)
	$MS_{(T,k),liquid/slurry/Pit-storage}$	%	19.23%	19.23%	Baseline Survey
	$MS_{(T,k),Daily Spread}$	%	0.17%	0.17%	Baseline survey
	NLT,y	Nos	3.490	0.294	Baseline Survey
	$VSrate_{,LT\ KG\ VS}$	KG VS (1000 KG ANIMAL MASS)-1 DAY-1	15.2000	8.7000	https://www.ipcc-nggip.iges.or.jp/public/2019
	TAMLT (kg)	kg	260	49	
	ndy (year)	days	1	1	Assumption
	$\mathbf{VS}_{LT,y}$	kg-dm/animal/day	3.952	0.4263	Calculated
	$\mathbf{PE}_{AWMS,y}$	tCO2e/yr	0.00339	0.00007	
	Total	tCO2e/yr	0.00346		Calculated

From the above equations, PP has estimated the project emission per household per year. Based on the actual number of functioning days, the total project emission has been calculated.

PP has submitted the calculation in the excel sheet. The project calculation in the excel sheet is checked whether the calculation is in accordance with the formula given in the validated VPA-DD.

Findings	No findings
Conclusion	The verification team confirms the following: • The calculations of baseline emission have been carried out in accordance with the equations and methods described in the registered monitoring plan and applied methodology. • The emission factor applied is an ex-ante value valid for the fixed crediting period. • Any assumptions used in emission or removal calculations have been justified. • Appropriate emission factor and other reference values have been correctly applied. It can be confirmed that the baseline calculation is overall correct. • The ER calculation sheet provided is clear, transparent and the calculations provided in the sheet are reproducible. Hence, the total baseline reduction reported in the monitoring report for the monitoring period is verified to be correct and the summary is given below:

Vintage	PE (tCO2)
01/01/2024 - 30/11/2024	5,968

Other SDG parameters

Means of verification

The project scenario of the different SDG indictor as follows

Item

Items	Project estimate	Assessment
SDG1- No Poverty	100%	The SDG indicator monitored is: • Proportion of population living in households with access to basic services. As verified from monitoring survey results all 100% project households have the access to the biogas units. This is also confirmed through acceptance sample sampling. Hence, the value is acceptable
SDG 2- No Hunger	3,714	The SDG indicator monitored is: • Number of farmers adopted practices promoted by the project As verified from monitoring survey results all 100% project households confirmed using the digested slurry for agriculture purpose as fertilizer as trained by the CME. This is also confirmed through acceptance sample sampling. Hence, the value is acceptable
SDG -3 Good health and well being	10.78% (76.8% reduction)	The SDG indicator monitored is: • Percentage of project population using polluting fuels As verified from project survey about 10.78% households still use polluting solid fuels such as fuel wood and Charcoal which is a reduction of 76.8% from baseline. This is also confirmed through acceptance sample sampling. Hence, the value is acceptable
SDG 5 – Gender equality	2.93 hours (3.12 hours reduction from baseline)	The SDG indicator monitored is: • Average time saving associated with cooking time and fuel collection As verified from monitoring survey about 2.93 hours spent by households in collection of fuel wood and cooking which is reduction of 3.12 hours from baseline scenario. This is also confirmed through acceptance sample sampling. Hence the value considered is acceptable.
SDG-7 Affordable and Clean energy	3,714	The SDG indicator monitored is: • Number of beneficiaries: Households This is verified form the project database and found to be correct. Hence the value considered is acceptable.
SDG- 8 Decent work and economic growth	64	The SDG indicator monitored is: • Total Number of Jobs This is verified from the CME's employment record. Hence the value considered is acceptable.
SDG -15	5,849 tonne	This SDG indicator monitored is

	Life on Land		• Total non-renewable wood fuel saved As per verified from baseline KPT results, project KPT result, the number of operational days and fNRB, about 5,849 t of NRB is saved during the monitoring period. The calculation is verified and found to be correct. Hence, the value considered is appropriate
Findings	No finding raised in this context		
Conclusion	The parameter is monitored appropriately, in accordance with the registered monitoring plan. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. All the monitored parameter values reported in the MR are found to be correct. Hence, the baseline SDG parameters reported in the monitoring report for the monitoring period is verified and found to be correct		

E.8.3. Calculation of leakage GHG emissions

Means of verification

The following potential sources of leakage were identified in the validated VPA-DD and as per applied methodology,

Leakage Source	Assessment
(a) The displaced baseline technologies are reused outside the project boundary in place of lower emitting technology or in a manner suggesting more usage than would have occurred in the absence of the project.	The baseline cookstove (traditional stove) do not have any economic value as these can be made easily with local materials. Hence, shifting the baseline stoves outside the project boundary is unlikely. Hence, considering this leakage as zero is appropriate.
(b) Non-project users who previously used lower emitting energy sources use the non-renewable biomass or fossil fuels saved under the project activity.	As per baseline survey, target population are highly dependent on non-renewable biomass or fossil fuels for cooking. Moreover, the lower emitting technology (such as LPG) is considered as high lifestyle standard. Hence, people who used lower emitting technology in the baseline is unlikely shift to non-renewable biomass or fossil fuel saved under this project. Hence, considering this leakage as zero is found to be appropriate.
(c) The project significantly impacts the NRB fraction within an area where other CDM or VER project activities account for NRB fraction in their baseline scenario.	As checked from GS database, there are 122 GS projects registered in Kenya. Considering the fuel wood saving from this project activity, the impact over fNRB is negligible. e. Hence considering this leakage as zero is appropriate.
(d) The project population compensates for loss of the space heating effect of inefficient technology by adopting some other form of heating or by retaining some use of inefficient technology.	The target population does not use space heating. Hence, this leakage is zero.

	(e) By virtue of promotion and marketing of a new technology with high efficiency, the project stimulates substitution within households who commonly used a technology with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.	The biogas technology leads to lower emissions compared to the fuels in the baseline scenario. Hence, considering this leakage as zero is appropriate.	
Findings	No findings		
Conclusion	The leakage emission is considered as zero.		

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

Means of verification

The Emission reduction of biogas units is directly calculated and the same is reported under baseline emission.

ERy=BEy- PEy **-** PLy

Where

ERy Emission reduction for total project activity in year y (tCO_2e/yr)

BE_y Baseline emissions for baseline scenario b in year y tCO_2e/yr)

PEy Project emissions in year y (t CO_2e/yr)

	Thermal Application (tCO2/hh/ day)	Manure Management (tCO2/hh/day)	Total (tCO2/hh/day)	Total For the monitoring period
BEy	0.0107	0.0178	0.0286	27,219
PEy	0.0003	0.0060	0.0063	5,968
LEy	0.0000	0.0000	0.0000	0
ERy	0.0104	0.0119	0.0223	21,251

Total Number of Biodigesters Installed	3,714
Total Number of biogas days	952,474
Usage rate as per sample survey	100.00%
Usage rate considered for ER calculation	90.0%

PP has submitted the calculation in the excel sheet/2/. The emission reduction calculation in the excel sheet is checked whether the calculation is in accordance with the formula given in the validated VPA-DD /3/

From the calculated emission reduction calculated as per above formula, the emission reduction for the monitoring period is estimated.

PP has submitted the calculation in the excel sheet/2/. The emission reduction calculation in the excel sheet is checked whether the calculation is in accordance with the formula given in the validated VPA-DD /3/.

Findings	No finding
Conclusion	The verification team confirms the following: • The calculations of emission reduction have been carried out in accordance with the equations and methods described in the registered monitoring plan and applied methodology. • The emission factor applied is an ex-ante value valid for the fixed crediting period.

	• Any assumptions used in emission or removal calculations have been justified. • Appropriate emission factor and other reference values have been correctly applied. It can be confirmed that the baseline calculation is overall correct. • The ER calculation sheet provided is clear, transparent and the calculations provided in the sheet are reproducible. • Hence, the emission reduction reported in the monitoring report for the monitoring period) is verified to be correct • The summery of baseline emission are as below: **Vintage** | **ER* (tCO_2)** 01/01/2024 - 30/11/2024 | 21,251 *rounded down values

For Other SDGs of the project activity:

Means of verification	The net benefit of the different SDG indictor as follows,

Items	Net Benefit	Assessment
SDG 1- No Poverty	100% households having basic access	The net value is calculated from the baseline estimate and project estimate which is correct. The assessment of appropriateness of the values are provided in Section E.3.6.1 & E.3.6.2.
SDG 2 – No Hunger	3,714 Number of households adopted practices promoted by the project	
SDG -3 Good health and well being	10.78% project population using polluting fuels (76.8% reduction from baseline) 10.78% (76.8% reduction)	
SDG 5 – Gender Equality	3.12 hours saving associated with cooking time and fuel collection	
SDG-7 Affordable and Clean energy	3,714 Number of household installed with biodigester	
SDG- 8 Decent work and economic growth	64 jobs created	
SDG -15 Life on Land	5,849 t non-renewable wood saved during the monitoring period	

Findings	No finding
Conclusion	The estimated SDG outcomes as per validated VPA-DD and the actual values achieved for the monitoring period are correctly reported in the section E.4 of MR and found correct.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in VPA-DD

Means of verification	The verification team has checked whether the MR includes a comparison of actual values of the monitoring period with the estimations in the validated VPA-DD.

	Section E.5 of the MR includes a comparison of the calculated actual emission reductions with the ex-ante calculated values in the validated VPA-DD. Emission reduction estimated as per the validated VPA-DD: 124,535 t CO_2e (Estimated based on average emission reduction provided in validated VPA-DD and the number of days in the monitoring period in the respective year) Actual emission reduction achieved as per Monitoring report: 21,251 t CO_2e Hence, the actual emission reduction achieved during the monitoring period is 88% less than the estimation in the validated VPA-DD.
Findings	No findings
Conclusion	The estimated emission reduction as per validated VPA-DD and the actual emission reduction achieved for the monitoring period are correctly reported in the section E.5 of MR. The actual achieved emission reduction is 83% less than the validated VPA-DD estimation. Hence no justification is required.

E.8.6. Remarks on difference from estimated value in VPA-DD

Means of verification	The verification team has determined the VER achieved during this monitoring period with the estimated value and reason for increase if any.
Findings	No findings
Conclusion	The actual achieved emission reduction is 88% less than the validated VPA-DD estimation due to the number of digesters installed are much lesser than the estimated value. Hence no justification is required.

E.9. Stakeholder Inputs & Legal Dispute

Means of verification	All the inputs from stakeholders are related to repair and maintenance of home biogas. As verified from the complaint register, about 383 repair & maintenance requests received from project households. Most of the requests are related to filter issues, blockages in the pipe and burner issues. PP attended all the cases and resolved the same. There were no grievances with regard to project implementation received during the current or previous monitoring period. Verification team checked the complaints register and confirmed that all the cases are resolved by repairing stove and component. Verification team checked with HomeBiogas Kenya team whether any legal consent or dispute arise during the monitoring period and PPs also confirmed that there are such no legal contests or dispute that has arisen with the project during the monitoring period. Verification team also interviewed stakeholders and independently checked though google to check any legal dispute ongoing with PP and found no such legal dispute is pending.
Findings	CAR-02 is raised and closed satisfactorily
Conclusion	The verification team confirms the following: • The only grievances received from biogas are related to repairs & maintenance of stoves. All the cases received during the monitoring period are attended and resolved during the monitoring period itself. • No other grievances received during the current or previous monitoring period • No legal consent or dispute arise during the monitoring period.

SECTION F. Internal quality control

The verification report prepared by team leader is reviewed by an independent technical reviewer (having competence of relevant technical area himself/herself or through an independent technical area expert) to

confirm the internal procedures established by 4KES are duly followed and the verification report/opinion is reached in an objective manner and complies with the applicable Gold Standard & CDM requirements.

The technical review team is collectively required to possess the technical expertise of all the technical area/sectoral scope the project activity relates to. All team members of technical review team are independent of the verification team. The independent technical reviewer(s) may approve or reject the draft verification report. The findings may be identified even at this stage, which needs to be satisfactorily resolved, before submit final report to Client/Gold Standard. The final approval decision is taken by the Head of DOE/Director.

The final decision is authorized by the Approver, 4KES, once the report is finalized by the Head of DOE/DOE Manager.

SECTION G. Verification opinion

The verification team confirms that the the evidence is of sufficient quantity, appropriate quality and reliable. The reported values, notation, units and sources in the monitoring report for all the monitoring parameters have been cross checked with the emission reduction sheet and monitoring report. During the course of verification, the data submitted by PP was cross verified with the values mentioned in the emission reduction sheet/2/ and monitoring report/1/. The procedure for data monitoring, recording, transfer and compilation was also verified and found in compliance with the monitoring plan as mentioned in the approved revised validated VPA-DD/3/.

Evidences (Documents/interview/on-site audit) referred for verification of individual monitoring parameter and fixed parameters are defined in section E.6 above. It is confirmed by the assessment team that the reported emission reductions have been conservatively calculated. A list of referred documents for verification is also included in Appendix 3 of this report.

Based on the information seen and evaluated we confirm that the implementation of the project has resulted in 21,251 tCO_2e emission reductions during period 01/01/2024 - 30/11/2024

SECTION H. Certification statement

4K Earth Science Private Limited has been contracted by 'HomeBiogas Ltd' to undertake independent verification and certification for the greenhouse gas (GHG) emission reductions reported and the contribution to sustainable development indicators from the GS Project activity "HomeBiogas Programme in Kenya – VPA1", (GS ID 12064) for the monitoring period 01/01/2024 - 30/11/2024. (including both dates) in the Monitoring Report Version 01.

The verification is based on the validated VPA-DD and the monitoring report for this project. Our verification approach was based on the requirements as defined under the Gold Standard requiments

The management of the 'Homebiogas Ltd' are responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions &monitoring of SDG parameters on the basis set out within the project Final Monitoring Report. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of the 'HomeBiogas Ltd'. The development and maintenance of records and reporting procedures are in accordance with the Monitoring Report Version 03.

In our opinion the GHG emissions reductions reported for the project activity are fairly stated in the Monitoring Report (final) Version 3. 4KES based on outcome of verification activities, certifies in writing that, during the monitoring period 01/01/2024 - 30/11/2024. (including both days), the registered GS VPA "HomeBiogas Programme in Kenya – VPA1" in the registered GS PA achieved the verified amount of 21,251 tCO_2e reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the project.

The Verified and certified emission reduction during the monitoring period 01/01/2024 - 30/11/2024 (including both dates) is stated below:

Vintage	Duration	Gold Standard Voluntary emission reductions (tCO_2e)

2024	01/01/2024 - 30/11/2024	21,251

Appendix 1. Abbreviations

Abbreviations	Full texts
4KES	4K Earth Science Pvt. Ltd
BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CH4	Methane
CL	Clarification Request
CO2e	Carbon dioxide equivalent
DOE	Designated Operating Entity
EF	Emission Factor
ERs	Emission Reductions
FAR	Forward Action Request
FT	Field Test
GHGs	Greenhouse Gas(es)
GS	Gold Standard
GWP	Global Warming Potential
HH	Household
ISO	International Organization of Standardization
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
KPT	Kitchen Performance Test
LE	Leakage Emissions
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
MP	Monitoring Plan
MR	Monitoring Report
NCV	Net Calorific Value
NGO	Non-Governmental Organisation
NRB	Non-Renewable Biomass
PE	Project Emissions
PDD	Project Design Document
PS	Project Standard
PCIA	Partnership for Clean Indoor Air
PCP	Project Cycle Procedure
SD	Sustainable Development
SDG	Sustainable Development Goal
SHG	Self Help Group
QA/QC	Quality Assurance/Quality Control
UNFCCC	United Nations Framework Convention on Climate Change
VER	Verified Emission Reduction
VVB	Validation and Verification Body
VVS	Validation & Verification Standard

Appendix 2. Competence of team members and technical reviewers

Certificate of Competence							
Name	☐ Mr. ☒ Ms.	**Swati S Acharya**					
Qualification Procedure		*Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GCC/GHG Projects.*					
Appointed to work as:							
		Validator/ Verifier	**Team Leader**	**Trainee**	**Technical Expert**	**Technical Reviewer**	**Financial Expert**	**Approver**
Appointed		Yes	Yes	No	Yes	No	No	No
Appointed Date		05-12-2023						
Authorized to work as Technical Expert for:								
Authorized Technical Area		**Sectoral Scope**		**TA Code**		**Technical Area within the scope**		
		Energy industries (renewable - / non-renewable sources)		1.2		Renewables		
		Transportation		7.1		Transport		
Authorized to work as Local Expert for:								
Country/Countries		India						
Compliance check by:		Anand S R						

Certificate of Competence							
Name	☒ Mr. ☐ Ms.	**Stalin S**					
Qualification Procedure		*Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GCC/GHG Projects.*					
Appointed to work as:							
		Validator/ Verifier	**Team Leader**	**Trainee**	**Technical Expert**	**Technical Reviewer**	**Financial Expert**	**Approver**
Appointed		Yes	Yes	No	Yes	Yes	Yes	Yes
Appointed Date		15-07-2023						
Authorized to work as Technical Expert for:								
Authorized Technical Area		**Sectoral Scope**		**TA Code**		**Technical Area within the scope**		
		Energy industries (renewable - / non-renewable sources)		1.1		Thermal energy generation		
		Energy industries (renewable - / non-renewable sources)		1.2		Renewables		
		Energy demand		3.1		Energy demand		
		Waste handling and disposal		13.1		Solid waste and wastewater		
		Waste handling and disposal		13.2		Manure		
Authorized to work as Local Expert for:								
Country/Countries		India						

Compliance check by:	Anand S. R.

Certificate of Competence

Name	☒ Mr. ☐ Ms.	**Sriram S**
Qualification Procedure		*Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GCC/GHG Projects.*

Appointed to work as:

	Validator/ Verifier	Team Leader	Trainee	Technical Expert	Technical Reviewer	Financial Expert	Approver
Appointed	Yes	No	No	No	No	No	No
Appointed Date	25-07-2024						

Authorized to work as Technical Expert for:

	Sectoral Scope	TA Code	Technical Area within the scope
Authorized Technical Area	-	-	-

Authorized to work as Local Expert for:

Country/Countries	-

Compliance check by:	Anand S R

Certificate of Competence

Name	☒ Mr. ☐ Ms.	**Sanjay Kandari**
Qualification Procedure		*Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GCC/GHG Projects.*

Appointed to work as:

	Validator/ Verifier	Team Leader	Trainee	Technical Expert	Technical Reviewer	Financial Expert	Approver
Appointed	Yes	Yes	No	Yes	Yes	No	No
Appointed Date	15-07-2023						

Authorized to work as Technical Expert for:

	Sectoral Scope	TA Code	Technical Area within the scope
Authorized Technical Area	Energy industries (renewable - / non-renewable sources)	1.1	Thermal energy generation
	Energy industries (renewable - / non-renewable sources)	1.2	Renewables
	Energy distribution	2.1	Energy distribution
	Energy demand	3.1	Energy demand
	Waste handling and disposal	13.1	Solid waste and wastewater
	Waste handling and disposal	13.2	Manure

Authorized to work as Local Expert for:

Country/Countries	India

Compliance check by:	Anand S. R.

Appendix 3. Documents reviewed or referenced.

No.	Author	Title	References to the document	Provider
1	HomeBiogas	Monitoring Report (first version)	Version 01, dated 15/12/2024	HomeBiogas
		Monitoring Report (Final Version)	Version 03, dated 17/03/2025	
2	HomeBiogas	VER Calculation Sheet (First Version)	Version 01	HomeBiogas
		VER Calculation Sheet (Final Version)	Version 02	HomeBiogas
3	HomeBiogas	Approved VPA-DD	Version 5, Dated 13/02/2024	HomeBiogas
4	4KES	VPA Validation Report	Dated 16/02/2024	HomeBiogas
5	HomeBiogas	Approved PoA-DD	Version 4, Dated 30/12/2023	HomeBiogas
6	HomeBiogas	Stakeholder Consultation Report	Version 3, dated 30/12/2023	HomeBiogas
7	Gold Standard	Gold Standard Methodology: "Methodology for Animal Manure Management and Biogas Use for Thermal Energy Generation" V.1.1	Version 01.1	Publically available
8	IPCC	1. 1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book 2. 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book 3. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Web Link	Publically available
9	UNFCCC	Kyoto Protocol (1997)	Web Link	Publically available
10	Gold Standard	Template: Key project information & VPA design Document (PDD)	Version 1.1	Publically available
11	UNFCCC	CDM Project Standard for programmes of activities	Version 03	Publically available
12	UNFCCC	Standard: Sampling and surveys for CDM project activities and programme of activities	Version 09	Publically available
13	UNFCCC	Guidelines for sampling and surveys for CDM project activities and programme of activities	Version 04	Publically available
14	UNFCCC	CDM Validation and Verification Standard for programmes of activities	Version 03	Publically available
15	UNFCCC	Glossary "CDM terms"	Version 11	Publically available
16	HomeBiogas	ODA Declaration letter		HomeBiogas
17	Gold Standard	Principles and Requirement	Version 1.2	Publically available
18	Gold Standard	Community Services Activity Requirements	Version 1.2	Publically available
19	Gold Standard	Programme of Activity requirements	Version 3.0	Publically available
20	Gold Standard	Safeguarding principles and requirements	Version 2.1	Publically available
21	Gold Standard	GS4GG preliminary Review report		HomeBiogas
22	HomeBiogas	Biogas basic record set: - End user agreement for VER ownership	-	HomeBiogas

		- Project database		
23	HomeBiogas	Baseline Survey sheets	-	HomeBiogas
24	HomeBiogas	Baseline KPT data: • Test sheets • Photographs	-	HomeBiogas
25	HomeBiogas	Project KPT data: • Test sheets • Photographs		HomeBiogas
26	HomeBiogas	Employment records	-	HomeBiogas
27	HomeBiogas	Training Records	-	HomeBiogas
28	HomeBiogas	Baseline KPT	-	HomeBiogas
29	HomeBiogas	Grievances records register		HomeBiogas
30	HomeBiogas	Biodigesters & stove specification		HomeBiogas
31	HomeBiogas	No double counting declaration	-	HomeBiogas
32	World Bank	Kenya Population information: https://data.worldbank.org/country/kenya?view=chart	-	Publically available
33	FAO	Global Forest Resources Assessment 2015, Country Report Kenya	-	Publically available
34	GTZ	GTZ Eastern Africa Online Resource Base (https://energypedia.info/wiki/Biomass_Energy_Resources_in_Kenya)	-	Publically available
35	FAO.	Estimating Biomass and Biomass Change of Tropical Forests: a Primer: Appendix 1 - List of wood densities for tree species from tropical America, Africa, and Asia https://www.fao.org/3/W4095E/w4095e0c.htm	-	Publically available

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.**~~		~~**Date:** DD/MM/YYYY~~
~~**Description of FAR**~~				
~~*No FARs from previous verification*~~				
~~**Project developer response**~~				~~**Date:** DD/MM/YYYY~~
~~*NA*~~				
~~**Documentation provided by project developer**~~				
~~*NA*~~				
~~**VVB assessment**~~				~~**Date:** DD/MM/YYYY~~

Table 2. CL from this Verification

CL ID	01	**Section no.**		**Date:** 03/01/2025
Description of CL				
CME is requested to submit the following documents / supporting's: 1. Sample survey sheets. 2. Details of the employment generated 3. End user agreements of the following IDs				
10220666	10230852	10230678	10231376	10240367	10240249
10220474	10220525	10220620	10220787	10221224	10221899
10230102	10230849	10230954	10231399	10231242	10231902
Project developer response				**Date:** 05/01/2025
The requested supporting documents are provided				
Documentation provided by project developer				
1. Sample Survey sheet 2. Employment records 3. End user agreements of the serial numbers provided				
VVB assessment				**Date:** 07/01/2025
The documents are provided and found to be ok. CL is closed.				

CL ID	02	**Section no.**	Section B.1	**Date:** 03/01/2025
Description of CAR				
In section B.1 of MR, the number of installation value provided is not matching with previous MR. PD shall clarify the same. Also, number of systems included in the December 2024 which is not included in this monitoring period. Clarify				
Project developer response				**Date:** 05/01/2025
This is due to the following reasons • There was a mistake in the date format which is corrected in this verification. • There are some units removed or stopped working which are now removed from the database that lead to different numbers. • In last verification, some digesters are missed out as it was not entered into the database at the time of verification which are included now.				
Documentation provided by project developer				
Revised MR				

VVB assessment	Date: 07/01/2025
The justification provided by PD is found to be acceptable. The database and the end-user agreement are verified and the same is confirmed. CL is closed.	

CL ID	03	Section no.	D.1	Date: 03/01/2025
Description of CAR				
Kindly provide the Project performance field tests document for the reference.				
Project developer response				**Date:** 05/01/2025
The KPT data sheets have been provided now. We have conducted KPT only to the households that reports fuel wood consumption during the monitoring sample survey. The data has been taken in to monitoring survey sheet and the average from the sheet has been taken into project emission calculation.				
Documentation provided by project developer				
KPT data sheets				
VVB assessment				**Date:** 07/01/2025
PD provided the KPT sheet. The data provided PD in the excel sheet is verified against the datasheet and the data provided by PD is found to be correct. CAR is closed.				

Table 3. CAR from this verification

CAR ID	01	Section no.	D.3	Date: 03/01/2025
Description of CAR				
In table 1 of MR, the amount of fuel wood consumed mentioned is not consistent with the estimation provided in the ER sheet. Also the number of biogas systems is not consistent with the database shared during the site visit. As per the database shared, the total digesters installed is 3,714 which is not matching with number mentioned in the MR. Corrective action is requested				
Project developer response				**Date:** 05/01/2025
The amount of fuel wood consumed and the total number of biogas systems are corrected in the MR.				
Documentation provided by project developer				
Revised MR				
VVB assessment				**Date:** 07/01/2025
PD now corrected MR which is consistent with the ER sheet & database. CAR is closed				

CAR ID	02	Section no.	E2	Date: 03/01/2025
Description of CAR				
Provide a copy of Grievance Expression Process Book.				
Project developer response				**Date:** 05/01/2025
Copy of Grievance Expression Process Book is submitted now				
Documentation provided by project developer				
Grievance register				
VVB assessment				**Date:** 07/01/2025
CME has now provided grievance expression book. CAR is closed				

CAR ID	03	Section no.	D.3	Date: 03/01/2025
Description of CAR				
The value of the NLTy mentioned in section D.3 is not matching with other sections in the MR				
Project developer response				**Date:** 05/01/2025
The value is corrected and now the NLT_y is consistent.				
Documentation provided by project developer				
Updated ER sheet and MR				
VVB assessment				**Date:** 07/01/2025

The above correction has been revised. CAR is closed

Table 4. FAR from this verification

~~**FAR ID**~~	~~xx~~	~~**Section no.**~~		~~**Date:** DD/MM/YYYY~~
~~**Description of FAR**~~				
~~**Project developer response**~~				~~**Date:** DD/MM/YYYY~~
~~**Documentation provided by project developer**~~				
~~**VVB assessment**~~				~~**Date:** DD/MM/YYYY~~

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