This document contains the following Sections

Key Project Information
SECTION A - Description of project
SECTION B- Implementation of project
SECTION C- Description of monitoring system applied by the project
SECTION D- Data and parameters
SECTION E- Calculation of SDG Impacts
SECTION F- Safeguards Reporting
SECTION G- Stakeholder inputs and legal disputes
# Key Project Information

<table>
<thead>
<tr>
<th>Key Project Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GS ID (s) of Project (s)</strong></td>
<td>GS 2519</td>
</tr>
<tr>
<td><strong>Title of the project (s) covered by monitoring report</strong></td>
<td>Household Biogas plants installed in rural areas of Maharashtra</td>
</tr>
<tr>
<td><strong>Version number of the PDD/VPA-DD (s) applicable to this monitoring report</strong></td>
<td>Version 03 of 19/05/2014</td>
</tr>
<tr>
<td><strong>Version number of the monitoring report</strong></td>
<td>2.1</td>
</tr>
<tr>
<td><strong>Completion date of the monitoring report</strong></td>
<td>22/08/2022</td>
</tr>
<tr>
<td><strong>Date of project design certification</strong></td>
<td>09/05/2014</td>
</tr>
<tr>
<td><strong>Date of Last Annual Report</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Monitoring period number</strong></td>
<td>9th</td>
</tr>
<tr>
<td><strong>Duration of this monitoring period</strong></td>
<td>09/05/2021 to 08/05/2022</td>
</tr>
<tr>
<td><strong>Project Representative</strong></td>
<td>Mr. Sandeep Roy Choudhury (Value Network Venture Advisory Services Pte. Ltd)</td>
</tr>
<tr>
<td><strong>Host Country</strong></td>
<td>INDIA</td>
</tr>
</tbody>
</table>
| **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

<table>
<thead>
<tr>
<th>Sustainable Development Goals Targeted</th>
<th>SDG Impact</th>
<th>Amount Achieved</th>
<th>Units/Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Climate Security and Sustainable Development*
**SDG 13**  
Emission reductions  40,668 tCO₂e

**SDG 3**  
1. Air quality
2. Livelihood of poor
3. Quantitative employment and income generation

96% users responded positively for improved air quality; 94% responded for positively for decrease in diseases

The project generated 20 employees which are still retained during this MP.

**SDG 7**  
Access to clean and affordable energy

12,018 users are accessed to clean energy sources

<table>
<thead>
<tr>
<th>Table 2 – Product Vintages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Dates</td>
</tr>
<tr>
<td>09/05/2021</td>
</tr>
<tr>
<td>01/01/2022</td>
</tr>
</tbody>
</table>
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 - 2m$^3$, 3m$^3$, 4m$^3$ and 6m$^3$. All 12,474 plants are commissioned in between January 2009- Dec 2011. Effective number of biogas systems in the project is 12,390 as described below.

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

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Capacity (m³)</th>
<th>Number of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>5,229</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>7,068</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>153</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>12,474**</td>
</tr>
</tbody>
</table>

Revised plants:

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Capacity (m³)</th>
<th>Number of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>5,198</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>7,026</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>143</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>23</td>
</tr>
</tbody>
</table>
**It was identified that there were some wring entries (repetition of same unique number of 42 biogas 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

<table>
<thead>
<tr>
<th>S.No</th>
<th>Districts</th>
<th>Geo coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ahmadnagar</td>
<td>18° 02' N -19° 09' N &amp; 73°90'E -75°50'E</td>
</tr>
<tr>
<td>2</td>
<td>Aurangabad</td>
<td>24° 09' N -25° 70' N &amp; 84°00'E -85°50'E</td>
</tr>
<tr>
<td>3</td>
<td>Beed</td>
<td>18° 28' N -18° 29' N &amp; 74°57'E -76°57'E</td>
</tr>
<tr>
<td>4</td>
<td>Bhandra</td>
<td>20° 39' N -21° 38' N &amp; 79°27'E -80°42'E</td>
</tr>
<tr>
<td>5</td>
<td>Chandrapur</td>
<td>18° 04' N -20° 05' N &amp; 78°50'E -80°60'E</td>
</tr>
<tr>
<td>6</td>
<td>Gadchiroli</td>
<td>18° 43' N -21° 50' N &amp; 79°45'E -80°53'E</td>
</tr>
<tr>
<td>7</td>
<td>Gondiya</td>
<td>20° 39' N -21° 38' N &amp; 79°27'E -80°42'E</td>
</tr>
<tr>
<td>8</td>
<td>Kolhapur</td>
<td>16° 42' N -16° 69' N &amp; 74°16'E -74°24'E</td>
</tr>
<tr>
<td>9</td>
<td>Nagpur</td>
<td>21° 91' N -21° 92' N &amp; 79°45'E -79°49'E</td>
</tr>
<tr>
<td>10</td>
<td>Nasik</td>
<td>20° 00' N -20° 08' N &amp; 73°47'E -73°79'E</td>
</tr>
<tr>
<td>11</td>
<td>Pune</td>
<td>18° 31' N -18° 52' N &amp; 73°51'E -73°85'E</td>
</tr>
<tr>
<td>12</td>
<td>Sangli</td>
<td>16° 51' N -16° 85' N &amp; 74°33'E -74°56'E</td>
</tr>
<tr>
<td>13</td>
<td>Satara</td>
<td>17° 36' N -17° 60' N &amp; 74°24'E -74°40'E</td>
</tr>
<tr>
<td>14</td>
<td>Sindhu durg</td>
<td>16° 10' N -16° 18' N &amp; 73°44'E -73°74'E</td>
</tr>
</tbody>
</table>
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/SO800GYGWHMXM287RBNKEYAMN9

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 $2m^3$, $3m^3$, $4m^3$ and $6m^3$, 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. Out of 12,390 plants, as per annual survey 97% are found in operational state which results to 12,018 number of systems 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

>> N/A

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 February 2022 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

>>
### Relevant SDG Indicator

<table>
<thead>
<tr>
<th><strong>Relevant SDG Indicator</strong></th>
<th>SDG 13</th>
</tr>
</thead>
</table>

#### Data/parameter:

<table>
<thead>
<tr>
<th><strong>Data/parameter</strong></th>
<th>Dy</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Unit</strong></th>
<th>Kg/month</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>Firewood consumption before biogas plants installation</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Source of data</strong></th>
<th>Survey</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Value(s) applied</strong></th>
<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>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>230</td>
<td>4</td>
<td>226</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>334</td>
<td>7</td>
<td>327</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>434</td>
<td>10</td>
<td>425</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>650</td>
<td>40</td>
<td>610</td>
</tr>
</tbody>
</table>

**Choice of data or measurement methods and procedures:**

Survey was conducted to know the firewood consumption pattern Environment and Energy Management Group, Bhopal

**Purpose of data:**

By (Total amount of biomass substituted) = Dy (fixed as per baseline) - Py (project firewood usage is monitored annually)

### Relevant SDG Indicator

<table>
<thead>
<tr>
<th><strong>Relevant SDG Indicator</strong></th>
<th>SDG 13</th>
</tr>
</thead>
</table>

#### Data/parameter:

<table>
<thead>
<tr>
<th><strong>Data/parameter</strong></th>
<th>( f_{\text{NRB},Y} )</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Unit</strong></th>
<th>%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>Fraction of Non Renewable Biomass</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Source of data</strong></th>
<th>Calculated</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Value(s) applied</strong></th>
<th>93%</th>
</tr>
</thead>
</table>

**Choice of data or measurement methods and procedures:**

Fraction of Non-renewable biomass was calculated

**Purpose of data:**

Baseline, project and leakage emissions estimation

### Relevant SDG Indicator

<table>
<thead>
<tr>
<th><strong>Relevant SDG Indicator</strong></th>
<th>13 (Climate Action)</th>
</tr>
</thead>
</table>

#### Data/parameter:

<table>
<thead>
<tr>
<th><strong>Data/parameter</strong></th>
<th>( NCV_{\text{biomass}} )</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Unit</strong></th>
<th>TJ/tonne</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Description</strong></th>
<th>Net Calorific Value of non-renewable biomass</th>
</tr>
</thead>
</table>

**Choice of data or measurement methods and procedures:**

Fraction of Non-renewable biomass was calculated
### Relevant SDG Indicator

**13 (Climate Action)**

### Data/parameter:

- **Data/parameter:** $E F_{\text{projected_fossil_fuel}}$
- **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

**>>**

<table>
<thead>
<tr>
<th>Relevant SDG Indicator</th>
<th>SDG 13 (linked to SDG target 13. 2 and 13.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data/parameter:</strong></td>
<td>Displacement or substitution of the non-renewable woody biomass</td>
</tr>
<tr>
<td><strong>Unit</strong></td>
<td>kg</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Monitoring should confirm the displacement or substitution of the non-renewable woody biomass at each location</td>
</tr>
<tr>
<td><strong>Measured/calculated/default</strong></td>
<td>Measured</td>
</tr>
<tr>
<td><strong>Source of data</strong></td>
<td>Survey</td>
</tr>
<tr>
<td><strong>Value(s) of monitored parameter</strong></td>
<td>An average 30 kg/month is used in parallel to biogas use which has been accounted to calculate the displacement of NRB at each location.</td>
</tr>
<tr>
<td><strong>Monitoring equipment</strong></td>
<td>Not Applicable</td>
</tr>
<tr>
<td><strong>Measuring/reading/recording frequency:</strong></td>
<td>At least once every two years (biennial). Previous monitoring: March 2021. Present monitoring: March 2022</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>
</tbody>
</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 | 97%. Out of 77 sampled bio-digesters, 75 are found operational during survey. Therefore, 97% 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: March 2021 |
| Present monitoring: March 2022 |
| 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 |

<p>| 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 |</p>
<table>
<thead>
<tr>
<th>Source of data</th>
<th>Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value(s) of monitored parameter</td>
<td>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 period</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring equipment</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Measuring/reading/recording frequency:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Calculation method (if applicable):</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>QA/QC procedures:</td>
<td>Since, default approach is applied as per methodology, no QA/QC is applicable.</td>
</tr>
<tr>
<td>Purpose of data:</td>
<td>Leakage 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>
</tbody>
</table>

### Relevant SDG Indicator

<table>
<thead>
<tr>
<th>Relevant SDG Indicator</th>
<th>SDG 3 (linked to SDG target 3.9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data/parameter:</td>
<td>Air quality</td>
</tr>
<tr>
<td>Unit</td>
<td>Qualitative</td>
</tr>
<tr>
<td>Description</td>
<td>Improvement in air quality</td>
</tr>
<tr>
<td>Measured/calculated/default</td>
<td>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.</td>
</tr>
<tr>
<td>Source of data</td>
<td>Sampling survey/annual usage survey/monitoring survey</td>
</tr>
<tr>
<td>Value(s) of monitored parameter</td>
<td>96% users positively responded.</td>
</tr>
<tr>
<td>Monitoring equipment</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Measuring/reading/recording frequency:</td>
<td>Annual Previous monitoring: March 2021 Present monitoring: March 2022</td>
</tr>
<tr>
<td>Calculation method (if applicable):</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>QA/QC procedures:</td>
<td>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</td>
</tr>
<tr>
<td>Purpose of data:</td>
<td>SD impact assessment</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>
<tr>
<td><strong>Relevant SDG Indicator</strong></td>
<td>SDG 3 (linked to SDG target 3.9)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Data/parameter:</strong></td>
<td>Livelihood of poor</td>
</tr>
<tr>
<td>Unit</td>
<td>Numbers</td>
</tr>
<tr>
<td>Description</td>
<td>Number of families have access to effective waste management system (biogas system) under the project</td>
</tr>
<tr>
<td>Measured/calculated/default</td>
<td>Measured</td>
</tr>
<tr>
<td><strong>Source of data</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Value(s) of monitored parameter</strong></td>
<td>12,390 families continue to utilize waste effectively. 97% users reported improved in livelihood due to the project activity.</td>
</tr>
<tr>
<td><strong>Monitoring equipment</strong></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
| **Measuring/reading/recording frequency:** | Annual  
Previous monitoring: March 2021  
Present monitoring: March 2022 |
| **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 |

<table>
<thead>
<tr>
<th><strong>Relevant SDG Indicator</strong></th>
<th>SDG 7 (linked to SDG target 7.1 and 7.2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data/parameter:</strong></td>
<td>Access to clean and affordable energy</td>
</tr>
<tr>
<td>Unit</td>
<td>Numbers</td>
</tr>
<tr>
<td>Description</td>
<td>Number of biogas system operational under the project activity</td>
</tr>
<tr>
<td>Measured/calculated/default</td>
<td>Sample survey to confirm if project biogas systems are operational. Operational status confirms that the users are accessed to affordable and clean energy</td>
</tr>
<tr>
<td><strong>Source of data</strong></td>
<td>Survey</td>
</tr>
<tr>
<td><strong>Value(s) of monitored parameter</strong></td>
<td>All 12,018 biogas plants are working. 100% users agree that biogas digester is clean and affordable energy source compared to other available options.</td>
</tr>
</tbody>
</table>
### Monitoring Report

<table>
<thead>
<tr>
<th>Monitoring equipment</th>
<th>Not Applicable</th>
</tr>
</thead>
</table>
| Measuring/reading/recording frequency: | Annual  
Previous monitoring: March 2021  
Present monitoring: March 2022 |
| 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

<table>
<thead>
<tr>
<th>Relevant SDG Indicator</th>
<th>SDG 3 (linked to SDG target 3.9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data/parameter:</td>
<td>Quantitative employment and income generation</td>
</tr>
<tr>
<td>Unit</td>
<td>Numbers</td>
</tr>
<tr>
<td>Description</td>
<td>Number of employment generation and income from the project activity</td>
</tr>
<tr>
<td>Measured/calculated/default</td>
<td>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).</td>
</tr>
<tr>
<td>Source of data</td>
<td>Project Participant/Project proponent</td>
</tr>
<tr>
<td>Value(s) of monitored parameter</td>
<td>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.</td>
</tr>
</tbody>
</table>

### Continuous input/grievance mechanism:

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

<table>
<thead>
<tr>
<th>Data/Parameter</th>
<th>Value obtained in this monitoring period</th>
<th>Value obtained last monitoring period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement or substitution of the non-renewable woody biomass</td>
<td>Average 30 kg/HH/month</td>
<td>Average 40 kg/HH/month</td>
</tr>
<tr>
<td>Checking of sampled biogas plants (Operational status)</td>
<td>97%</td>
<td>100%</td>
</tr>
<tr>
<td>Air quality</td>
<td>96%</td>
<td>100%</td>
</tr>
<tr>
<td>Livelihood of poor</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Access to clean energy</td>
<td>97% (i.e. 12801 households are accessed to clean energy sources)</td>
<td>100%</td>
</tr>
</tbody>
</table>

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:

**Target Population:** The target population for different parameters discussed in the table above are given below:

- For the proportional parameter; the target population is the bio-digester users listed in the project database.
- For the mean value parameter; the target population is the total number of operational biogas digester for which the emission reductions will be accounted for the monitoring period in question.

**Sampling frame:** All the households with biogas digester within the project will be the sampling frame.
**Sampling Method:** A simple random sampling will be adopted for estimating the sample size for the monitoring surveys. Simple random sampling is suited to populations that are homogenous (EB 75 annex 08).

For Annual survey:
Proportional parameter (operation proportion of biogas systems):

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:

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

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.

Mean value parameter (Amount of firewood consumption in continuation to biogas use):

The minimum sample size for the monitoring parameters is determined using the equation given in para 51 of appendix 1, EB 86 Annex 4, Guidelines for Sampling and Surveys for CDM Project activities and Programme of Activities Ver. 4.0.

\[
 n \geq \frac{1.645^2 NV}{(N-1) \times 0.1^2 + 1.645^2 V}
\]

Where,
- \( V \) = (SD/Mean)2
- \( n \) = Sample Size
- \( N \) = Total number of Population
- \( SD \) = Standard deviation
Mean = Mean for the average annual woody biomass consumption by pre-project device during project activity
1.645 = Represent 90% confidence required
0.1 = Represent the 10% relative precision

With SD value of 9.43 and mean of 30.87 from previous survey result, the sample size comes to 25.

However, on a conservative side, the surveyor took 77 bio-digesters for survey as given below:

<table>
<thead>
<tr>
<th>Capacity (m³)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number(N)</td>
<td>5198</td>
<td>7026</td>
<td>143</td>
<td>23</td>
</tr>
<tr>
<td>Share in total number capacity wise</td>
<td>42%</td>
<td>57%</td>
<td>1%</td>
<td>0.19%</td>
</tr>
<tr>
<td>Required Samples for survey</td>
<td>28</td>
<td>38</td>
<td>1</td>
<td>0.12</td>
</tr>
<tr>
<td>Actual Samples taken for survey</td>
<td>30</td>
<td>40</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

Survey method: A face-to-face meeting with owner and physical visit of sample biogas system is followed for survey. 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.

**Quality Assurance/Quality Control:**
A survey questionnaire was prepared to seek responses of operating status (yes or no) of biogas digesters within the project activity. The survey was performed by a third party expertise in similar project survey experience. During the survey, in order to anticipate any low response rate and answers bias, sample number was increased from the calculated sample size. Training to survey team was provided prior to start of the survey to ensure survey capture the intended parameters.

Achieved precision:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Achieved precision</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational fraction of biogas systems</td>
<td>0.8%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Amount of firewood consumption in continuation to biogas use</td>
<td>1%</td>
<td>&lt;10%</td>
</tr>
</tbody>
</table>
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:

\[ ER_y = B_y \times f_{NRB, y} \times NCV_{\text{biomass}} \times EF_{\text{projected_fossilfuel}} \]

\( ER_y \) = Emission reductions during the year \( y \) in tCO2
\( B_y \) = Quantity of woody biomass that is substituted or displaced in tonnes
\( f_{NRB, y} \) = 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
\( NCV_{\text{biomass}} \) = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)
\( EF_{\text{projected_fossilfuel}} \) = 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

<table>
<thead>
<tr>
<th>Size(m³)</th>
<th>Before installation of Biogas</th>
<th>After installation of Biogas plants(Py)</th>
<th>Amount of firewood displaced (By)</th>
<th>Total firewood (tonne/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>230</td>
<td>30</td>
<td>200</td>
<td>12,101</td>
</tr>
<tr>
<td>3</td>
<td>334</td>
<td>30</td>
<td>304</td>
<td>24,862</td>
</tr>
<tr>
<td>4</td>
<td>434</td>
<td>30</td>
<td>404</td>
<td>672</td>
</tr>
<tr>
<td>6</td>
<td>650</td>
<td>30</td>
<td>620</td>
<td>166</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>37,801</td>
</tr>
</tbody>
</table>

Therefore,

\[ ER_y = B_y \times f_{NRB, y} \times NCV_{\text{biomass}} \times EF_{\text{projected_fossilfuel}} \]

\[ = 37,801 \times 93\% \times 0.015 \times 81.6 \]
\[ = 42,809.16 \text{ tCO2.} \]
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. 96% users reported positive impact in air quality and 94% 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 97% surveyed plants are in operation which justifies that 12,018 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

\[ = 42,809.16 \times 0.95 = 40,668.70 \text{ tCO}_2\text{e} \] (round down value).
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 97% surveyed plants are in operation which justifies that 12,018 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

<table>
<thead>
<tr>
<th>SDG</th>
<th>SDG Impact</th>
<th>Baseline estimate</th>
<th>Leakage estimate</th>
<th>Net benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDG 13</td>
<td>Climate Change (Emission reductions)</td>
<td>42,809</td>
<td>2,140</td>
<td>40,668</td>
</tr>
<tr>
<td>SDG 3</td>
<td>Air quality</td>
<td>100% users affected with poor indoor air quality, poor waste management (cattle dung) and no employment generation.</td>
<td>Positive impact</td>
<td>96% users reported positive impact in air quality and 94% users reported positive impact on health from smoke related diseases. Also 100% users reported improved waste management (cattle dung) due to the project activity</td>
</tr>
<tr>
<td>SDG 7</td>
<td>Access to clean and affordable energy</td>
<td>100% users were using firewood</td>
<td>Positive impact</td>
<td>97% users (i.e. 12,018 households) agree that</td>
</tr>
</tbody>
</table>
which is not a clean source of energy  

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
t⁴achieved during this monitoring period |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>48,551 tCO₂e</td>
<td>40,668 tCO₂e</td>
</tr>
<tr>
<td>3</td>
<td>100% users affected with poor indoor air quality, poor waste management (cattle dung) and no employment generation</td>
<td>100% users reported positive impact in air quality and 96% users reported positive impact on health from smoke related diseases. Also 100% users reported improved waste management (cattle dung) due to the project activity</td>
</tr>
</tbody>
</table>
| 7   | 100% users were using households) are accessed to firewood which is not a clean and affordable energy source of energy | 97% (i.e. 12,018) 

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

Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.
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 tCO2e.

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 does not require any regulatory approval. It happens at household level and household owners set up the biogas system with their own consent.
### Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>14 October 2020</td>
<td>Hyperlinked section summary to enable quick access to key sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved clarity on Key Project Information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Section for POA monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forward action request section</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved Clarity on SDG contribution/SDG Impact term used throughout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity on safeguard reporting</td>
</tr>
<tr>
<td></td>
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<td>Clarity on design changes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leakage section added for VER/CER projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addition of Comparison of monitored parameters with last monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provision of an <a href="#">accompanying Guide</a> to help the user understand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>detailed rules and requirements</td>
</tr>
<tr>
<td>1.0</td>
<td>10 July 2017</td>
<td>Initial adoption</td>
</tr>
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</table>