

Gold standard for the global goals
Monitoring report



June 2017, version 1

Title of the project	Household Biogas plants installed in rural areas of Maharashtra
Gold Standard project id	GS 2519
Version number of the monitoring report	3.1
Completion date of the monitoring report	15/10/2020
Date of project design certification	09/05/2014
Start date of crediting period	09/05/2012 (Retroactive)
Duration of this monitoring period	09/05/2019 to 08/05/2020
Duration of previous monitoring period	09/05/2018 to 08/05/2019
Project representative(s)	Mr. Sandeep Roy Choudhury (Value Network Venture Advisory Services Pte. Ltd)
Host Country	India
Certification pathway (activity certification/impact certification)	Pathway 1 (Impact certification-VERs)
SDG Contributions targeted (as per approved PDD)	1 – Good health and well-being (SDG 3) – Improvement in air quality, livelihood of poor (effective water management system), employment and income generation 2 – Affordable and Clean Energy (SDG 7)- Clean energy source to all project households 3– Climate Action (SDG 13)-To reduce yearly 48,551 tCO ₂ e GHG emissions
Gold Standard statement/product certification sought (GSVER/ADALYs/RECs etc.)	GS VER
Selected methodology(ies)	CDM Small Scale Methodology: AMS I.E Version 05
Estimated amount of annual average certified SDG impact (as per approved PDD)	SDG 3: 100% project biogas users are targeted to access improved air quality & improved livelihood. The project targeted to generate employments. SDG 7: 100% project biogas users are targeted to access clean energy sources SDG 13: 48,551 tCO ₂ /year
Total amount of certified SDG impact (as per approved methodology) achieved in this monitoring period	SDG 13: 44,313 tCO ₂

SECTION A. Description of project

A.1. Purpose and 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

Continued operational years since first batch commissioning: 10 years

Effective number of plants as on 08/05/2019: 12,390

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 (m ³)	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 has been identified that there were some wrong 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

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

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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 the 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 (CH₄) 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. This is evident in emission reduction worksheet and survey report. Therefore, PP is considering a more conservative approach to claim emission reduction.

B.2. Post-registration changes

B.2.1. Temporary deviations from Certified Key Project Information, Project Design Document, Monitoring & Reporting Plan, applied methodology or applied 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 registered 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

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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/>) between 5th June 2020 to 20 June 2020 to ascertain monitoring results covering the monitoring period. Results of the survey have been incorporated in the monitoring report and emission reduction

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worksheet. 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

(Copy this table for each piece of data and parameter)

Relevant SDG Indicator	SDG 13			
Data/parameter:	Dy			
Unit	Kg/month			
Description	Firewood consumption before biogas plants installation			
Source of data	Survey			
Value(s) applied)	Size	Before installation of Biogas plants(Dy)	After installation of Biogas plants(Py)	Amount of firewood displaced (By)
	2	230	4	226
	3	334	7	327
	4	434	10	425
	6	650	40	610
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)			
Additional comments				

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	tCO ₂ /TJ
Description	Emission factor for the substitution of non-renewable woody biomass
Source of data	IPCC
Value(s) applied)	81.6 tCO ₂ /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

(Copy this table for each piece of data and parameter)

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

Value(s) of monitored parameter		Before installation of Biogas plants(Dy)	After installation of Biogas plants(Py)	Amount of firewood displaced (By)
	Size			
	2m3	230	15	215
	3m3	334	15	319
	4m3	434	20	414
	6m3	650	25	625
	The survey result provided a range of fire-wood consumption when biogas system is not in operation in a given month. On a conservative side, the maximum from the range is taken for emission reduction calculation.			
Monitoring equipment	Not Applicable			
Measuring/reading/recording frequency:	At least once every two years (biennial). Previous monitoring: May 2019 Present monitoring: June 2020			
Calculation method (if applicable):	Not Applicable			
QA/QC procedures:	Third party survey conducted covering the monitoring period. Samples are selected considering 90/10 confidence precision and following UNFCCC sampling standard.			
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. For 6 m3 plant, only one sample was surveyed which showed zero firewood consumption and hence on conservative size, previous year survey value is used.			

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 biogas digesters 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: May 2019 Present monitoring: June 2020

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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:	At least once every two years (biennial) Previous monitoring: May 2019 Present monitoring: June 2020
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 76 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

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Value(s) of monitored parameter				
	District	Sample surveyed (all sizes)	Number of users responded positively	Percentage terms
	Ambient air quality			
	Bhandara	42	39	93%
	Kolhapur	34	34	100%
	Impact on health			
	Bhandara	42	35	83%
Kolhapur	34	32	94%	
Monitoring equipment	Not Applicable			
Measuring/reading/recording frequency:	Annual Previous monitoring: May 2019 Present monitoring: June 2020			
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. 88% users reported improved in livelihood due to the project activity.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency:	Annual Previous monitoring: May 2019 Present monitoring: June 2020
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
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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: May 2019 Present monitoring: June 2020
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: May 2019 Present monitoring: June 2020
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. A total of 20 issues related to minor functional issues were reported during the monitoring period which were resolved either same day or within next two days of reporting. Records of registry shown to the verification team.

D.3. 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 76 bio-digesters for survey. Details of sample selection is provided in the emission reduction worksheet.

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Selection of samples: Following recommendation from GS (GS issuance review 3rd monitoring period covering 09-05-2015 to 08-05-2016) not to repeat the samples considered in previous years for survey, PP has been considering new samples each year for survey. Accordingly, randomly selected samples from the left out biogas plants for survey were considered. However, due to COVID-19 impact severely in the project state, PP chose only two districts which was possible to access by survey team.

PD would like to acknowledge that since 3rd monitoring there was no specific method followed while picking random samples. Concentration was given not to pick same sample. No statistical method either random sample number generator or excel function was used. Specially, current monitoring focused more on selecting easily accessible samples due to COVID-19 impact and surveyor selected easily accessible samples from non-surveyed list. **PD would like to ensure that from next verification appropriate method either random sample generator or excel function shall be used to select random samples from the non-sampled households.**

SECTION E. Calculation of SDG outcomes

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

>> 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 (ER_y) in tCO₂, during each year of the crediting period are expressed as follows:

$$ER_y = B_y * f_{NRB,y} * NCV_{biomass} * EF_{projected_fossilfuel}$$

ER_y = Emission reductions during the year y in tCO₂e

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 (f_{NRB}) values available on the CDM website

NCV_{biomass} = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)

EF_{projected_fossilfuel} = Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO₂/TJ

B_y 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	15	215	13411
3	334	15	319	26896
4	434	20	414	710
6	650	25	625	173

Total

41,189

Therefore,

$$ER_y = B_y * f_{NRB,y} * NCV_{biomass} * EF_{projected_fossilfuel}$$

$$= 41,189 * 93\% * 0.015 * 81.6$$

$$= 46,645 \text{ tCO}_2.$$

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 76 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 outcome

>> 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. 96.5% users reported positive impact in air quality and 88% users reported positive impact on health from smoke related diseases. Also 88% 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 net benefits as difference of baseline and project values or direct calculation for each SDG outcome

>> SDG 13:

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

$$= 46,645 * 0.95 = 44,313 \text{ tCO}_2\text{e (round down value).}$$

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.

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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. Summary of ex-post values of each SDG outcome for the current monitoring period

Item	Baseline estimate	Project estimate	Net benefit
SDG 13	46,645	2,332	44,313
SDG 3	100% users affected with poor indoor air quality, poor waste management (cattle dung) and no employment generation.	Positive impact	96.5% users reported positive impact in air quality and 88% users reported positive impact on health from smoke related diseases. Also 88% users reported improved waste management (cattle dung) due to the project activity.
SDG 7	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.

Vintage-wise emission reduction from the monitoring period:

Period	Baseline Emissions (tCO ₂ e)	Leakage Emissions (tCO ₂ e)	Emission Reductions (tCO ₂ e)
09/05/2019 to 31/12/2019	30,205	1,510	28,694
01/01/2020 to 08/05/2020	16,440	822	15,619

E.5. Comparison of actual value of outcomes with estimates in approved PDD

Item	Values estimated in ex ante calculation of approved PDD	Actual values achieved during this monitoring period
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SDG 13	48,551	44,313
SDG 3	100% users affected with poor indoor air quality, poor waste management (cattle dung) and no employment generation.	96.5% users reported positive impact in air quality and 88% users reported positive impact on health from smoke related diseases. Also 88% users reported improved waste management (cattle dung) due to the project activity.
SDG 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.6. Remarks on difference from estimated value in approved PDD

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

SECTION F. Stakeholder inputs and legal disputes

F.1. List all inputs/grievances which have been received for the project during the monitoring period together with their respective answers/actions

>> *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.*

F.2. List all inputs/grievances from previous monitoring period where follow up action is to be verified in this monitoring period

>> *There was no input/grievance to follow up action.*

F.3. Provide details of any legal contest or dispute 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.