Monitoring report form
(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT		
Title of the project activity	Bagepalli CDM Biogas Programme	
UNFCCC reference number of the project activity	0121	
Version number of the monitoring report	01	
Completion date of the monitoring report	09/02/2017	
Monitoring period number and duration of this monitoring period	Monitoring Period Number – 05 Duration of this monitoring period – 01/09/2013 to 31/12/2016	
Project participant(s)	Agricultural Development and Training Society (ADATS)	
Host Party	India	
Sectoral scope(s)	Sectoral Scope I; TYPE I - RENEWABLE ENERGY PROJECTS	
Selected methodology(ies)	AMS-I.E. ver. 5 - Switch from non-renewable biomass for thermal applications by the user	
Selected standardized baseline(s)	NIL	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	62,218 tCO_{2e}	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0 tCO_{2e}	52,088 tCO_{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

(a) **Purpose of the project activity and the measures taken for GHG emission reductions:** The project activity has been to set up 5,500 biogas plants (digesters) of 2 m^3 capacity each for single households. Each household utilises the dung of its cattle to feed the digester for the production of biogas for cooking purpose and heating of hot water. The aim of the project is to replace the commonly used inefficient wood fired mud stoves technology, with clean, sustainable and efficient biogas. Based on Ramachandra, 2007, the fuel wood in the project area is 3.0733 t/family/day. This relatively high consumption compared to energy actually used is due to the low level of efficiency of the traditional stoves.

About 95% of biomass used for cooking and heating water is non-renewable and by burning this firewood, the users were causing the emission of greenhouse gases in the baseline. In the project activity, fuel wood is replaced with renewable biogas, thus avoiding greenhouse gas emissions. Each family was using 3.0733 t of wood/year in the baseline. The CO_2 emission reduction from avoidance of non-renewable wood usage was estimated *ex-ante* at 3.57 tCO_2/family/year.

(b) Brief Description of the installed technology and equipment: The biogas plant (Deenbandhu Model) consists of a digester with a fixed, non-movable gas space. Families load cattle dung through the inlet into the fixed dome made of bricks and cement, located outside the kitchen. Biogas is produced through anaerobic digestion of the dung and stored in the upper part of the digester before being piped to the biogas stove in the kitchen. Users prepare batches of slurry in the mixing tank, before allowing the final mixture to flow into the digester for methane formation phase. The recovered gas is combusted and used for cooking and water heating. The gas pressure displaces the digested slurry into the compensating tank, ready to be used as manure**.**

(c) **Relevant dates for the project activity (construction, commissioning, continued operation periods, etc.):**

Registration of the project activity: 10th December 2005
First Crediting period: 01st September 2006 to 31st August 2013
Second Crediting period: 01st September 2013 to 31st August 2020

This is the fifth monitoring report for the project activity and the first monitoring period for the second crediting period.

The details of the earlier monitoring and verification for the project activity belonging to the First Crediting Period are as follows:

Monitoring Report and Verification	Monitoring Period	Biogas Units Commissioned (Nos)	Net Emission Reductions (tCO_2)	Status
I	1st Sept 2006 to 31st August 2007	4,399	11,761	Issued
II	1st Sept 2007 to 31st July 2009	5,485	35,872	Issued
III	1st August 2009 to 31st July 2011	5,485	33,087	Issued
IV	1st August 2011 to 31st August 2013	5,485	21,118	Issued

This is the fifth monitoring period for the period 1st September 2013 to 31st December 2016 (inclusive of both days). No further biogas units were constructed during the second crediting period. As of 31st December 2016, 5,485 biogas units were constructed and commissioned.

(See *ER Calculations-2013-16.xlsx*). Thus of the 5,500 units which were taken up as the CDM project, only 5,485 units were built, the details of which are as follows:

Taluk	Units Commissioned	Number of Villages
Bagepalli	2,617	125
Chickballapur	647	48
Chintamani	1,001	78
Siddalaghatta	840	58
Gudibanda	380	27
Total	5,485	336

No further units were built and only repair and maintenance of constructed units were done during this monitoring period. Of the constructed units, 80.68% units were operational. The remaining 19.31% units become non-operational at various times of the monitoring period.

The operational domestic biogas units are in continuous operation after installation. The dates of installation for each of the unit is recorded and included in the excel ER calculations sheet (see *ER Calculations-2013-16.xlsx*). In between, due to repair and maintenance, some of the biogas units may not be in operation. The days not operational is recorded for each of the unit.

This information is included in the excel ER calculations sheet (*see ER Calculations-2013-16.xlsx*). The dates on which the problem occurred and the problem was fixed is recorded in the village level monitoring sheets and then entered into the online monitoring solution, which is the basis for emission reduction calculations for operational days of the installed units.

(d) Total GHG emission reductions achieved in this monitoring period

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	1-September - 2013
Carbon credits claimed up to	31-December -2016
Emission reduction/unit/yr after considering leakage (tCO_2)	3.39
Total Biogas Units Commissioned till 31st December 2016	5,485
Total ERs generated for operational biogas units (after subtracting for non-operational days and non-operational units) for 1st September 2013 to 31st December 2016 (tCO_2)	**52,088 tCO_2**

A.2. Location of project activity

>>

a) Host Party(ies): Non-Annex 1 country: India

b) Region/ State/Province, etc: Karnataka State, India.

c) City/Town/Community, etc: Five Taluks of Chickballapur District namely Bagepalli, Chickballapur, Chintamani, Gudibanda and Siddalaghatta.

d) Physical/ Geographical Location:

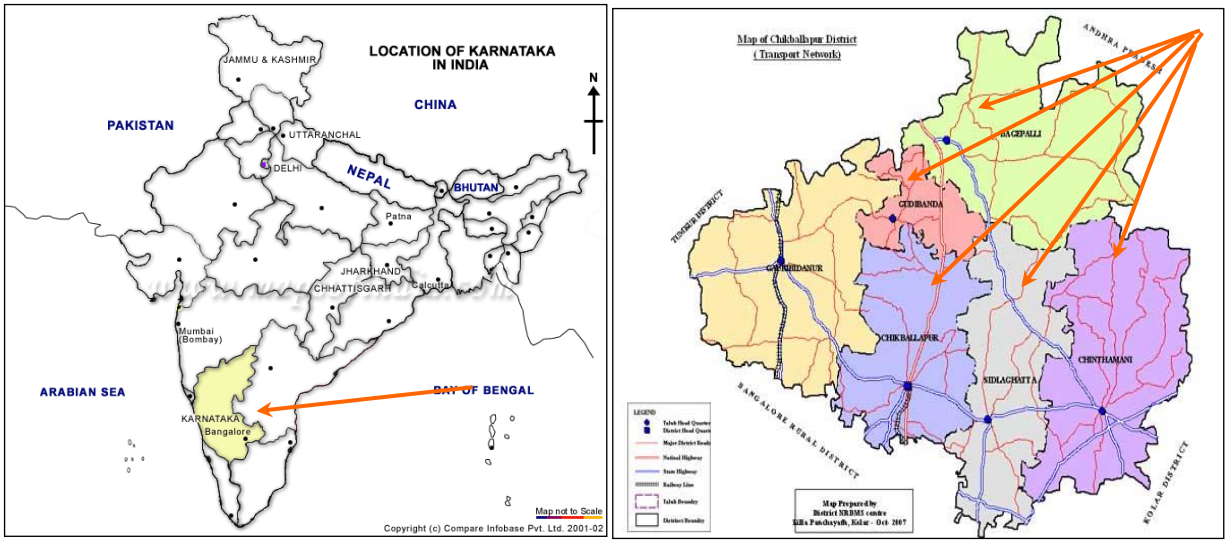

Fig 1: Map showing Karnataka State and the 5 taluks in Chickballapur district where the project is being implemented.

Taluks	Coordinates
Bagepalli	13° 47' 5" North, 77° 47' 35" East
Chickballapur	13° 26' 3" North, 77° 43' 27" East
Chintamani	13° 24' 0" North, 78° 4' 0" East
Gudibanda	13° 40' 10" North, 77° 41' 54" East
Siddalaghatta	13° 23' 17" North, 77° 51' 46" East

The above table gives the GPS co-ordinates of the Taluks where project was implemented.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
India (host)	Private Entity: Agricultural Development and Training Society (ADATS)	No

A.4. Reference of applied methodology and standardized baseline

>>

Sectoral Scope: I; TYPE I - RENEWABLE ENERGY PROJECTS

Methodology: AMS-I.E. ver. 5 - Switch from non-renewable biomass for thermal applications by the user.

A.5. Crediting period of project activity

>>

a) Type : Renewable Crediting Period
b) Crediting Period: Second
c) Start date of the second crediting period: 01/09/2013
d) Length of the crediting period: 7 years - 0 months (from 01/09/2013 – 31/08/2020)

A.6. Contact information of responsible persons/entities

>>

Ram Esteves, Project Director, ADATS
Mukhaem Pasha, Biogas Coordinator, ADATS
Dr. Sudha Padmanabha, CDM Specialist, Fair Climate Network

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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a) Provide information on the implementation status of the project activity during this monitoring period in accordance with the applicable provision for description of implemented registered CDM project activity in the Project standard.

The Bagepalli Biogas CDM project is implemented by ADATS, a 36 year old rural development NGO, for small and poor peasant families in over 336 villages from 5 taluks i.e. Bagepalli, Chickballapur, Chintamani, Gudibanda and Siddalaghatta of Chickballapur District, Karnataka, India.

The project activity is construction of 5,500 biogas plants in the project area. Of these, 5,485 were built during 2006-2009. The units were commissioned between 05-Jan 2006 – 05 Feb 2009. The biogas project involves implementation of the technology, maintenance and monitoring the emission reductions. All the tasks and activities were carried out in 16 designated "Areas[1]" comprising of 336 villages. Each Area Team consists of a Field Worker, Case Worker and Mahila Trainers (The organization chart of ADATS can be seen at http://www.adats.com/misc/Organogram.pdf). Each Area Team is in-charge of the processes in their respective villages.

The construction of biogas plants was done in a phased manner. The details of the units commissioned and operational are as follows:

Taluk	2006	2007	2008	2009	Total
Bagepalli	1,411	1,108	97	01	2,617
Chickballapur	352	293	02	00	647
Chintamani	657	317	27	00	1,001
Siddalaghatta	377	324	139	00	840
Gudibanda	203	165	12	00	380
Total	**3,000**	**2,207**	**277**	**01**	**5,485**

The list of beneficiaries, their unique user ID, village, and other details are provided in the enclosed excel file (*ER Calculations-2013-16.xlsx*). The dates of commission of all the 5,485 biogas plants is listed in the excel sheet. The project activity of 5,485 biogas units was implemented in 336 villages of 5 Taluks, Chickballapur district, the details of which are as follows.

Taluk	Units Commissioned	Number of Villages
Bagepalli	2,617	125
Chickballapur	647	48
Chintamani	1,001	78
Siddalaghatta	840	58
Gudibanda	380	27
Total	**5,485**	**336**

No further units were built and only repair and maintenance of constructed units were done during this monitoring period. Of the constructed units, 80.68% (4716) units were operational at the end of this monitoring period. The remaining 19.31% units become non-operational at various times of the monitoring period.

The operational domestic biogas units are in continuous use after installation. In between, due to repair and maintenance, some of the biogas units were not be in operation for

[1] Area comprises of a group of villages being overlooked by the Area Team

different durations of time. For each of the unit, the days not operational, is recorded. This information is included in the excel ER calculations sheet (see *ER Calculations-2013-16.xlsx*). The date on which the problem occurred and the problem was fixed is recorded in the village level monitoring sheets and then entered into the online monitoring solution, which is the basis for emission reduction calculations for only the operational units and operational days of installed units. The various reasons and days lost due to repairs and maintenance are as follows:

Reason For Breakdown/ Non-Usage	Non-operational biogas days[2] for the monitoring period (1st September 2013 – 31st December 2016)
Non-Operational Units	485,935
Empty and Replaster Dome	283,874
Gobar Dried	150,313
No Cattle	64,508
No Gobar	54,022
Abandoned Unit	34,849
Substrate too Watery	4,054
Repair Stove - 2 Burners	1,942
Rain Water in Dome	807
Replace Stove	268
Total Days Lost	**1,080,572**

The units were repaired as soon as it is informed to the case workers.

b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate.

The biogas plant of Deenbandhu model (Fig 2) consists of a digester with a fixed, non-movable gas space. Users prepare batches of dung slurry in the mixing tank, before allowing the final mixture to flow into the digester for methane formation phase. By utilizing dung substrate in an anaerobic digestion and combustion system, biogas is made available. Biogas is generated by fermentation of cellulose rich organic matter under anaerobic conditions. In anaerobic conditions, the methane-producing bacteria become more active. The anaerobic digestion consists of three stages: I Hydrolysis; II Acid formation and III Methane fermentation. The processes are carried out by two sets of bacteria namely acid forming bacteria and methane formers. The acidogenic phase I is the combined hydrolysis and acid formation stages in which the organic wastes are converted mainly into acetate, and phase II is the methanogenic phase in which methane and carbon dioxide are formed. The recovered gas is combusted and used for cooking and water heating. The chosen methane recovery and combustion system is the time tested Deenabandhu model biogas technology which is well-known in India.

The individual plant consists of a mixing chamber where waste water and cow dung are mixed, an inlet pipe to feed the slurry into the reactor, the main biogas reactor/digester where methane formation/recovery takes place, a slurry outlet pipe, an outlet chamber, and a slurry platform. The outlet pipe and tank are provided to remove the digested/treated sludge or fermentation residue and the slurry platform is provided to maintain the treated slurry in clean condition. A pipe leading from the top of the dome to the stove is provided to

[2] This is the total number of days in the monitoring period for all the biogas units which were under repair and not operational. Thus for a month of 30 days, the total biogas days are 5,485 x 30 days = 164,550

supply biogas to a 2-ring stove inside the house. The cross-section of a biogas unit is as shown in Fig 2.

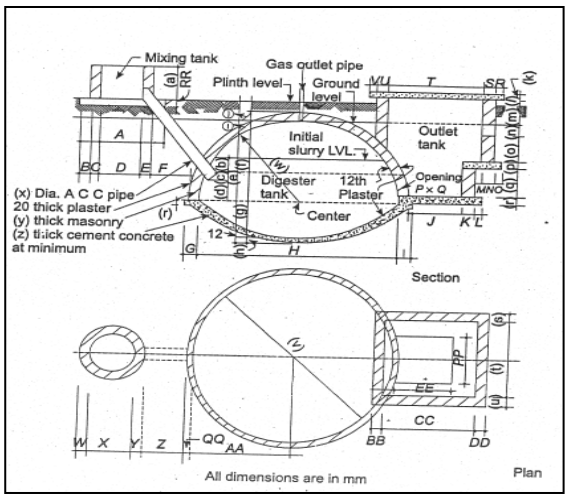
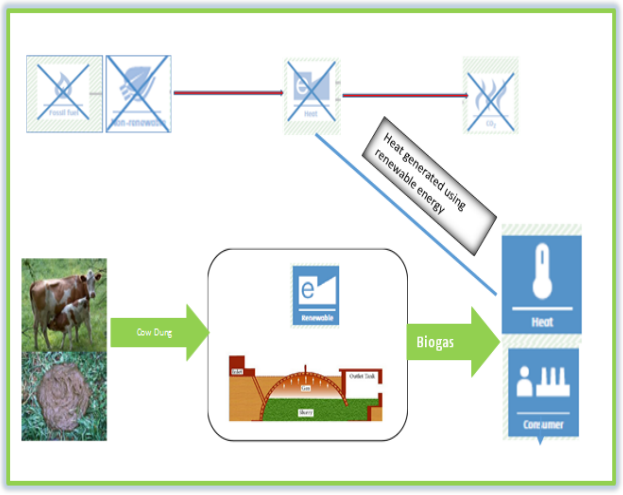


Fig 2: Cross-section of Deenabandhu biogas model



Technical process and equipment of biogas unit

Deenabhandu Model Biodigester

Biogas Stove used for Cooking

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>>
There are no temporary deviations from the registered monitoring plan and applied methodology

B.2.2. Corrections

>> The correction to the PDD is in Section B.7.2. Sampling Plan of the PDD.

The sample size calculations is for the Parameter “Confirmation that non-renewable biomass has been substituted”, which according to the methodology and also mentioned in the PDD needs to be done at 90/30 precision/confidence level.

In the registered PDD, the calculation for sample size is done for 90/10 precision/confidence level. This has been revised in the PDD and recalculated for a 90/30 precision/confidence level. The revised PDD is submitted along with the Monitoring Report.

According to the Standard CDM Project Standard, any corrections to project information of a registered clean development mechanism (CDM) project activity or programme of activities (PoA)

that do not affect the design of the project activity or the PoA do not require prior approval by the CDM Executive Board (the Board). Such corrections include typographical errors, locations, names and numbers of components, etc.

As it is a correction that does not affect the design of the project activity, prior approval is not necessary.

B.2.3. Changes to start date of crediting period

>>

During the first crediting Period the start date was changed from 18th December 2005 – 17th December 2012 to 1st September 2006 to 31st August 2013.

Choice of Crediting Period: Renewable

This is the second crediting period, continued from the end of the first crediting period.

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>

There is not inclusion of a monitoring plan to the registered PDD. The monitoring plan was included at the time of registration.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>

There are no permanent changes from registered monitoring plan and applied methodology.

B.2.6. Changes to project design of registered project activity

>>

There are no changes to project design of the registered project activity.

B.2.7. Types of changes specific to afforestation or reforestation project activity

>>

Not applicable.

SECTION C. Description of monitoring system

>> This section describes the monitoring system followed stepwise for each of the parameters. This includes data collection procedures which includes data generation, aggregation, recording, calculation and reporting.

The organizational structure, roles and responsibilities of personnel, and emergency procedures for the monitoring system is also described in the following sections.

A CDM Team from Fair Climate Network (FCN) and ADATS has been formed for monitoring and verification of all the monitoring parameters. Qualified and trained people monitor the parameters and calculate the emission reductions.

Organization structure

The biogas project involves implementation and maintenance of the technology, monitoring the operation of the units, based on which emission reductions (ER) are calculated. All the tasks and activities are carried out in 16 designated “Areas” comprising of 336 villages. Each Area Team consists of a Field Worker, Case Worker and Mahila Trainers (The organization chart of ADATS can be seen at http://www.adats.com/misc/Organogram.pdf). Each Area Team was in-charge of

the processes in their respective villages. The Area Team transfers as much as this charge to the village level cadre of the Coolie Sangha – i.e. elected Cluster Secretaries, elected Representatives, Village Health Workers and Balakendra Teachers[3]. The construction phase completed, only monitoring, repair and maintenance is being done by the management team. The local masons trained by ADATS help in maintenance and repair of the units and the details of them are maintained in the Infoneeds database. Monitoring of the parameters mentioned below for emission reduction calculations are conducted jointly by ADATS and FCN.

Management

ADATS is the project implementing agency and in-charge of the project activity. ADATS was in charge of construction and now in charge of service and maintenance of the units, and data collection for preparation of monitoring reports for emission reduction calculations. ADATS provides support in the villages through the Bagepalli Coolie Sangha, the CBO.

Suitable project data collection methods: ADATS maintains a list of all the users who have installed plants under this project activity on their InfoNeeds Database. In this database every household with a biogas plant has a unique identification number and updated information taken from the individual plant logbooks concerning monitoring parameters listed below. The number of installed and operating systems is updated monthly at the ADATS office. The differentiation between installed and operating systems is made to control the over-all performance of the project activity. ADATS runs the internal training programmes for supervisors and masons to ensure that both the service and maintenance procedures, and the collection of monitoring data is reliable and transparent. The reports on the problems of the biogas plants are passed on by the local supervisor to the office team and other masons at the ADATS office in case the local supervisor cannot rectify the fault. ADATS provides normative operation and maintenance procedures which must be adopted by families after installation. All information is recorded on paper and electronically that is compiled for the detailed monitoring report, which is sent to the DOE verification team.

Data: The data collected consists of the monitoring data listed - Number of installed 2 m^3 systems, Number of operating 2 m^3 systems, non-usage days. ADATS has a system in place which builds on the current practice already in place and supplements and strengthens it as required.

Number of installed systems: Lists name of household, date of installation, Taluk, village, Coolie Sangha Unit (CSU) membership number and the supervisor responsible for plant service and maintenance.

Number of operating systems: Lists name of household, date of installation, dates of supervisor visit and maintenance activities if any. It will cross reference to the plant log book being maintained for each plant by the supervisor in charge. Non usage days are recorded to estimate emission reductions only for days the systems were operational.

Project performance review: This is carried out on a monthly basis on the basis of the review of the performance standard tests and the monthly aggregated logbooks from all the plants.

Techniques for data interpretation for monitoring and verifying GHG emission reductions with specific focus on technical/efficiency/performance parameters:

ADATS maintains the Bagepalli CDM Biogas Programme project activity in such a way so as to provide sustainable energy services to the communities, thereby leading to GHG reductions. The aim is to establish accurately the operational units and the non-usage units to estimate the emission reductions with accuracy and less uncertainty. This is done by ensuring correct assessment of needs and management practices.

[3] Teachers working at village level who impart informal education to the children.

Review, scrutiny and benchmarking against established norms for monitoring and verification – internal audit for GHG compliance:

This refers mainly to service and maintenance norms. It is ADATS's task to ensure that every plant owner is fully aware of their rights and obligations under this project activity in terms of ensuring 100% functioning of their plant. Intensive user education followed by education and training of supervisors, and rigorous checking of follow-up action at the ADATS office is done to ensure immediate repair of biogas units.

All monitoring and control functions are done as per the internal standards and norms of ADATS. There are no instruments that need calibration**.**

C.2. Monitoring and Data Collection Procedures

Monitoring during pre-commission and commission of biogas units**:** The construction of biogas plants was done in a phased manner between 2006-2009, which was systematically monitored and records maintained on InfoNeeds Database of ADATS. These processes were reported in the earlier monitoring reports during construction phase. Each of the biogas unit has been marked with "ADATS-VELCAN" and the Unique Unit ID number. These evidences validate the construction and commission of the 5,485 biogas plants built in the project area.

The list of biogas users are identified by a User ID, the name of the beneficiary, the CSU membership number, the village and taluk, and other details such as family strength, land holding, caste, etc. (See *ER Calculations-2013-16.xlsx* for details). Other information includes the start date of construction and the date of commissioning.

All activity processes, including financial transactions for construction of biogas units, were digitally monitored using an online intranet solution that is integrated into ADATS's intranet based monitoring system InfoNeeds that tracks various Coolie Sangha activities. Open and transparent online reports are used by everyone – ADATS Staff, Coolie Sangha functionaries and all other secondary stakeholders. Reports can be generated at all levels i.e. Project, Taluk, Area, Cluster, Village and individual Family level. The database is updated as and when Field Staff return from their respective villages.

The information on the daily operating units is gathered by the village health worker or Balakendra teacher from its users on a day to day basis or during the weekly Mahila meetings[4] held in every village. The information is updated to the individual biogas user's monitoring database maintained by ADATS by the case worker on monthly basis.

[4] These Mahila meetings have been held regularly since many years to discuss all issues of coolie sangha

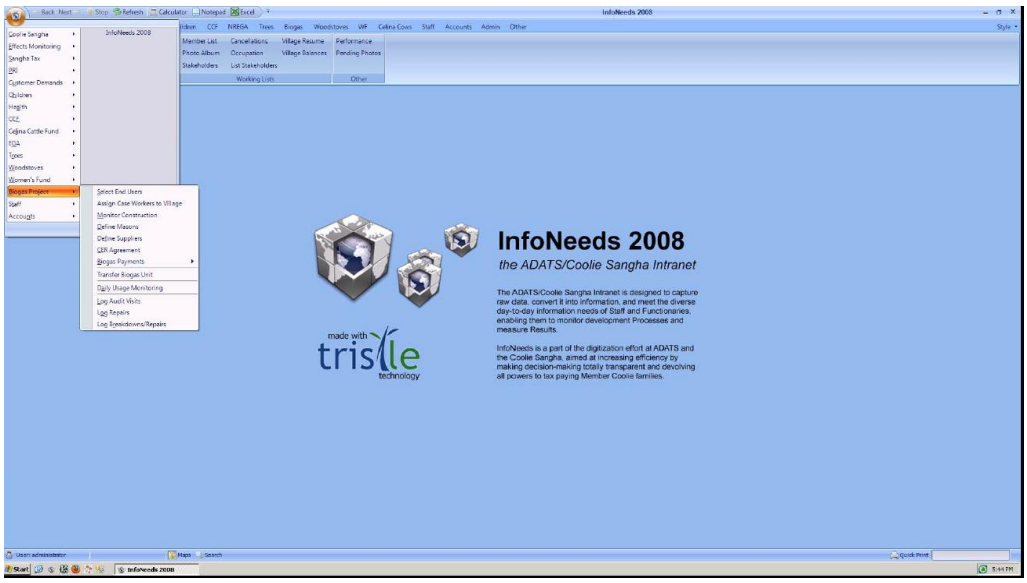
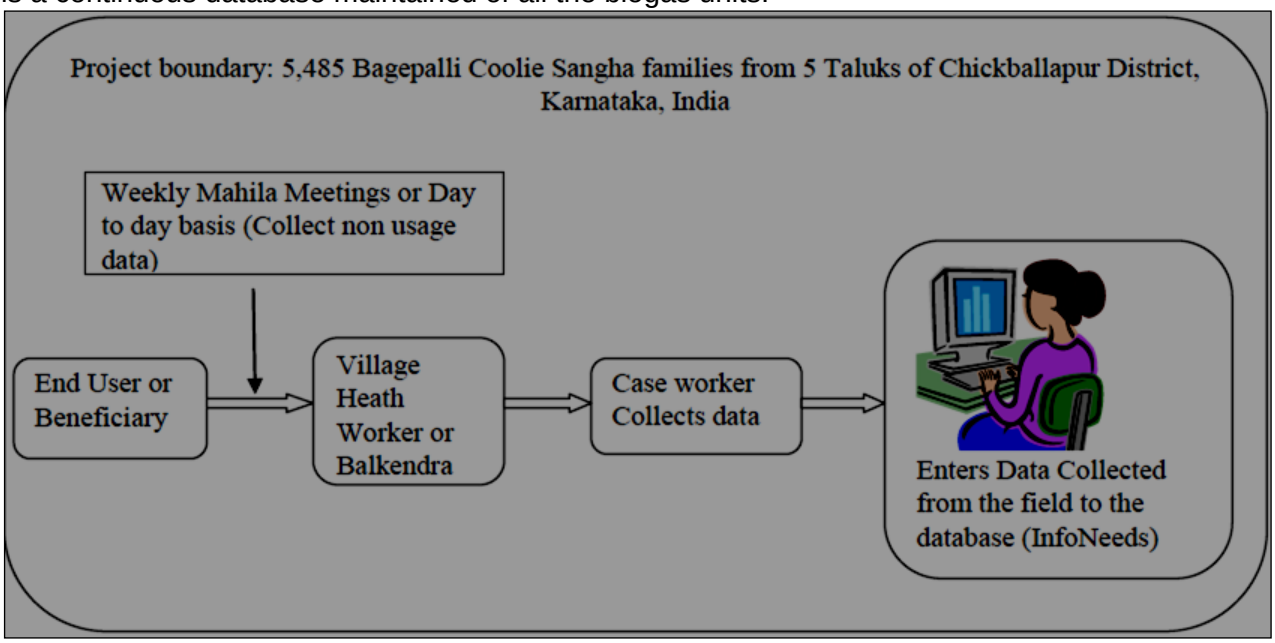


Fig 3: Screenshot of Digital Monitoring System, InfoNeeds.

Non-Usage Days: The staffs log-in the repairs required and the dates from when the units were not operational. The day the unit is repaired, the person attending to it and date is logged-in. These in between days are the non-operational days for the units. The information on biogas non-usage days are recorded either by the Balakendra or Village Health worker from its users on a day to day basis or during the weekly Mahila meetings held in every village. The information is updated to the individual biogas user's data base InfoNeeds by the case worker on regular basis. The end users also communicate through mobile phones to the Balakendra or Village Health workers. Thus there is a continuous database maintained of all the biogas units.



The above diagram describes the arrangement of monitoring the project activity and how the monitored data flows from end user to the system database.

SECTION D. Data and parameters

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

Data/parameter:	**B_y**
Unit	Tonnes/year

Description	Quantity of woody biomass that is substituted or displaced in tonnes
Source of data	Field Survey
Value(s) applied)	3.0733 tonnes/year/family
Choice of data or measurement methods and procedures	Based on a third party study conducted by Ramachandra, 2005
Purpose of data	Estimation of emission reductions
Additional comments	This parameter is fixed for the entire second crediting period

Data/parameter:	**$f_{NRB,y}$**
Unit	
Description	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass
Source of data	Assessment of non-renewable biomass based on data provided by Forest Survey of India, 2011, Ministry of Environment and Forests, India
Value(s) applied)	0.95
Choice of data or measurement methods and procedures	Based on data from State of Forest Report, 2011. Forest Survey of India, Ministry of Environment and Forests, Government of India. The data gives the consumption of fuel wood and production of fuel wood from forests and from trees outside forests. This data is assessed at the state level. Thus the f_{NRB} for Karnataka is applied for the project activity.
Purpose of data	Estimation of emission reductions
Additional comments	This parameter is fixed for the entire crediting period

Data/parameter:	**$NCV_{biomass}$**
Unit	TJ/tonne
Description	Net Calorific Value of Biomass
Source of data	AMS-I.E., Version 5 methodology
Value(s) applied)	0.015
Choice of data or measurement methods and procedures	Default
Purpose of data	Estimation of emission reductions
Additional comments	This parameter is fixed for the entire crediting period

Data/parameter:	**$EF_{projected\_fossilfuel}$**
Unit	tCO_2/TJ
Description	Emission Factor for fossil fuel. Emission factor for substitution of nonrenewable woody biomass by similar consumers.
Source of data	AMS-I.E., Version 5 methodology
Value(s) applied)	81.6
Choice of data or measurement methods and procedures	Based on the methodology, this value represents the emission factor of the substitution fuels likely to be used by similar users on a weighted average basis. It is assumed that the mix of present and future fuels would consist of a solid, liquid and gaseous fossil fuel.
Purpose of data	Estimation of emission reductions
Additional comments	This parameter is fixed for the entire crediting period

Data/parameter:	Diversion of non-renewable biomass saved under the project activity by non-project households
Unit	Tonnes/year
Description	Diversion of non-renewable biomass saved under the project activity by non-project households
Source of data	Based on the methodology By will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages.
Value(s) applied)	B_y x 0.95
Choice of data or measurement methods and procedures	According to I.E, Version 5, B_y can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.
Purpose of data	Calculation of leakage
Additional comments	This parameter is fixed for the entire crediting period. Surveys will not be conducted to determine leakage

D.2. Data and parameters monitored

Data/parameter:	Number of installed 2 m^3 systems
Unit	Number of Units
Description	Number of biogas units installed under the project activity
Measured/calculated/default	Measured. Monitored on a daily basis and entered into the monitoring database. The units have been constructed during the first crediting period.
Source of data	5,485
Value(s) of monitored parameter	The construction processes were monitored on a day to day basis and database maintained from its initiation to completion dates for each of the biogas unit. Thus the start date of each of the unit installed in fixed for each of the unit. In case of replacement of any unit due to demolition will be recorded and the loss days accounted for. This could be for the same user or new users, in which case the baseline is the users were using fuel wood. A new end user agreement will signed with them and recorded.
Monitoring equipment	All the units have been installed for the project activity during the first crediting period.
Measuring/reading/recording frequency:	All the units have been installed for the project activity during the first crediting period.
Calculation method (if applicable):	Not applicable
QA/QC procedures:	All activity processes, including financial transactions for construction of biogas units, are digitally monitored using the online intranet solution that is integrated into ADATS's intranet based monitoring system InfoNeeds. This provides verification for the construction of biogas units. All data will be archived and stored throughout the crediting period and an additional 2 years.
Purpose of data:	Estimation of emission reductions
Additional comments:	ERs are calculated for only the installed and operational biogas units.

Data/parameter:	Number of biogas plants operating
Unit	Number
Description	Number of plants operating in year
Measured/calculated/default	Measured

<table>
<tr><td>Source of data</td><td>Log books maintained and entered in the digitized monitoring database for biogas units operating</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>80.68% of 5,485 at the end of the monitoring period are operational units. Alongside, the operational units are also monitored for the days non-operational, which is computed and included into the ER calculations sheet. The summary of the same is as follows:

<table>
<tr><th>Reason For Breakdown/ Non-Usage</th><th>Non-operational biogas days[5] for the monitoring period (1st September 2013 – 31st December 2016)</th></tr>
<tr><td>Non-Operational Units</td><td>485,935</td></tr>
<tr><td>Empty and Replaster Dome</td><td>283,874</td></tr>
<tr><td>Gobar Dried</td><td>150,313</td></tr>
<tr><td>No Cattle</td><td>64,508</td></tr>
<tr><td>No Gobar</td><td>54,022</td></tr>
<tr><td>Abandoned Unit</td><td>34,849</td></tr>
<tr><td>Substrate too Watery</td><td>4,054</td></tr>
<tr><td>Repair Stove - 2 Burners</td><td>1,942</td></tr>
<tr><td>Rain Water in Dome</td><td>807</td></tr>
<tr><td>Replace Stove</td><td>268</td></tr>
<tr><td>Total Days Lost</td><td>1,080,572</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>In every village, the women volunteer will monitor the biogas units that are non-operational. The days other than that non-operational will determine the biogas units which are operational.</td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>The data of non-operational units are done on a regular basis as and when a unit is dysfunctional. As and when biogas units are not operational, it is recorded. The remaining days are considered operational.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>This parameter is monitored and there is no calculations.</td></tr>
<tr><td>QA/QC procedures:</td><td>Log books and digitized database will be checked regularly by project staff and CDM coordinator.</td></tr>
<tr><td>Purpose of data:</td><td>Estimation of emission reductions</td></tr>
<tr><td>Additional comments:</td><td>Though the methodology requires monitoring this parameter biennially, it is done on a day to day basis. This is to ensure regular energy supply to the rural households through continuous monitoring and repairs to decrease downtime.</td></tr>
</table>

Data/parameter:	**Confirmation that non-renewable biomass has been substituted**
Unit	
Description	Confirmation that non-renewable biomass has been substituted
Measured/calculated/default	Measured
Source of data	Based on Sample Survey

[5] This is the total number of days in the monitoring period for all the biogas units which were under repair and not operational. Thus for a month of 30 days, the total biogas days are 5,485 x 30 days = 164,550

Value(s) of monitored parameter	Based on the stratified sample survey, the extent of replacement of non-renewable fuelwood is complete. Few households use renewable biomass of which the major species are *Lantana camara*, which is a wide spreading weed and forms dense thickets, fallen twigs and branches of *Pongamia pinnata, Eucalyptus*, dried twines of grape plant and crop residue of dried maize stalks, Red gram stalks, Groundnut shells, Coconut waste and Mulberry stalks. As per Annex 18 of the EB 23, this is considered renewable. The non-renewable wood previously used by the beneficiaries is the costliest in terms of time spent to collect or purchase and preparation of the fuel for usage and storage. Thus, by providing a new energy facility to the user which decreases the need for additional fuel usage, the first wood to be replaced is the non-renewable one. Also, renewable wood is available nearer to their homes and fields with less effort and is the first alternative by the user. Thus 100% of non-renewable wood and kerosene is being completely replaced by biogas under the project activity.
Monitoring equipment	A household level sample survey was conducted to confirm that non-renewable biomass has been substituted.
Measuring/reading/recording frequency:	Annual Stratified Sample Survey
Calculation method (if applicable):	This survey was done annually for a statistically determined number of households at 90/30 precision confidence level. All data is archived and stored throughout the crediting period and an additional 2 years.
QA/QC procedures:	
Purpose of data:	Confirmation of replacement of non-renewable biomass.
Additional comments:	-

Data/parameter:	**Non-usage days of installed and operational biogas plants**
Unit	Days
Description	Usage of non-renewable biomass in case of non-performance of biogas Units
Measured/calculated/default	Measured
Source of data	The days not used from the daily monitoring report for each of the unit done at the village level and data maintained on the digitized monitoring database.
Value(s) of monitored parameter	
Monitoring equipment	As and when the biogas units are not functional, the beneficiaries report to the village level women volunteer, who in turn reports to the Case Worker of the project for the repair of the unit. A log book is maintained for the reason of non-function and days under repair. The data is entered into the monitoring solution for each of the unit. For the monitoring period, the operational days of installed biogas units is calculated by subtracting the non-usage days. The emission reduction is estimated only for operational days.
Measuring/reading/recording frequency:	It is monitored on a day to day basis by the Balakendra/Village Health Workers, which is entered into the monitoring solution for all the biogas units.
Calculation method (if applicable):	To calculate emission reductions for only the operational days for each biogas unit.
QA/QC procedures:	
Purpose of data:	Estimation of emission reduction

Additional comments:	The objective to monitor the non-functional days is to ensure prompt operation and maintenance of the units so that the rural communities can continuous use biogas and are rid of drudgery they are facing using traditional biomass cook stove.

D.3. Implementation of sampling plan

>> The various parameters that need to be monitored as described in section D.2. are:
(i) Biogas units constructed
(ii) Number of biogas plants operating
(iii) Non-usage days of biogas plants
(iv) Confirmation that non-renewable biomass has been substituted

The parametes (i), (ii) and (iii) was monitored for all the biogas plants constructed and in operation. Only parameters (iv) was monitored based on sample survey.

Objectives and Reliability Requirements: The objective of the sampling effort is to determine or confirm that non-renewable biomass has been substituted with 90/30 confidence/precision during the crediting period. The survey was conducted yearly once through stratified random sample survey. The population is homogeneous in terms of cooking patterns and socio-economic strata. The biogas units implemented in the region is also of single type – 2 cum deenabhandu model. But to capture the data from all the taluks in which the project has been implemented, stratified random sample survey was conducted. Here each of the taluks, Bagepalli, Chintamani, Chickballapur, Gudibanda and Sidlaghatta are the strata.

Target Population: The target population is the rural households for which biogas has been constructed and operational in the 5 taluks of Chickballapur District, Karnataka, India.

Sampling Frame: The sampling frame was the complete listing of all the rural households for which biogas was built under the project activity in the 5 taluks, Chickballapur District, Karnataka State. Each of the household has a unique identify number with all the required details of the family.

Sampling Method: The sampling method chosen for the project area is simple random sampling

Sample Size: The sample size was determined use the equation

$$n \geq \frac{1.645^2 NV}{(N-1)\times 0.3^2 + 1.645^2 V}$$

Where:
n Sample size
N Total number of households (5,485)
p The proportion (0.80)
1.645 Represents the 90% confidence required
0.3 Represents the 30% relative precision

Substituting the values for the project activity,

$$V = \frac{0.80\times(1-0.80)}{0.80^2} = 0.25$$

$$n \geq \frac{1.645^2 \times 5845 \times 0.25}{(5845-1)\times 0.3^2 + 1.645^2 \times 0.25} = 7.51 \approx 8$$

Therefore the required sample size is at least 8 households. Assuming a response rate of only 80%, the number of households scaled up is 8/0.8 = 10 households. The sample was drawn at random from the sampling frame. The number of households sampled was apportioned accordingly to the 5 taluks of Chickballapur District.

Apportioning to all the Taluks, the number of households to be sampled is as follows:

Mandals	Total Number of Households
Bagepalli	$\frac{2,617}{5,485} \times 10 = 5$
Chickballapur	$\frac{647}{5,485} \times 10 = 2$
Chintamani	$\frac{1,001}{5,485} \times 10 = 2$
Siddalaghatta	$\frac{840}{5,485} \times 10 = 2$
Gudibanda	$\frac{380}{5,485} \times 14 = 1$
Total	**12**

The villages were selected using randomly using random sample selection in Microsoft excel and again random selection of households in each village. The details of the survey and the field studies conducted for the study is as follows:

Taluk-wise details of villages and end-user households sampled

Taluks	2013-14		2014-15		2014-15	
	No. of Villages	No. of HHs	No. of Villages	No. of HHs	No. of Villages	No. of HHs
Bagepalli	6	26	8	29	9	29
Chickballapur	4	14	3	12	3	12
Chintamani	7	17	5	19	7	18
Gudibanda	1	4	1	4	2	4
Siddalaghatta	6	18	5	18	6	19
Total	**24**	**79**	**22**	**82**	**27**	**82**

The details of the villages visited and the number of households visited for the survey is as follows:

Year wise details of the villages and number of households sampled

Taluks	2013-14		2014-15		2015-16	
	Village	No. of HHs	Village	No. of HHs	Village	No. of HHs
Bagepalli	Lagumaddepalli	3	Pedduru	6	Pedduru	6
	Somanthapura	3	Kothapalli	5	Kothapalli	5
	Billuru MV	6	Nadimpalli	3	Nadimpalli	3
	Madhalakana	5	Marappagaripalli	3	Marappagaripalli	3
	Masanapalli	3	Polakuntlapalli	4	Polakuntlapalli	4
	Madepalli	6	Krishnapura	4	Krishnapura	4
			Bandolaplli	2	Bandolaplli	2
			G.Cherloppali	2	G.Cherloppali	2
Chickballapu	Uppuguttahalli	3	489 Suddahalli	4	Kadiseeeganahalli	4

r	Mannarpura	4	Bandahalli	4	Karaganpalya	3
	Beeraganhalli	3	Reddygollarahalli	4	Yellagalahalli	5
	Kondenahalli	4	Batharahalli	4		
Chintamani	Yerramareddipalli	3	Burudugunte HC	4	Korlaparthi HC	2
	Y Kapalli	4	Doddakattigenahalli	3	Maliapura	4
	Soonnapagutta	2	Kadirepalli Cross	4	Munganahalli MV	3
	Madamangala	2	Kondavenkapalli	4	Sheetinayakanahalli	2
	Gudarlahalli HC	2			Talarolapalli	2
	Basavapura	2			Yasagalahalli	4
	Chikka kattigenahali	2			Yerramareddipalli	1
Gudibanda	Chikka Kurubarahalli	4	Cholashettihalli	4	Thirumani	2
					Yellodu	2
Siddalaghatta	Davyappagudi	2	Karipalli B	2	Bayapanahalli	4
	Devaramullur	4	Marapanahalli	3	Kadirinayakanahalli	4
	Gadminchnahalli	4	Peddabandaragatta	5	Nallacheruvupalli	2
	Gundlapalli	2	Thurakashanahalli	4	Somanahalli	2
	K.Muthadakahalli	4	Valasahalli	4	Thimmasandra	2
	Palicherula MV	2			Vemgal	5
Total		**79**		**82**		**82**

Field Measurements: The variable recorded/measured on field was Confirmation that non-renewable biomass has been substituted. A household level questionnaire was designed to collect information for the parameter of interest. The frequency of measurement was once a year during the monitoring period.

Quality Assurance/Quality Control: The QA/QC procedure is to achieve good quality data through field measurements. The household level questionnaire was designed and field tested before administering the actual questionnaire survey. The team was trained to conduct the survey. Oversampling was done to replace non-respondents, if any. The data collected was entered, checked and verified further for any typographic mistakes.

Analysis: The data entry was done in Microsoft excel sheet. The data was cross checked with the filled in questionnaire as QA/QC procedure. The data was analyzed for the parameter.

Implementation Plan: The implementation of sampling effort was done by the NGO in consultation with CDM Team of Fair Climate Network (FCN). The FCN has the skill and resources to implement the sampling procedure. The team is experienced with rural energy CDM projects implemented for the rural poor for more than 10 years. The collected data was analyzed by the FCN for inclusion in the monitoring report.

Demonstration on whether the required confidence/precision has been met: As the survey was to determine if non-renewable biomass has been substituted, there are no quantitative data to demonstrate confidence/precision levels.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

According to the methodology, there are no project emissions. According to the methodology, Para 4, the specific equations for calculations of Baseline emissions and Project emissions is not provided, but only for Emissions Reductions as follows:

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

Where

ER_y	Emission reductions during the year *y* in tCO_2e
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
$NCV_{biomass}$	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 tCO_2/TJ

Baseline Emissions

The parameters and values for baseline emissions are explained in Section B.4.

Baseline Emissions for the Monitoring Period (1st Sept 2013 to 31st Dec 2016)		
Activity Data	**Value**	**ID Ref**
Quantity of Biomass that is substituted (t) for the monitoring period	47,153.33	B_y
Fraction of NRB	0.95	$f_{NRB, y}$
NCV Biomass (TJ/t)	0.015	$NCV_{biomass}$
Emission factor (tCO_2/TJ)	81.6	$EF_{projected\_fossilfuel}$
Emission Reductions (tCO_2 for 5,485 families after non-operational units and non-operational days of operational units) for the monitoring period for the monitoring period	**54,829**	***ER***

E.2. Calculation of project emissions or actual net GHG removals by sinks

>> There are no project emissions in the project activity

E.3. Calculation of leakage

>> According to Para 10 and 11 of the methodology:

Leakage 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:

(a) *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.*

If the equipment currently being utilised is transferred from outside the boundary to the project boundary, leakage is to be considered.

There was no transfer of equipment being currently utilized transferred from outside the project boundary to the project boundary. All the biogas units were constructed at site. Thus leakage from equipment transfer need not be monitored.

Leakage relating to non-renewable biomass B_y is addressed by multiplying net to gross adjustment factor of 0.95 to account for leakages, in which case surveys was not conducted as per the methodology AMS-I.E, Para 10.

After applying the leakage factor, the emission reduction calculations are as follows:

Emission Reduction for the Monitoring Period (1st Sept 2013 to 31st Dec 2016)		
Activity Data	**Value**	**ID Ref**
Quantity of Biomass that is substituted (t/yr) per family after applying leakage factor (By * 0.95)	44,795.66	B_y *x 0.95*
Fraction of NRB	0.95	$f_{NRB, y}$
NCV Biomass (TJ/t)	0.015	$NCV_{biomass}$
Emission factor (tCO_2/TJ)	81.6	$EF_{projected\_fossilfuel}$
Emission Reductions after considering leakage (tCO_2 for 5,485 families after non-operational units and non-operational days of operational units)	**52,088**	

Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	**54,829**	**0**	**2,741**	**0**	**52,088**	**52,088**

E.4. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions(t CO_2e)	62,218	52,088

E.5. Remarks on difference from estimated value in registered PDD

>> The emission reductions are lesser than that projected in the PDD as only 5,485 are commissioned. Of the constructed units, only 80.68% units were operational, thereby decreasing the anticipated emission reductions. Also, as detailed in section B.1, many units were under repair and maintenance leading to non-operational biogas days during the monitoring period. This has led to a decrease of 15.17% biogas usage days and 16.28% of expected emission reductions for the monitoring period.

These factors has accounted for lesser emission reductions to that estimated in the registered PDD.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Person/entity responsible for completing the CDM-MR-FORM
Organization name	**Agricultural Development and Training Society (ADATS)**
Street/P.O. Box	ADATS Campus
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Document information

Version	*Date*	*Description*
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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