Gold Standard for the Global Goals

TEMPLATE

MONITORING REPORT

PUBLICATION DATE **14.10.2020**

VERSION **v.1.1**

RELATED SUPPORT- **TEMPLATE GUIDE Monitoring Report v. 1.1**

This document contains the following Sections

KEY PROJECT INFORMATION

Key Project Information

GS ID (s) of Project (s)	GS 2519
Title of the project (s) covered by monitoring report	Household Biogas plants installed in rural areas of Maharashtra
Version number of the PDD/VPA-DD (s) applicable to this monitoring report	Version 03 of 19/05/2014
Version number of the monitoring report	2.2
Completion date of the monitoring report	14/09/2021
Date of project design certification	09/05/2014
Date of Last Annual Report	09/05/2019 to 08/05/2020
Monitoring period number	8th
Duration of this monitoring period	09/05/2020 to 08/05/2021
Project Representative	Mr. Sandeep Roy Choudhury (Value Network Venture Advisory Services Pte. Ltd)
Host Country	INDIA
Activity Requirements applied	☒ Community Services Activities ☐ Renewable Energy Activities ☐ Land Use and Forestry Activities/Risks & Capacities ☐N/A
Methodology (ies) applied and version number	AMS I.E Version 05
Product Requirements applied	☒GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A

Table 1 - Sustainable Development Contributions Achieved

Sustainable Development Goals Targeted	SDG Impact	Amount Achieved	Units/ Products

SDG 13	Emission reductions	41,823	tCO_2e
SDG 3	1. Air quality 2. Livelihood of poor 3. Quantitative employment and income generation	100% users responded positively for improved air quality, improved livelihood The project generated 20 employees which are still retained during this MP.	N/A
SDG 7	Access to clean and affordable energy	12,390 users are accessed to clean energy sources	N/A

Table 2 – Product Vintages

		Amount Achieved		
Start Dates	**End Dates**	**GS VERs**	**…**	**…**
09/05/2020	31/12/2020	27,156 tCO_2e		
01/01/2021	08/05/2021	14,667 tCO_2e		

SECTION A. DESCRIPTION OF PROJECT

A.1. General description of project

>>The aim of the project is to replace the commonly used inefficient wood fired mud stoves technology, with clean, sustainable and efficient biogas. The purpose of the project activity is to bundle 12,474 plants installed in rural areas of Maharashtra of varying capacities – 2m3, 3m3, 4m3 and 6m3. All 12,474 plants are commissioned in between January 2009- Dec 2011

Each household utilizes the dung of its cows to feed the digester for the production of biogas for cooking purpose and heating water. This leads to reduction of greenhouse gas emissions by displacing conventionally used non-renewable biomass with renewable biogas. In addition, the hygienic conditions in the rural areas to be improved by an appropriate disposal of waste. Further, residue from the bio digesters can be used as organic fertilizer and which improves soil conditions in rural areas.

Project activity contributes towards sustainable development by replacing firewood with biogas generated from the biodigesters. Major milestones of the project implementation are as below:

First batch of project biogas start date: 01/01/2009 (22 biogas digesters were commissioned)

Final date by when all bio-digesters were commissioned: 12/12/2011

Registration of the project at Gold Standard Registration: 09/05/2014

Operational lifetime: 15 years

Pre project Scenario:

Household survey was conducted to assess the baseline fuel and quantity used. As per the baseline survey, firewood was the main fuel used to suffice domestic needs. It was sourced from nearby forests and open market. Families had to walk 2-5 km to collect this firewood as Maharashtra, like many other regions of India, is a firewood deficit region. Usage of inefficient firewood leads to indoor pollution and land use patterns have been showing a decrease in forest land cover and increase in degraded land. Increasing pressure from human and livestock population and indiscriminate and illegal exploitation of forest resources are among factors that have lead to further intensification of the problem. A trend of forests turning into open scrubs has been observed. Degradation of forest lands has exacerbated the already existing problem of

desertification. There is a need to maintain adequate forest cover in the state to mitigate climate change effects.

Project Scenario:

Project activity involves bundling of 12,474 plants installed in rural areas of Maharashtra installed between Jan 2009 and December 2011.
The size of the biodigesters varies, depending on the number of people and number of cattles available per household. A detailed breakdown of the plants with the respective installed capacity is given below in Table 1.

Table 1. Breakdown of the plants with the respective installed capacity

Sr. No	Capacity (m3)	Number of plants
1	2	5,229
2	3	7,068
3	4	153
4	6	24
Total		12,474**

Revised plants:

Sr. No	Capacity (m3)	Number of plants
1	2	5,198
2	3	7,026
3	4	143
4	6	23
Total		12,390

It was identified that there were some wring entries (repetition of same unique number of 42 bio-digesters in the main list. On a conservative side all total 84 digesters are removed from the list and therefore, total number revised to 12,390. **This has been removed effective from 09/05/2016 and emissions reductions are not claimed from 09/05/2016 onwards for the removed plants.

A.2. Location of project

>> Host Country: India

The project activity is located in Maharashtra and geo coordinates of the districts are given below.

Table 2: Project location

S.No	Districts	Geo coordinates
1	Ahmadnagar	18° 02' N -19° 09' N & 73°90'E -75°50'E
2	Aurangabad	24° 09' N -25° 70' N & 84°00'E -85°50'E
3	Beed	18° 28' N -18° 29' N & 74°57'E -76°57'E
4	Bhandra	20° 39' N -21° 38' N & 79°27'E -80°42'E
5	Chandrapur	18° 04' N -20° 05' N & 78°50'E -80°60'E
6	Gadchiroli	18° 43' N -21° 50' N & 79°45'E -80°53'E
7	Gondiya	20° 39' N -21° 38' N & 79°27'E -80°42'E
8	Kolhapur	16° 42' N -16° 69' N & 74°16'E -74°24'E
9	Nagpur	21° 91' N -21° 92' N & 79°45'E -79°49'E
10	Nasik	20° 00' N -20° 08' N & 73°47'E -73°79'E
11	Pune	18° 31' N -18° 52' N & 73°51'E -73°85'E
12	Sangli	16° 51' N -16° 85' N & 74°33'E -74°56'E
13	Satara	17° 36' N -17° 60' N & 74°24'E -74°40'E
14	Sindhu durg	16° 10' N -16° 18' N & 73°44'E -73°74'E
15	Solapur	17° 40' N -17° 68' N & 75°55'E -75°92'E
16	Wardha	20° 44' N -20° 74' N & 78°36'E -78°60'E

A.3. Reference of applied methodology

>> Type: Type I – Renewable energy project

Methodology: AMS I.E - Switch from non-renewable biomass for thermal applications by the user

Version: 05

Reference:

https://cdm.unfccc.int/methodologies/DB/SO8OOGYGWHMXM287RBNKEYAMN9EUN0

A.4. Crediting period of project

>> Project start date: 01/01/2009

Length of crediting period: 09/05/2012 to 08/05/2022

SECTION B. IMPLEMENTATION OF PROJECT

B.1. Description of implemented project

>> The project activity involved installation and operation of 12,474 bio digesters (revised to 12,390) of capacities of 2m3, 3m3, 4m3 and 6m3, at individual households, thus avoiding the use of non-renewable biomass i.e. fuel wood from forests in the baseline scenario. The project activity is spread across 16 districts in the state of Maharashtra in India. All the 12,474 biodigesters commissioned between 01/01/2009 to 12/12/2011. However, it was noted that unique ID of 42 bio-digesters are overlapped and therefore, on a conservative side total 84 digesters are removed from the list and therefore, total number revised to 12,390. This has been removed effective from 09/05/2016 and emissions reductions are not claimed from 09/05/2016 onwards for the removed plants. All 12,390 plants are in operation during this monitoring period.

The project activity involved the installation of fixed-dome digesters which consist of one lower segment (digester) and a hemisphere over it which functions as a gas holder. The "feed" is fed into the digester via the inlet pipe and undergoes digestion in the digestion chamber. Anaerobic digestion takes place in the bio-digesters in which microorganisms break down biodegradable material (primarily cow dung) in the absence of oxygen. This process produces methane (CH_4) rich biogas which is used as fuel in gas burner replacing non-renewable firewood for cooking applications.

All plants are centrally managed by Adivasi Khadi Avom Krishi Prashikshan Sansthan (AKKPS) although jointly installed by AKKPS partner agencies. If there is any breakdown reported for any of the digesters the same is attended at the earliest possible time. Breakdowns are recorded as part of grievance mechanism and based on annual survey any result from any of the system is applied to entire population conservatively.

B.1.1 Forward Action Requests

>> One forward action request raised during last verification is addressed as below:

"Over the next monitoring periods, PD shall use a random sample generator or excel function to ensure the objective randomness of samples selected for monitoring surveys."

Response: The same has been taken into account while selecting random samples. As explained in section D.4 of the MR households selected randomly using random sample number generator (https://stattrek.com/statistics/random-number-generator.aspx). The MR is further updated stating the details in Appendix 1 of the MR.

B.2. Post-Design Certification changes

>> N/A

B.2.1. Temporary deviations from the approved Monitoring & Reporting Plan, methodology or standardized baseline

>> N/A

B.2.2. Corrections

>> N/A

B.2.3. Changes to start date of crediting period

>> N/A

B.2.4. Permanent changes from the Design Certified monitoring plan, applied methodology or applied standardized baseline

>> N/A

B.2.5. Changes to project design of approved project

>> N/A

SECTION C. DESCRIPTION OF MONITORING SYSTEM APPLIED BY THE PROJECT

>> The primary monitoring parameter for the project activity is the operational status of biogas systems covered in the project activity which is done in two ways: 1) AKKPS does six monthly operation and maintenance of all biogas systems to check whether all plants are functioning or not and repair if any functional problem exist; 2) Third party survey covering the monitoring period is conducted to monitor all the monitoring parameters required as per the monitoring plan, methodology and all non-neutral sustainable development parameters.
AKKPS do provide regular service to the plant owners. In case of malfunctioning of the biodigester, plant owner informs AKKPS or any of its representatives. AKKPS do inspect the plant and resolve the problem at earliest.

Continuous grievance mechanism: AKKPS do maintain a system to record and address any grievance related to project activity. The system includes the followings:

- periodic service of bio-digester
- provide contact details of local maintenance team to record and address any complaint
- maintaining log book at AKKPS office to record and address any complaint

Annual Survey:

Third party survey was conducted by Gramodyog Sanstan (http://www.gramodyog.in/) in the month of March 2021 to ascertain monitoring results covering the monitoring period. Gramodyog Sanstan is renown in various activities including household biogas construction and monitoring and therefore highly competent to carry out the survey. The team engaged for primary data collection is competent for survey.

SECTION D. DATA AND PARAMETERS

D.1. Data and parameters fixed ex ante or at renewal of crediting period

>>

<table>
<tr><td>Relevant SDG Indicator</td><td>SDG 13</td></tr>
<tr><td>Data/parameter:</td><td>Dy</td></tr>
<tr><td>Unit</td><td>Kg/month</td></tr>
<tr><td>Description</td><td>Firewood consumption before biogas plants installation</td></tr>
<tr><td>Source of data</td><td>Survey</td></tr>
<tr><td>Value(s) applied)</td><td>
<table>
<tr><td>Size</td><td>Before installation of Biogas plants(Dy)</td><td>After installation of Biogas plants(Py)</td><td>Amount of firewood displaced (By)</td></tr>
<tr><td>2</td><td>230</td><td>4</td><td>226</td></tr>
<tr><td>3</td><td>334</td><td>7</td><td>327</td></tr>
<tr><td>4</td><td>434</td><td>10</td><td>425</td></tr>
<tr><td>6</td><td>650</td><td>40</td><td>610</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>Survey was conducted to know the firewood consumption pattern Environment and Energy Management Group, Bhopal</td></tr>
<tr><td>Purpose of data</td><td>By (Total amount of biomass substituted) = Dy (fixed as per baseline) - Py (project firewood usage is monitored annually)</td></tr>
<tr><td>Additional comments</td><td></td></tr>
</table>

Relevant SDG Indicator	SDG 13
Data/parameter:	$f_{NRB,y}$
Unit	%
Description	Fraction of Non Renewable Biomass
Source of data	Calculated
Value(s) applied)	93%
Choice of data or measurement methods and procedures	Fraction of Non-renewable biomass was calculated
Purpose of data	Baseline, project and leakage emissions estimation
Additional comments	

Relevant SDG Indicator	13 (Climate Action)
Data/parameter:	$NCV_{biomass}$
Unit	TJ/tonne
Description	Net Calorific Value of non-renewable biomass

Source of data	IPCC
Value(s) applied)	0.015 TJ/tonne
Choice of data or measurement methods and procedures	Default Value obtained from 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Purpose of data	Baseline emissions estimation.
Additional comments	

Relevant SDG Indicator	13 (Climate Action)
Data/parameter:	$EF_{projected\_fossil\ fuel}$
Unit	tCO2/TJ
Description	Emission factor for the substitution of non-renewable woody biomass
Source of data	IPCC
Value(s) applied)	81.6 tCO2/TJ
Choice of data or measurement methods and procedures	Default Value obtained from methodology "AMS-IE, Switch from non-renewable biomass for thermal applications by the user", Ver-05
Purpose of data	Baseline emissions estimation
Additional comments	

D.2 Data and parameters monitored

>>

Relevant SDG Indicator	SDG 13 (linked to SDG target 13. 2 and 13.3)
Data/parameter:	Displacement or substitution of the non-renewable woody biomass
Unit	kg
Description	Monitoring should confirm the displacement or substitution of the non-renewable woody biomass at each location
Measured/calculated/default	Measured
Source of data	Survey

<table>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>Size</th><th>Before installation of Biogas plants(Dy)</th><th>After installation of Biogas plants(Py)</th><th>Amount of firewood displaced (By)</th></tr>
<tr><td>2m3</td><td>230</td><td>23</td><td>207</td></tr>
<tr><td>3m3</td><td>334</td><td>36</td><td>298</td></tr>
<tr><td>4m3</td><td>434</td><td>43</td><td>391</td></tr>
<tr><td>6m3</td><td>650</td><td>43.5</td><td>606.5</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Not Applicable</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>At least once every two years (biennial).
Previous monitoring: June 2020
Present monitoring: March 2021</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Not Applicable</td></tr>
<tr><td>QA/QC procedures:</td><td>Third party survey conducted covering the monitoring period. Samples are selected considering 90/10 confidence precision and following UNFCCC sampling standard.</td></tr>
<tr><td>Purpose of data:</td><td>Baseline emissions estimation</td></tr>
<tr><td>Additional comments:</td><td>Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2</td></tr>
</table>

Relevant SDG Indicator	SDG 13 (linked to SDG target 13. 2 and 13.3)
Data/parameter:	Checking of sampled biogas plants
Unit	%
Description	Monitoring consist of checking of representative sample, to ensure that biodidgesters operating or are replaced by an equivalent in service appliance.
Measured/calculated/default	Calculated
Source of data	Survey
Value(s) of monitored parameter	100%. All sampled bio-digesters found operational during survey. Therefore, 100% plants are in operation during the monitoring period.
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency:	At least once every two years (biennial) Previous monitoring: June 2020 Present monitoring: March 2021
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Third party survey conducted covering the monitoring period.
Purpose of data:	Baseline emissions estimation

Additional comments:	Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2

Relevant SDG Indicator	SDG 13 (linked to SDG target 13. 2 and 13.3)
Data/parameter:	Amount of firewood saved under the project activity that is used by non-project households/users
Unit	Tonne/year
Description	In order to assess the leakages specified under paragraph 10 of AMS IE, version 05, monitoring shall include data on the amount of woody biomass saved under the project activity that is used by non-project households/users (who previously used renewable energy sources).
Measured/calculated/default	Calculated
Source of data	Survey
Value(s) of monitored parameter	During this monitoring period leakage is accounted considering default factor as per applied methodology. Hence, survey did not capture the parameter. This parameter is applicable for accounting leakage emissions which is accounted applying default leakage factor (0.95) during this monitoring parameter
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency:	Not applicable
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Since, default approach is applied as per methodology, no QA/QC is applicable.
Purpose of data:	Leakage estimation
Additional comments:	Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2

Relevant SDG Indicator	SDG 3 (linked to SDG target 3.9)
Data/parameter:	Air quality
Unit	Qualitative
Description	Improvement in air quality
Measured/calculated/default	Response is calculated in percentage terms. Survey considered 77 end users. Response from each user on ambient air quality and impact on health post project activity was asked and positive feedback is considered during the monitoring period. The results are given below and also in emission reduction worksheet.
Source of data	Sampling survey/annual usage survey/monitoring survey

Value(s) of monitored parameter	100% users positively responded.
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency:	Annual Previous monitoring: June 2020 Present monitoring: March 2021
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Third party survey was conducted to check the functionality rate of biogas plants during the monitoring period and if the biogas plants are functional, this confirms the air quality is improved
Purpose of data:	SD impact assessment
Additional comments:	Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2

Relevant SDG Indicator	SDG 3 (linked to SDG target 3.9)
Data/parameter:	Livelihood of poor
Unit	Numbers
Description	Number of families have access to effective waste management system (biogas system) under the project
Measured/calculated/default	Measured
Source of data	Survey. Survey to ensure number of project biogas system in operation which ensures the number of families accessed to effective waste management system which in term justifies that livelihood of those families are improved. Prior to the project activity cow dung was left to decay in the open areas without proper handling. This causes bad odour and was breeding ground for flies and mosquitoes. As a result of which chances of diseases like malaria and other diseases were high.
Value(s) of monitored parameter	12,390 families continue to utilize waste effectively. 100% users reported improved in livelihood due to the project activity.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency:	Annual Previous monitoring: June 2020 Present monitoring: March 2021
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Survey was conducted to check the proper functioning of sampled biodigesters utilizing cow dung& other organic waste as feed
Purpose of data:	SD Assessment

Additional comments:	Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2

Relevant SDG Indicator	SDG 7 (linked to SDG target 7.1 and 7.2)
Data/parameter:	Access to clean and affordable energy
Unit	Numbers
Description	Number of biogas system operational under the project activity
Measured/calculated/default	Sample survey to confirm if project biogas systems are operational. Operational status confirms that the users are accessed to affordable and clean energy
Source of data	Survey
Value(s) of monitored parameter	All 12,390 biogas plants are working. 100% users agree that biogas digester is clean and affordable energy source compared to other available options.
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency:	Annual Previous monitoring: June 2020 Present monitoring: March 2021
Calculation method (if applicable):	N/A
QA/QC procedures:	Third party survey conducted covering the monitoring period
Purpose of data:	SD Assessment
Additional comments:	Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2

Relevant SDG Indicator	SDG 3 (linked to SDG target 3.9)
Data/parameter:	Quantitative employment and income generation
Unit	Numbers
Description	Number of employment generation and income from the project activity
Measured/calculated/default	Monitoring shall provide exact number of employment generated due to the project activity beyond the project and other employment/jobs created due to the project activity (as an effect generated in design, construction, distribution or start-up or decommissioning of the project).
Source of data	Project Participant/Project proponent

Value(s) of monitored parameter	At present 20 jobs are created at various hierarchy level like Supervisors, local technicians and mesons. The 20 employees are created during previous years and not created during this monitoring period. There is no change in staff during the monitoring period. The list of employees responsible for the project is submitted to verification team.
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency:	Annual Previous monitoring: June 2020 Present monitoring: March 2021
Calculation method (if applicable):	N/A
QA/QC procedures:	Payment receipt/ employment record etc.
Purpose of data:	SD Assessment
Additional comments:	Annual monitoring is followed and maintained. The annual reporting also meets GS4GG rule under principle and requirement version 1.2

Continuous input/grievance mechanism:
During the monitoring period no negative comment/input received from the stakeholders. The inputs are minor problems related to biogas operation which were rectified within very short span of time. Records of input registry was shown to the verification team.

D.3. Comparison of monitored parameters with last monitoring period

Data/Parameter	Value obtained in this monitoring period	Value obtained last monitoring period
Displacement or substitution of the non-renewable woody biomass**	Average 36.37 kg/HH/month	Average 18.75 kg/HH/month
Checking of sampled biogas plants (Operational status)	100%	100%
Air quality	100%	100%
Livelihood of poor	100%	95%
Access to clean energy	100%	100%

**The survey result showed firewood consumption was high during the period May 2020 to May 2021 compared to previous monitoring survey. Due to COVID-19 impact, the time spend at home remained high during the monitoring period which might have resulted high energy demand or excess firewood consumption which otherwise could have been avoided. Although this interpretation is from project proponent's perspective and did not include under the scope of the survey. Project proponent considered the survey result in emission reduction calculation.

D.4. Implementation of sampling plan

>> As per AMS I E, version 05 - A statistically valid sample where the systems are deployed is selected. As per GUIDELINES FOR SAMPLING AND SURVEYS FOR CDM PROJECT ACTIVITIES AND PROGRAMME OF ACTIVITIES, EB 69, Annex-5, the project proponent chooses simple random sampling. In this crediting period 90% confidence interval and a 10% margin of error requirement was considered for the sampled parameters. Details given below:

For Annual survey:
90% confidence level with 10% precision error has been considered to calculate the sample size.
90% confidence level with 10% precision error and 0.8 as proportion has been considered. As all 12,390 plants included in project activity were installed by Dec 2011. Third party survey was conducted to check the functionality rate of biogas plants.
Formula used has been given below:

$$n \geq \frac{1.645^2 N \times p(1-p)}{(N-1)\times 0.1^2 \times p^2 + 1.645^2 p(1-p)}$$

Where	
n	Sample size
N	Total number of households (12390)
P	Our expected proportion (0.80). It has been assumed that 80% of the plants would be functional considering previous survey results where 100% plants were functional
1.64	Represents the 90% confidence required
0.1	Represents the 10% relative precision

As per the formula, for current monitoring period 67 households are required to survey. However, on a conservative side, the surveyor took 77 bio-digesters for survey as given below:

Capacity (m3)	2	3	4	6	
Number(N)	5198	7026	143	23	12390
Share in total number capacity wise	42%	57%	1%	0.19%	100%
Required Samples for survey	28	38	1	0.12	67
Actual Samples taken for survey	30	40	5	2	77

Household selection: The list of project biogas plants are segregated respective to its size and a random number is assigned for each biogas plant. Then random sample number

generator (https://stattrek.com/statistics/random-number-generator.aspx) is used to get the required samples for each of the biogas size as per above table.

Achieved precision:

For the proportional parameter (operational fraction of biogas systems) the sample result showed 100% operational and hence desired precision has been achieved.

For mean vale parameters i.e. average fuel wood consumption post biogas usage the achieved precision for all sizes of biogas plants are as below:

Size of biogas plants	Number of samples	Achieved precision
2m3	30	8.7%
3m3	40	6.0%
4m3	5	5.5%
6m3	2	6.5%

SECTION E. CALCULATION OF SDG IMPACTS

E.1. Calculation of baseline value or estimation of baseline situation of each SDG Impact

>> SDG Indicator 13:

Baseline Emissions:

The amount of firewood consumed in absence of the project activity accounts the baseline emissions. And amount of firewood saved due to the project activity results the emission reductions. Therefore, annual emission reductions (ERy) in tCO2, during each year of the crediting period are expressed as follows:

$$ER_y = B_y * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

ERy = Emission reductions during the year y in tCO2e
By = Quantity of woody biomass that is substituted or displaced in tonnes
fNRB,y = Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods or government data or approved default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website
NCVbiomass = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)
EFprojected_fossilfuel = Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO2/TJ

By is determined by using the following option:

- Calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year); This is estimated using survey methods

Amount of Firewood replaced (kg/month) by each plant (As per Survey Report)

Size(m3)	Before installation of Biogas plants(fixed for baseline)	After installation of Biogas plants(Py)	Amount of firewood displaced (By)	Total firewood (tonne/year)
2	230	23	207	12912
3	334	36	298	25,125
4	434	43	391	671
6	650	43.5	606.5	167
Total				38,875

Therefore,

$$ER_y = B_y * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

= 38,875 * 93% * 0.015 * 81.6
= 44,025.26 tCO2.

SDG 3: For 'Improvement in health and decrease in illness' the baseline situation is poor due to firing of firewood which generates smoke (poor air quality) and leads to health problems pertaining to smoke. Under livelihood of poor in the baseline scenario, cattle dung was not managed to dispose or use leading to foul smell and unhygienic scenario. For 'quantitative employment and income generation' there was no employment needed to continue the use of firewood in cooking practice in the baseline situation. Survey considered 77 end users. Response from each user on ambient air quality and impact on health post project activity was asked and positive feedback is considered during the monitoring period. The results are given in D.2 of this report and also in emission reduction worksheet.

SDG 7: For 'access to affordable and clean energy services' the baseline scenario can be described as poor due to that fact that firewood based cooking practice is not considered a clean source of energy and less efficient leading of high firewood consumption for desired energy.

E.2. Calculation of project value or estimation of project situation of each SDG Impact

>> SDG Indicator 13:
Project emissions: As per the PDD and applied methodology project emissions from the project activity is already accounted while arriving By value. Therefore, a separate calculation of project emission is not required.

SDG 3: For 'Improvement in health and decrease in illness' a qualitative assessment was done through third party survey and results from end users response shows that health problems related to smoke is reduced. Under waste management, cattle dung being used in digester and slurry coming out the digester is applied as manure in fields which is leading to improved management of cattle dung. 100% users reported positive impact in air quality and 95% users reported positive impact on health from smoke related diseases. Also 100% users reported improved waste management (cattle dung) due to the project activity.

SDG 7: For 'access to affordable and clean energy services' the survey result shows that all surveyed plants are in operation which justifies that all project plants are in operation during the monitoring period. This means that the project leads to clean energy services to the users. 100% users agree that biogas digester is clean and affordable energy source compared to other available options.

E.3. Calculation of leakage

>>

SDG 13:

In line with the applied methodology and PDD, By is multiplied with 0.95 to account leakage. Therefore, the net benefit is

= 44,025.26 * 0.95 = 41,823 tCO2e (round down value).

SDG 3: For 'Improvement in health and decrease in illness' a qualitative assessment was done through third party survey and results from end users response shows that health problems related to smoke is reduced. During the monitoring period 20 employments are retained as previous year due the project activity. Under waste management, cattle dung being used in digester and slurry coming out the digester is applied as manure in fields which is leading to improved management of cattle dung.

SDG 7: For 'access to affordable and clean energy services' the survey result shows that all surveyed plants are in operation which justifies that all project plants are in operation during the monitoring period. This means that the project leads to clean energy services to the users.

E.4. Calculation of net benefits or direct calculation for each SDG Impact

SDG	SDG Impact	Baseline estimate	Leakage estimate	Net benefit
SDG 13	Climate Change (Emission reductions)	44,025	2,202	41,823
SDG 3	4. Air quality 5. Livelihood of poor 6. Quantitative employment and income generation	100% users affected with poor indoor air quality, poor waste management	Positive impact	100% users reported positive impact in air quality and 95% users reported

		(cattle dung) and no employment generation.		positive impact on health from smoke related diseases. Also 100% users reported improved waste management (cattle dung) due to the project activity
SDG 7	Access to clean and affordable energy	100% users were using firewood which is not a clean source of energy	Positive impact	100% users agree that biogas digester is clean and affordable energy source compared to other available options

E.5. Comparison of actual SDG Impacts with estimates in approved PDD

SDG	Values estimated in ex ante calculation of approved PDD for this monitoring period	Actual values[1] achieved during this monitoring period
13	48,551 tCO_2e	41,823 tCO_2e
3	100% users affected with poor indoor air quality, poor waste management (cattle dung) and no employment generation	100% users reported positive impact in air quality and 95% users reported positive impact on health from smoke related diseases.

[1] Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.

		Also 100% users reported improved waste management (cattle dung) due to the project activity
7	100% users were using firewood which is not a clean source of energy	100% users agree that biogas digester is clean and affordable energy source compared to other available options

E.5.1. Explanation of calculation of value estimated ex ante calculation of approved PDD for this monitoring period

>> As per registered PDD, annual emission reductions from the project activity is 48,551 tCO2e. Current monitoring period also covers one year and hence ex-ante estimation for this monitoring period is 48,551 tCO_2e.

E.6. Remarks on increase in achieved SDG Impacts from estimated value in approved PDD

>> Decrease in emission reduction is due to firewood consumption by households during non-operational period.

SECTION F. SAFEGUARDS REPORTING

>> As per approved GS4GG transition Annex of the project, no safeguarding principles are required to be monitored. Moreover, the safeguarding principles are not adversely affected by the project activity. The project has been appropriately aligned with the safeguarding principles.

SECTION G. STAKEHOLDER INPUTS AND LEGAL DISPUTES

G.1. List all Inputs and Grievances which have been received via the Continuous Input and Grievance Mechanism together with their respective responses/mitigations.

>>All grievances were related to minor repair issues of biogas systems which were resolved within 1-2 days and as per survey result the emission reductions are conservatively claimed. Dedicated field coordinators are responsible cluster wise and

end users are provided with contact details so that they can contact immediately and issues are resolved. The ground level issues are reported back to AKKPS for compilation.

G.2. Report on any stakeholder mitigations that were agreed to be monitored.

>>Not applicable.

G.3. Provide details of any legal contest that has arisen with the project during the monitoring period

>> No legal contest or dispute has been arisen with the project during the monitoring period. This is because the project soes not require any regulatory approval. It happens at household level and household owners set up the biogas system with their own consent.

Appendix 1: Sample identification details

Step 1: Sample allocation

Capacity (m3)	2	3	4	6	
Number(N)	5198	7026	143	23	12390
Share in total number capacity wise	42%	57%	1%	0.19%	100%
Samples for survey	28	38	1	0.12	67
Actual Samples taken for survey	30	40	5	2	77

In order to identify random sample for each size of the biogas plant, entire project systems were divided capacity wise and sample number was allotted for each size of plants.

2. Sample identification:

Online sample generator 'https://stattrek.com/statistics/random-number-generator.aspx' is used and required number of samples are selected.

For 2m3 plants:

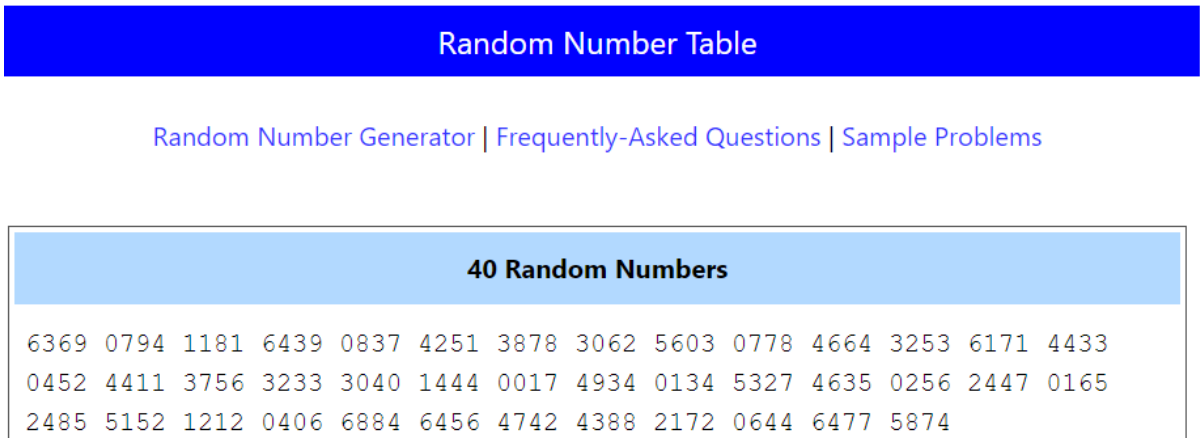
Random Number Table

Random Number Generator | Frequently-Asked Questions | Sample Problems

30 Random Numbers

4846 1742 5090 4814 0710 1493 3513 2220 0575 0961 4025 0039 5148 4847
3244 2246 0234 0169 4048 4431 1986 2484 1683 4282 4668 4629 2368 2965
2509 4745

For 3m3 plants:



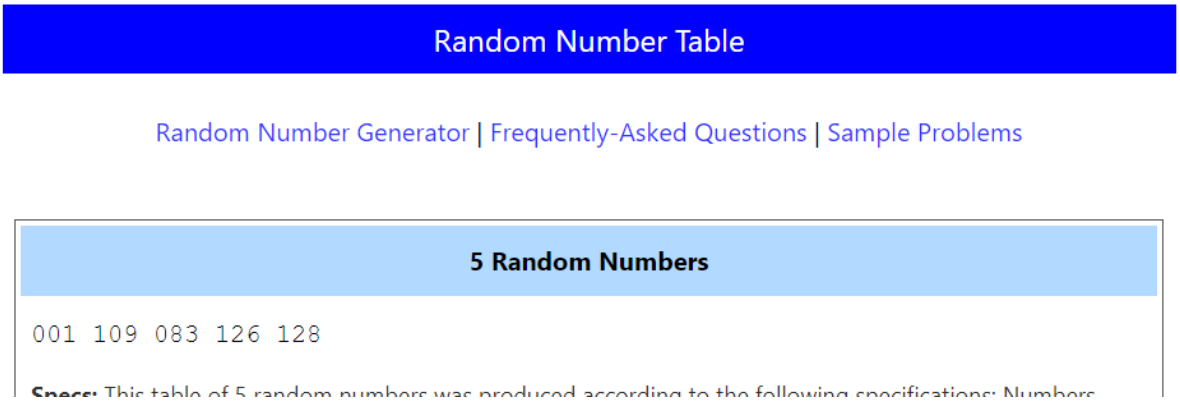
Random Number Table

Random Number Generator | Frequently-Asked Questions | Sample Problems

40 Random Numbers

6369 0794 1181 6439 0837 4251 3878 3062 5603 0778 4664 3253 6171 4433
0452 4411 3756 3233 3040 1444 0017 4934 0134 5327 4635 0256 2447 0165
2485 5152 1212 0406 6884 6456 4742 4388 2172 0644 6477 5874

For 4m3 plants:



Random Number Table

Random Number Generator | Frequently-Asked Questions | Sample Problems

5 Random Numbers

001 109 083 126 128

Specs: This table of 5 random numbers was produced according to the following specifications: Numbers

The above random samples were used in survey accordingly.

Revision History

Version	Date	Remarks
1.1	14 October 2020	Hyperlinked section summary to enable quick access to key sections Improved clarity on Key Project Information Section for POA monitoring Forward action request section Improved Clarity on SDG contribution/SDG Impact term used throughout Clarity on safeguard reporting Clarity on design changes Leakage section added for VER/CER projects Addition of Comparison of monitored parameters with last monitoring period Provision of an accompanying Guide to help the user understand detailed rules and requirements

1.0	10 July 2017	Initial adoption