



**Verified Carbon
Standard**

Sustainable Biogas Project for Community Empowerment



Document Prepared by Infinite Solutions



**INFINITE
SOLUTIONS**

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project activity involves operation of 15,100 household biogas plants (biodigestors) in Haryana state, India. All Biodigesters are of 3m³ capacity. The biogas plants are of deenbandhu model. The purpose of the project is to replace the commonly used inefficient wood fired mud stoves technology, with clean, sustainable and efficient biogas. Each household utilizes cow dung to feed the digester for the production of biogas for cooking purpose and heating water. In addition, the hygienic conditions in the rural areas will be improved by an appropriate disposal of organic waste. Further, residue from the bio digesters can be used as organic fertilizer and will improve soil conditions in rural areas leading to increase in soil productivity. Project activity will contribute towards sustainable development by replacing nonrenewable firewood with biogas generated from the bio digesters. Project activity involves bundling of 15,100 plants installed in rural areas of Haryana

The estimated annual emission reductions over a 7-year period from initial project activity instances are 43,885 tonnes of tCO₂/year.

The current monitoring period is from 01/10/2020 to 30/11/2021. The total GHG emission reductions or removals generated in this monitoring period are 51,199 tCO₂.¹

1.2 Sectoral Scope and Project Type

The project falls into sectoral scope 01: Energy industries (renewable - / non-renewable sources), sectoral scope 13: Waste handling and disposal.

The project is not a grouped project.

Methodology: AMS-I.E.: Switch from Non-Renewable Biomass for Thermal Applications by the User - Version 12.0.

1.3 Project Eligibility

The project is a household biogas digester unit project, capturing Greenhouse Gases (GHGs), methane in particular, generated from animal manure in anaerobic conditions and utilizing them via biogas generator units. The biogas plants are of deenbandhu model. This leads to

¹ These estimations are based on the preliminary feasibility study conducted for the project's eligibility to apply voluntary emission scheme. Estimated GHG emission reductions or removals (tCO₂e) are going to be measured in detail and finalized in accordance with the methodologies applied to the project in the final version of this PD which will be submitted to a Designated operational Entity (DoE) for the project's validation.

reduction of greenhouse gas emissions by displacing conventionally used nonrenewable biomass with renewable biogas.

which is eligible under Version 4 of the VCS Standard.

1.4 Project Design

The project is not a grouped project.

Eligibility Criteria

NA

1.5 Project Proponent

Organization name	Green Solutions
Contact person	Mr. Nityanand Joshi
Title	Director
Address	19/1 Rajendra Nagar, St. -1. Dehradun – 248001, Uttarakhand, Dehradun
Telephone	+91-9412127663
Email	greensolutions.mailbox@gmail.com

1.6 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the project	Project Consultant
Contact person	Mr. Jimmy Sah
Title	Chief Operating Officer
Address	Milinda's Manor, 214-215, 2, RNT Marg, Indore, Madhya Pradesh 452001
Telephone	
Email	

1.7 Ownership

The Project is owned by M/s Green Solutions, which is the project participant of the Project. Further the Ownership is demonstrated through Commissioning certificates. It is important to note here that the Mr. Nityanand Joshi, the Director of Green Solutions.

1.8 Project Start Date

The project start date is **01 October 2020**, as the operation start date on which the first biodigester unit has begun reduced emission reductions.

It is noticed here that PP has installed the Biodigesters unit in the Batch process in which the first batch of biodigester has installed in month of October 2020.

1.9 Project Crediting Period

Crediting Period Type: Renewable (Renewable twice for a total of 21 years)

Crediting Period Start date: 01-October 2020

Crediting Period End date: 30- September-2027

(Start and end dates included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
2020 ²	43,885 ³
2021	43,885

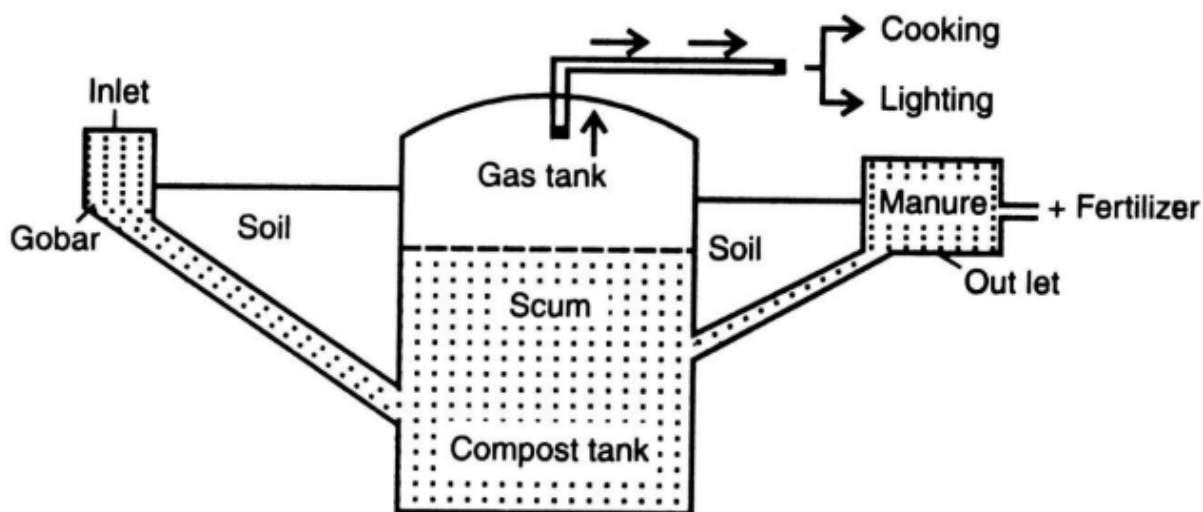
² Year one starts from the date of commissioning of first biodigester unit of this project activity i.e., 01/10/2020.

³ These estimations are based on the preliminary feasibility study conducted for the project's eligibility to apply voluntary emission scheme. Estimated GHG emission reductions or removals (tCO₂e) are going to be measured in detail and finalized in accordance with the methodologies applied to the project in the final version of this PD which will be submitted to a Designated operational Entity (DoE) for the project's validation.

2022	43,885
2023	43,885
2024	43,885
2025	43,885
2026	43,885
2027	43,885
Total estimated ERs	3,07,195
Total number of crediting years	7
Average annual ERs	43,885

1.11 Description of the Project Activity

The household bio-digesters involved in the project activity are Fixed –Dome Digester technology (Deenbandhu model) of 3m³. The major feed cattle dung is mixed with water and fed into the plant through the inlet chamber of the plant. This waste is converted into biogas with the help of a special type of anaerobic bacteria. The digested material, which comes out of the plant, is enriched manure. The main feature of a Deenbandhu biogas plant is the fixed underground digester chamber, constructed with a layer of bricks and an additional layer of cement mortar forming the roof above. Connected to the underground chamber is an inlet tank, through which manure is fed into the plant. The manure then ferments separating the slurry from the methane gas which rises and collects at the top of the digester tank and is released through the gas outlet pipe. The slurry passes into the outlet tank where it is ejected from the plant and can be used as fertilizer on the field.

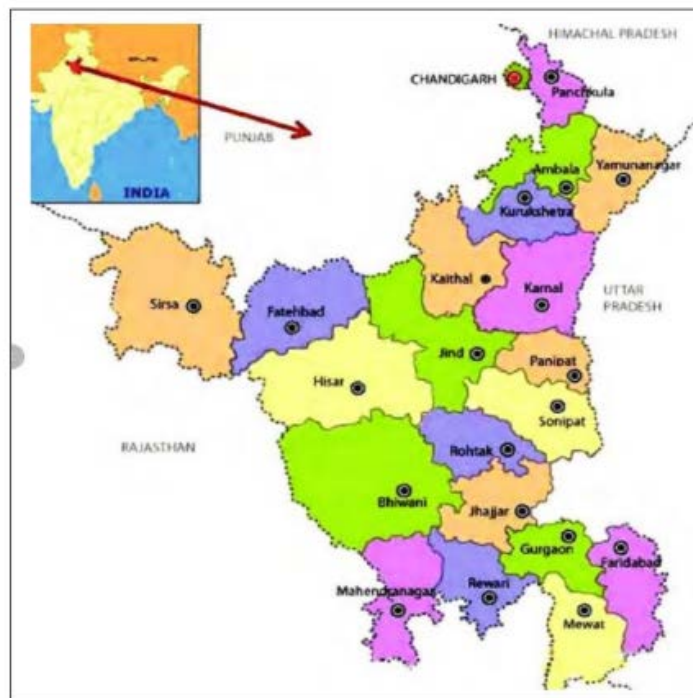


The cattle dung otherwise would have been left to decay in open which leads to methane emissions and by utilizing the same for generation of biogas leads to capture of methane and utilize as fuel. The biogas thus generated replaces firewood that otherwise would have been used for cooking and heating purposes.

1.12 Project Location

The project activity is located in various districts of Haryana, India

State	District	Geo-coordinates
Haryana	sirsa, fatehabad, Hisar, Jinda & Bhiwani	Latitude: 29.0588° N Longitude: 76.0856° E



1.13 Conditions Prior to Project Initiation

The Scenario existing prior to the start of the implementation of the project activity is:

Before the project activity, 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 led to further intensification of the problem. Degradation of forest lands has exacerbated the already existing.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Legislation concerned for this current project activity there is no mandate law and enforcement mentioned as per the state level (Haryana) and country level. This project is voluntary initiatives by the Project Proponent.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The Project has not participated in any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The Project is not rejected by other GHG programs

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits.

1.16.2 Other Forms of Environmental Credit

The Project has no intent to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.17 Additional Information Relevant to the Project

Leakage Management

In accordance with the methodologies applied to the project, no leakage effects are accounted for.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description

Sustainable Development

The project contributes directly to achieving the SDG 3, 7 & 8 in addition to SDG 13. Apart from the SDGs mentioned above, the project also indirectly contributes to SDG 5, 8 & 15. More specifically, the project will have following benefits.

Environmental Benefits: Reduction in firewood consumption and emission of greenhouse gases, forest and biodiversity conservation (SDG#13).

Economic Benefits: Employment creation and saving of health cost (SDG 3,5, 8)

Health Benefits: Sufficiently enhance indoor air quality thereby improving health family members and reducing incidences of smoke and fire related injuries (SDG 3).

Social Benefits: The project will provide affordable and clean fuel compared to baseline scenario (SDG 7)



Further Information

There are no information or incidents that will have bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 SAFEGUARDS

2.1 No Net Harm

There was no harm identified from the project and hence no mitigations measures are applicable.

2.2 Local Stakeholder Consultation

As the project activity has sirsa, fatehabad, Hisar, Jinda & Bhiwani district of Haryana state, India. As the PP distributed the Biodigester in batch manner. The first batch of biodigesters has installed in October 2020. further, **The local stakeholder was informed regarding the meeting on 2nd July 2020.** The following are the stakeholders for the project activity:

- Local community
- Local village administration
- Technology suppliers
- Local vendors

All the stakeholders have been invited through invitation letters and/ or public notice to attend the stakeholders meeting 19th August 2020. reduction in GHG emissions. Mr. Nityanand Joshi (PP) mediated the meeting and started the meeting by welcoming all the stakeholders. He informed about Green solutions UK group and various projects in the area being undertaken and how the area has been benefitted by operation of Biogas projects.

He explained how such Biogas projects help in providing clean energy for cooking and other purpose and thereby help in mitigating impacts due to Global Warming. He briefly explained the gist of VCS standards prerequisites and sustainability projects in the country. Further, he explained the impacts of these projects which lead to providing clean energy, increase in employment opportunities both long term and short term, increased income and thereby leading to improvement in living standard of the people.

The agenda for the meeting is as follows.

- Introduction of the project
- Implementation of Biogas program
- Grievance Mechanism for stakeholders
- Yearly monitoring process for Sustainable development
- Feedback/Questions from Stakeholders

- Question and Answer session.

2.3 Environmental Impact

The project activity is household biogas plants (biodigestors) which is free from any kind of anthropogenic emission. Project activity is not having any negative environmental impacts.

2.4 Public Comments

The project shall be listed for 30 days period. In case any comments are received they shall be incorporated during the validation.

2.5 AFOLU-Specific Safeguards

NA.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user — Version 12.0⁴

3.2 Applicability of Methodology

As per AMS-I.E. Small-scale Methodology Switch from non-renewable biomass for thermal applications by the user Version 12.0: ⁵

Criteria for the applicability of the methodology	Justification why the methodology is suitable for the proposed project activity
1. Project participants are able to show that non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.	A number of studies on bio resource use in Haryana show that non-renewable biomass has been used since 31 December 1989. In particular, Haryana in “Bioresource Status in Haryana ” (2019 – noted that the share of fuel wood in cooking in rural areas increased has sharply increased.

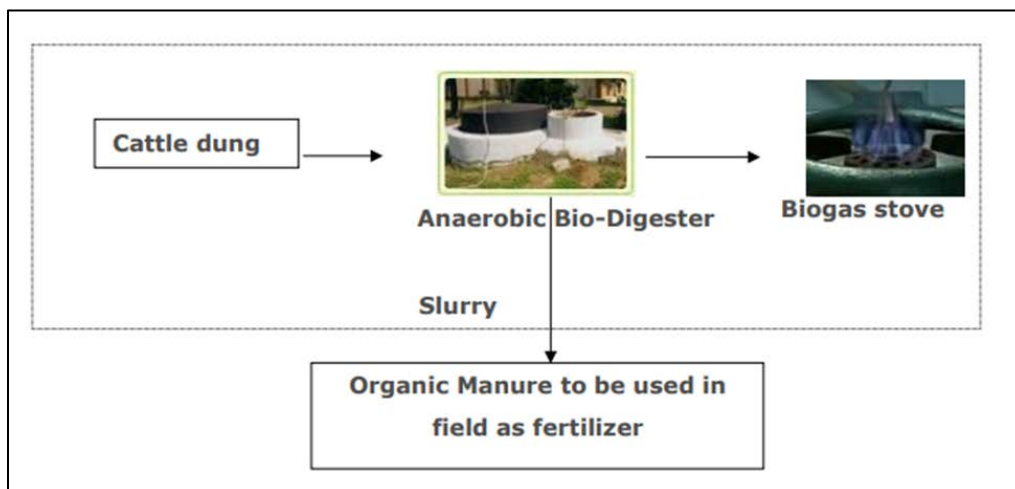
⁴ <https://cdm.unfccc.int/methodologies/DB/BLVN9ULDP1FRUVS2LYWW6WPYN9W78E>

⁵ https://cdm.unfccc.int/filestorage/R/S/J/RSJ8Y23D6ZLXE9WHQ74CBNOVUGPKMI/EB110_repan06_AMS-I.E%20%28v12.0%29_clean.pdf?t=dFZ8cjNqNDYyfdc-G3ThhJ8fqvCsBjZPT92

	Supporting Weblink : https://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-haryana.pdf
2. In the case that technologies using renewable biomass are used under the project activity, this methodology is applicable where all emissions related to processing of biomass are fully accounted for and biomass is sourced from biomass residues and/or a dedicated plantation of the CDM project activity, meeting the following conditions: (a) For projects that use biomass residues, prior to the implementation of the project activity, the biomass residues have not been collected and used but been left for decay and would, in the absence of the project activity, continue to be left for decay; and (b) For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process; and (c) The biomass used by the project facility is not stored for more than one year; and (d) In the case biomass from dedicated plantations are used, the applicability conditions of TOOL16 “Project and leakage emissions from biomass” are satisfied.	This project activity is not registered under the CDM and any other mechanism. However project activity is considered and accounted biomass as a source and the biomass as residue.
3. For electric cookstoves with integrated renewable energy device or with grid connected renewable energy system employing net metering, project	NA

participants shall demonstrate that, on an annual basis, at least 80% of the electricity generated is consumed by the electric cook stoves (i.e. 20% or less of electricity is consumed by other loads connected).	
4. For electric cook stoves, in all cases under paragraph 2(d) above where back-up diesel generators are used, this methodology is only applicable when no more than 1% of total electricity supply occurs from back up diesel generators on an annual basis	NA
5. Under this methodology, emission reductions cannot be claimed only due to fuel-switch aspect and proposed project activities shall introduce new renewable energy-based technologies, i.e. technology switch is also involved.	Project activity involves installation of biodigesters, biogas thus produced will displace the use of nonrenewable biomass to major extent. Therefore, condition is justified.
6. Project participants shall describe in the PDD/PoA-DD the proposed method for distribution of project devices and how the double counting of emission reductions has been addressed, for example, using methods such as unique identifications of product and end-user locations (e.g. programme logo), to prevent double counting of emission reductions from the project devices (e.g. between end users, distributors and producers of stoves, producers of renewable energy, producers of processed renewable biomass).	Each of the bio-digesters shall be allocated a unique id against each end users. End user and project implementer shall have an agreement to avoid any double counting.
7. For project activities introducing bio-ethanol cookstoves, project participants shall demonstrate that the bioethanol cookstoves are designed, constructed and operated to the requirements (e.g. with regard to safety) of a relevant national or local standard or comparable literature. Latest guidelines issued by a relevant national authority or an international organisation may also be used.	NA

3.3 Project Boundary



The project boundary encompasses the sum of all the 15,100 physical geographical sites of all individual biogas plants (digester system, pipe leading to the stove and the stove itself) realized by the project activity.

Source		Gas	Included?	Justification/Explanation
Baseline	Firewood	CO ₂	Yes	The major source of emissions in the baseline due to burning of firewood
		CH ₄	No	Excluded for simplification, this is conservative
		N ₂ O	No	Not applicable for the project activity
		Other	NA	Not applicable
Project	Not applicable	CO ₂	NA	Not applicable
		CH ₄	NA	Not applicable
		N ₂ O	NA	Not applicable
		Other	NA	Not applicable
Leakage	The use/diversion of non-renewable woody biomass saved under the project activity by	CO ₂	Yes	Default option as per methodology to be applied
		CH ₄	No	Not applicable for the project activity
		N ₂ O	No	Not applicable for the project activity
		Other		

Source		Gas	Included?	Justification/Explanation
	non-project			
	households/users			

In addition to the table, provide a diagram or map of the project boundary, clearly showing the physical locations of the various installations or management activities taking place as part of the project activity.

3.4 Baseline Scenario

As per “AMS I.E- Switch from non-renewable biomass for thermal applications by the user, Version 12.0” “the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs. The project activity involves the installation of anaerobic bio digesters for the production of biogas which will replace nonrenewable biomass, used as a fuel for household cooking purposes. A survey has been done to estimate the average firewood consumption prior to project activity at user point following sampling standard as per UNFCCC ‘Sampling and surveys for CDM project activities and programs of activities’ version 07 and guideline ‘Sampling and surveys for CDM project activities and programs of activities’ version 04. Below parameter needed to identify:

- Type of fuel used prior to biogas
- Average fuel consumption before biogas

A simple random sampling approach has been applied as the target population are of homogeneous nature. However, samples are drawn for each size of digester and for each state separately so that, a clear and more reliable result is arrived. A 90% confidence interval and 10% margin of error has been considered to determine the sample size. Expected proportion is considered 90%. As per the baseline survey 100% of the sampled households were using firewood and traditional (mud based/clay based) cookstoves before biogas installation. Therefore, baseline scenario for the project activity is use of non-renewable biomass (firewood) for thermal energy needs (cooking).

3.5 Additionality

The maximum capacity of individual unit (biogas) is 3 m³. Considering a 3 m³ plant can save around 488 kg/month of firewood, the emission reduction as per applied methodology (AMS-I. E, version12.0) for a plant is calculated as below:

$$By = NHH \times (BCBL, HH, y - BCPJ, y)$$

Where,

By = Quantity of woody biomass that is substituted or displaced in tonnes

NHH = Number of households in the project activity, number. It is considered 1 considering a single unit.

$BCBL_{,y}$ = Average annual consumption of woody biomass per household before the start of the project activity, tonnes/household/year. 435 kg/month is considered.

$BCPJ_{,HH,y}$ = If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per household in the pre-project devices during the project activity, tonnes/household/year. It is considered conservatively that entire firewood is replaced.

$$B_y = 1 * (5.22 \text{ ton})$$

$$= 5.86 \text{ ton}$$

Therefore, emission reduction is

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

$$= 5.86 * 52.0 \% * 0.0156 * 64.4$$

$$= 3 \text{ tCO}_2 \text{ (Round down Value)}$$

Therefore, with conservative assumptions, the emission reduction for an individual unit is far below 600 tons of emission reduction per year. Hence, the proposed project activity falls under the 'Positive List' and hence Financial Additionally & Ongoing Financial Need, the project is considered deemed additional and therefore not required to prove Financial Additionally at the time of Design Certification.

3.6 Methodology Deviations

There is no methodology deviation.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As per "AMS I.E- Switch from non-renewable biomass for thermal applications by the user, Version 12.0", the

baseline emissions (BE_y) are calculated as:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

Where,

BE_y = Baseline emissions during the year y in t CO₂e

B_y = Quantity of woody biomass that is substituted or displaced in tones

$f_{NRB,y}$	=	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass (f_{NRB})
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/ton)
$EF_{projected_fossil\ fuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 64.4 t CO ₂ /TJ

By is determined by using option (a) paragraph 15 of the methodology as follows:

“Calculated as the product of the number of households multiplied by the estimate of average annual consumption of woody biomass per household that is displaced by the project activity (tons/household/year)”;

$$B_y = N_{HH} \times (BC_{BL,HH,y} - BC_{PJ,HH,y})$$

Where,

N_{HH} = Number of households in the project activity, number

$BC_{BL,HH,y}$ = Average annual consumption of woody biomass per household before the start of the project activity, tons/household/year

$BC_{PJ,HH,y}$ = If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per household in the pre-project devices during the project activity, tons/household/year

$BC_{BL,HH,y}$ has been determined as per third party survey for the sample of households explained in section B.4 above. The average firewood consumption per month only on firewood is around 488 kg for 3 m³.

Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass ($f_{NRB,y}$) is determined as per methodological tool

‘Calculation of the fraction of non-renewable biomass’ as follows:

The fraction of woody biomass that can be established as non-renewable, is:

$$f_{NRB} = \frac{NRB}{NR + RB}$$

Where,

f_{NRB} = Fraction of non-renewable biomass (fraction or %) NRB = Quantity of non-renewable biomass (t/yr)

RB = Quantity of renewable biomass (t/yr)

Estimation of consumption of woody biomass (H/Bold, total) is done following paragraph 11 (a) of the tool 'Official Statistics'.

As per Forest Survey of India report 2019, Annual fuelwood consumption in household sector and consumption of wood in House construction, Furniture and Agriculture is given below:⁶

Procedure to estimate RB: Renewable biomass (RB) in the country/region/area is estimated using the equation below:

$$RB = \sum (MAI_{forest,i} \times (F_{forest,i} - P_{forest})) + \sum (MAI_{other,i} \times (F_{other,i} - P_{other}))$$

Where:

$MAI_{forest,i}$ = Mean Annual Increment of woody biomass growth per hectare in subcategory i of forest areas (t/ha/yr). For this parameter report from Ministry of Environment and Forest, Govt. of India has been referred⁷.

$MAI_{other,i}$ = Mean Annual Increment of woody biomass growth per hectare in subcategory i of other wooded land areas (t/ha/yr). Same value as $MAI_{forest,i}$ is considered.

$F_{forest,i}$ = Extent of forest in sub-category i (ha). India state of forest report, has been referred for this parameter.

$F_{other,i}$ = Extent of other wooded land in sub-category i (ha).

the f_{NRB} would be:

State	f_{NRB}
Haryana	51.22%

4.2 Project Emissions

As per applied methodology AMS-I. E, version 12.0, project emissions are accounted for below activities:

- CO₂ emissions from on-site consumption of fossil fuels due to the project activity
- CO₂ emissions from electricity consumption by the project activity
- Methane emission from solid waste disposal or wastewater
- Project emissions related to cultivation of feedstock
- Project emissions from transportation

⁶ <http://fsi.nic.in/isfr19/vol1/chapter7.pdf>

⁷ <http://www.moef.nic.in/sites/default/files/Pacific.pdf>

The project activity does not involve any of the above activity and hence, project emissions for the project activity is not applicable.

4.3 Leakage

Leakage emissions (related to the non-renewable woody biomass saved by the project activity) shall be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples).

The following potential source of leakage shall be considered: The use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources.

If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project households/users that is attributable to the project activity, then B_y is adjusted to account for the quantified leakage. Alternatively, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. PP has opted default option, and B_y shall be adjusted with adjustment factor of 0.95 to account leakage.

Emission reductions:

Emission reductions are to be estimated based on the equation below:

$$ER_y = BE_y - PE_y - LE_y$$

4.4 Estimated Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
Year-1	46,195	2,310	0	43,885
Year-2	46,195	2,310	0	43,885
Year-3	46,195	2,310	0	43,885
Year-4	46,195	2,310	0	43,885
Year-5	46,195	2,310	0	43,885
Year-6	46,195	2,310	0	43,885
Year-7	46,195	2,310	0	43,885

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	fNRB,y
Data unit	%
Description	<i>Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass</i>
Source of data	Calculated as per 'tool for calculation of the fraction of non-renewable biomass' version 03
Value applied:	52%
Justification of choice of data or description of measurement methods and procedures applied	In line with the 'tool for calculation of the fraction of non-renewable biomass' version 03.
Purpose of Data	<i>Baseline emissions estimation.</i>
Comments	-

Data / Parameter	NHH
Data unit	<i>Number</i>
Description	<i>Number of households in the project activity in year y</i>
Source of data	As per PP's project database
Value applied:	15,100
Justification of choice of data or description of measurement methods and procedures applied	For each of the participating users all details (name of user, location, size of digester, commissioning date, unique digester ID etc.) are recorded and database is maintained.
Purpose of Data	<i>Baseline emissions estimation.</i>
Comments	-

Data / Parameter	BCBL,HH,y
Data unit	tonnes/household/year

Description	Average annual consumption of woody biomass per household before the start of the project activity
Source of data	Baseline survey
Value applied:	5.22 ton This is a weighted average calculated for all the households
Justification of choice of data or description of measurement methods and procedures applied	Third party survey was conducted to know the firewood consumption pattern. Survey was conducted following UNFCCC sampling standard 'Sampling and surveys for CDM project activities and programs of activities' version 07 and guideline 'Sampling and surveys for CDM project activities and programs of activities' version 04.
Purpose of Data	Baseline emissions estimation.
Comments	-

Data / Parameter	NCVbiomass
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted
Source of data	AMS-I.E, version 12.0
Value applied:	0.0156 TJ/tonne
Justification of choice of data or description of measurement methods and procedures applied	IPCC default for wood fuel
Purpose of Data	Baseline emissions estimation.
Comments	

Data / Parameter	EF _{project_fossil fuel}
Data unit	tCO ₂ /TJ
Description	Emission factor for the substitution of non-renewable woody biomass
Source of data	Default value as per AMS-I.E, version 12.0
Value applied:	64.4 tCO ₂ /TJ
Justification of choice of data or description of measurement methods and procedures applied	Default value as per AMS-I.E, version 12.0 .

Purpose of Data	Baseline emissions estimation
Comments	tCO2/TJ

5.2 Data and Parameters Monitored

Data / Parameter	BCPJ,HH,y
Data unit	tonnes/household/year
Description	Average annual consumption of woody biomass per household in the pre- project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent.
Source of data	Survey
Description of measurement methods and procedures applied	
Frequency of monitoring/recording	At least once every two years (biennial)
Value applied:	Twenty. During survey, it was found that none of the sampled households reported fire wood consumption. Hence, 20 is considered for entire population of biogas plants.
Monitoring equipment	Not Applicable
QA/QC procedures applied	Third party survey conducted covering the monitoring period.
Purpose of data	
Calculation method	Samples are selected considering 95/10 confidence precision and following UNFCCC sampling standard and applied methodology.
Comments	-

Data / Parameter	NHH,y
Data unit	Number
Description	Number of households (biogas system) in the project activity in operational per year

Source of data	Survey
Description of measurement methods and procedures applied	Number of households (biogas system) in the project activity in operational per year.
Frequency of monitoring/recording	At least once every two years (biennial)
Value applied:	As part of third-party survey 390 biogas plants are surveyed and out of 10,446 units total 20 units found un-operational
Monitoring equipment	Not Applicable
QA/QC procedures applied	Third party survey conducted covering the monitoring period. Samples are selected considering 95/10 confidence precision and following UNFCCC sampling standard. Identification of samples are done randomly using random sample generator in worksheet . Details are included in the emission reduction worksheet.
Purpose of data	Baseline emissions estimation
Calculation method	
Comments	

Data / Parameter	Air Quality/ Reduction in health problems
Data unit	Qualitative
Description	Impact on health due biogas use leading to improved air quality
Source of data	Sampling survey/annual usage survey/monitoring survey
Description of measurement methods and procedures applied	Impact on health due biogas use leading to improved air quality
Frequency of monitoring/recording	At least once every two years (biennial)
Value applied:	Positive result compared to baseline scenario.
Monitoring equipment	Not Applicable
QA/QC procedures applied	Third party survey conducted covering the monitoring period. Samples are selected considering 95/10 confidence precision and following UNFCCC sampling standard. Identification of samples are done randomly using random sample generator in worksheet . Details are included in the emission reduction worksheet

Purpose of data	SD impact assessment
Calculation method	
Comments	

Data / Parameter	Time saving (Fuel wood collection and Cooking) and use of the time save
Data unit	Qualitative
Description	<i>Users' perception on time saving due to project (comparing to baseline) and use of the saved time</i>
Source of data	Sampling survey/annual usage survey/monitoring survey
Description of measurement methods and procedures applied	<i>Positive result compared to baseline scenario..</i>
Frequency of monitoring/recording	<i>At least once every two years (biennial)</i>
Value applied:	100% surveyed users positively responded towards saving of time otherwise used in firewood collection and utilize the same for productive works
Monitoring equipment	Not Applicable
QA/QC procedures applied	Third party survey conducted covering the monitoring period. Samples are selected considering 95/10 confidence precision and following UNFCCC sampling standard. Identification of samples are done randomly using random sample generator in worksheet . Details are included in the emission reduction worksheet.
Purpose of data	SD impact assessment
Calculation method	Not Applicable
Comments	

Data / Parameter	Access to affordable and clean energy services
Data unit	Numbers

Description	Number of biogas system operational under the project activity
Source of data	Sampling Surveys/Annual usage survey/Monitoring survey
Description of measurement methods and procedures applied	<i>From the number of sampled biogases plants the result of operational plants are calculated. From the percentage of operation plants in the sampled biogas plants the equal percentage is considered for entire population.</i>
Frequency of monitoring/recording	At least once every two years (biennial)
Value applied:	As part of third-party survey 390 biogas plants were surveyed representing entire population of 10,500. Out of 390 plants 370 units found in operational as per survey results.
Monitoring equipment	Not Applicable
QA/QC procedures applied	Third party survey conducted covering the monitoring period. Samples are selected considering 95/10 confidence precision and following UNFCCC sampling standard. Identification of samples are done randomly using random sample generator in worksheet. Details are included in the emission reduction worksheet.
Purpose of data	SD Assessment
Calculation method	
Comments	

5.3 Monitoring Plan

As per applied methodology AMS-I. E, version 12.0, when biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error requirement shall be achieved for the sampling parameter. On the other hand, when the project proponent chooses to inspect annually, a 90 per cent confidence interval and a 10 per cent margin of error requirement shall be achieved for the sampled parameters.

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).

Sample Size: The calculation of the required sample size for each parameter will be calculated at 95/10 confidence/precision as required for the annual monitoring. The sample size is determined using the Guidelines for Sampling and Surveys for CDM Project activities and program of Activities Ver. V4.0 (EB86, Annex 4).

The minimum sample size to determine number of biogas system in operation using the procedure outlined in para 12 of appendix 1, EB 86 Annex 4, Guidelines for Sampling and Surveys for CDM Project activities and Program of Activities Ver. 4.0.

$$n \geq \frac{1.96^2 N \times p (1 - p)}{(N - 1) \times 0.1^2 \times p^2 + 1.96^2 p (1 - p)}$$

Where:

n= Sample size

N = Total number of biogas system of type *i* installed under the project

p = expected proportion (0.5). Depending on results of surveys the proportion shall be adjusted in next surveys.

1.96 = represents the 95% confidence required

0.1 = represents the 10% relative precision (0.1x0.5=0.05 = 5% points either side of p)

Accordingly, the sample determined for the survey is 370.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	By
Data unit	Tonnes/year
Description	Quantity of woody biomass that is substituted or displaced
Value applied:	51,199.00 for entire 15,100 bio digester plants
Comments	-

6.2 Baseline Emissions

Baseline Emissions:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

Where,

$$B_y = NHH \times (BCBL_{HH,y} - BCPJ_{HH,y})$$

Total population (NHH)	Average firewood consumption (kg/month) BCBL,HH,y	Average firewood consumption (ton/yr)- BCBL,HH,y	By (ton/year)
15,100	488 for 3m	5.86	103,163

BCPj,HH,y (if it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass. per household in the pre-project devices during the project activity, tones/household/year) is considered zero during design certification stage. The same shall be monitored ex-post certification.

$$BE_y = By \times f_{NRB, y} \times NCV_{biomass} \times EF_{projected_fossil_fuel}$$

$$= 103,163 \times 52.0\% \times 0.0156 \times 64.4$$

$$\text{Total } BE_y = 53,894 \text{ tCO}_2$$

6.3 Project Emissions

The project activity does not involve any of the above activity and hence, project emissions for the project activity is not applicable.

6.4 Leakage

By is multiplied by a net to gross adjustment factor of 0.95 to account for leakages. Therefore, Leakage would be 2,695 tCO₂

6.5 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-10-2020 to 31-12-2020	11,639	-	582	11,057
01-01-2021 to 30-11-2021	42,255	-	2,113	40,142

APPENDIX X: <TITLE OF APPENDIX>