



**Monitoring report form
(Version 03.1)**

Monitoring report

Title of the project activity	Social Education and Development Society (SEDS) Biogas CDM project for the rural poor
Reference number of the project activity	CDM Reference No: 3541
Version number of the monitoring report	02
Completion date of the monitoring report	08/04/2013
Registration date of the project activity	09/09/2010
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 1 Duration of this monitoring Period: (first and last days included (01/01/2011 - 31/12/2012))
Project participant(s)	1. Social Education and Development Society (SEDS)
Host Party(ies)	1. INDIA
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: Type I - Renewable Energy Projects Applied Methodology: I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User, version 01, EB 37
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	24,396 tCO ₂
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	6,043 tCO ₂

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 purpose of this biogas CDM Project activity is to set up 5,000 biogas plants (digesters) of 2 m³ capacity each for single households in 5 Mandals of Anantapur District. Each household has installed a 2 m³ biogas plant and feed cattle dung into the anaerobic digester for the production of biogas for cooking purpose and heating water. The aim of the project is to replace the commonly used inefficient wood fired mud stoves technology with clean, sustainable and efficient biogas and in this way replace non-renewable biomass with biogas for cooking and water heating.

Anantapur is a drought prone region, with very low forest area. Nearly 90% of 3.37 t of biomass used per family per year for cooking and heating water in the District is non-renewable. By burning this firewood, the users were causing emission of greenhouse gases in the baseline.

In the project activity, fuel wood is replaced with renewable biogas, thus avoiding greenhouse gas emissions of the baseline.

(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 chamber into the fixed dome made of bricks and cement, located outside the kitchen. Biogas is produced through anaerobic digestion of 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 (e.g. construction, commissioning, continued operation periods, etc.)

This is the first monitoring report for the period 1st January 2011 to 31st December 2012.

The project was registered as a CDM project on 9th Sept 2010 and the crediting period started from 1st January 2011. The project was implemented after forward carbon funds were secured. The start date of construction of the first biogas unit is 4th January 2011. The first biogas unit was commissioned and started use from 4th March 2011.

From then, up to 31st December 2012, 2,403 units have been commissioned and 786 are under construction. All the 2,403 units commissioned are in continued operation. Of course, some the units were under repair and maintenance for different periods of time. The downtime for each of the unit has been recorded, and emission reductions has been discounted for days not used.

As of 31st December 2012, of the 5,000 biogas units that needs to be constructed, 2,403 units are constructed. The status of the project as on 31st December 2012 is as follows:

Mandal	Details of Biogas Units Commissioned		Details of Biogas Units under Construction		Total No. of villages**
	No. of Units	No. of Villages	No. of Units	No. of Villages	
Chillamathur	350	28	114	25	30
Gorantla	403	37	86	22	38
Penukonda	196	23	88	17	24
Roddam	886	44	226	39	48
Somandepalli	568	38	272	35	41
Total	2,403	170	786	138	181

**It includes total number of villages in which biogas units are commissioned and under construction

The 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 *SEDS_ER_Calculations.xls*). 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 *SEDS_ER_Calculations.xls*). 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 monitoring solution, which is the basis for ER calculations excluding non-operational days of the installed units.

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

The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of first monitoring period	01-Jan-2011
Carbon credits claimed up to	31-Dec-2012
Total Biogas Units Commissioned till 31 st December 2012	2,403
Total ERs generated (after subtracting for non-operational days) and accounting for leakage	6,043
ERs generated for the period 1st January 2011 to 31st December 2012	6,043

A.2. Location of project activity

- (a) Host Parties: India
- (b) Region/State/Province: Andhra Pradesh
- (c) City/Town/Community: Anantapur District, 5 Mandals – Penukonda, Roddam, Somandepalli, Gorantla and Chilamathur.
- (d) Physical/Geographical location:

Anantapur District lies between 13'- 40' and 15'-15' Northern Latitude and 76'-50' and 78'-30' Eastern Longitude. It is bound by Bellary, Kurnool District on the North, Cuddapah and Kolar Districts of Karnataka on South East and North respectively. The coordinates of the Mandals are as follows:

Mandals	Co-ordinates
Penukonda	14° 05' 00" North, 77° 35' 00" East
Roddam	14° 06' 00" North, 77° 26' 00" East
Somandepalli	14° 00' 44" North, 77° 36' 30" East
Gorantla	13° 59' 21" North, 77° 46' 13" East
Chillamathur	13° 34' 25" North, 80° 00' 12" East

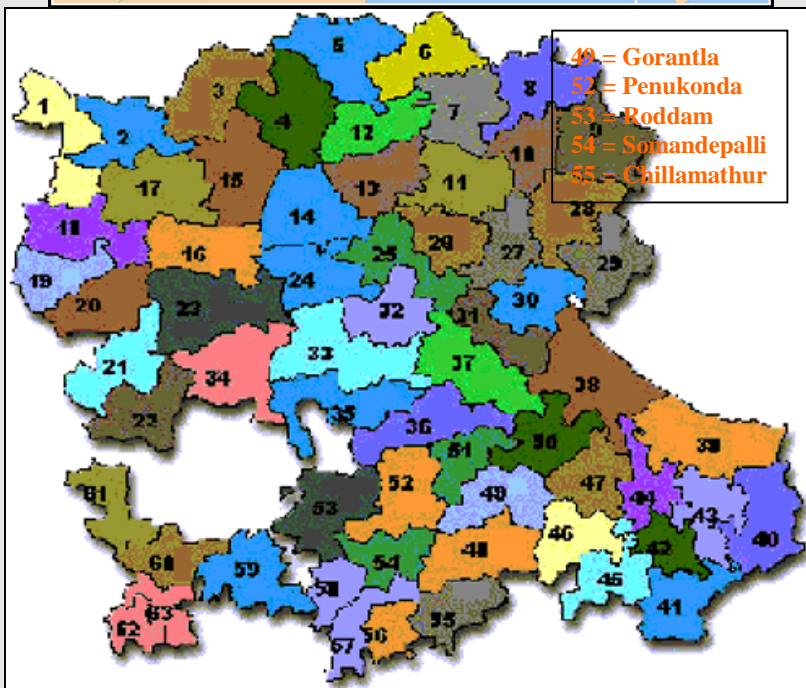


Fig 1: Map of Andhra Pradesh with an arrow indicating the location of Anantapur district and Anantapur district showing the Mandals in which the project will be implemented

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 if the Party involved wishes to be considered as project participant (Yes/No)
INDIA (host)	Private entity: Social Education and Development Society (SEDS)	No

A.4. Reference of applied methodology

- (a) TYPE I - RENEWABLE ENERGY PROJECTS, I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User, Version 01, EB 37.

A.5. Crediting period of project activity

- (a) Type: Renewable
 (b) Start Date: 01/01/2011
 (c) Length of the crediting period: 7 yrs – 0 months (01 Jan 11 - 31 Dec 17)
 (d) Crediting Period corresponding to this monitoring Period: 01/01/2011 – 31/12/2012

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The biogas plant (Deenabandhu 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 will be provided to supply biogas to a 2-ring stove inside the house.

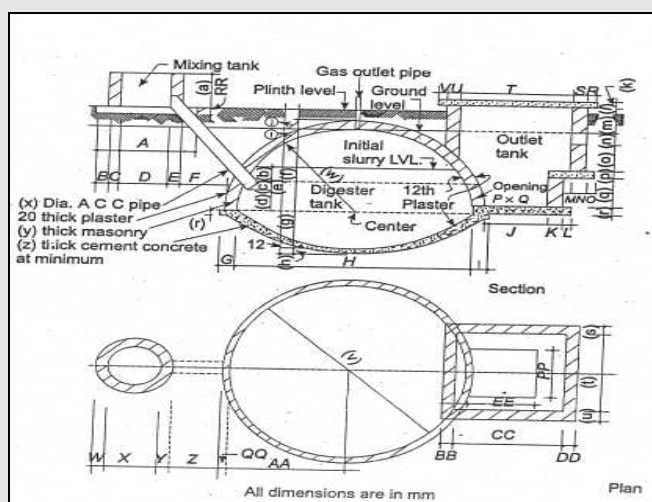
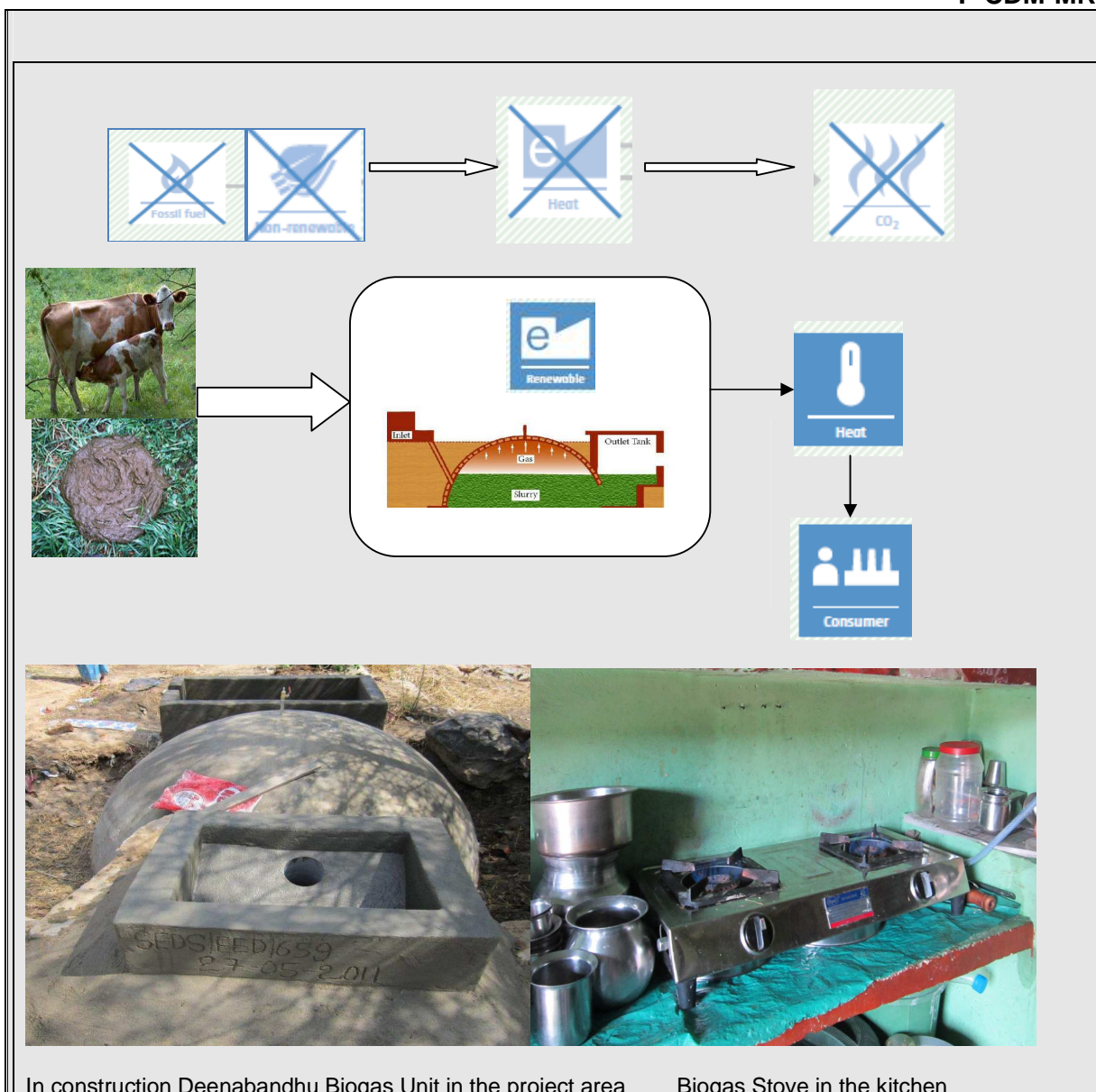


Fig 2: Diagram of a cross-section of the Deenabandhu 2 m³ biogas model



In construction Deenabandhu Biogas Unit in the project area Biogas Stove in the kitchen

Fig 3: Technical process and equipment of biogas unit

According to the registered PDD, after registration of the project and securing CER forward finance funding, the project was to be implemented in phases in 2 years. During the first year 2,500 units was to be built followed by another 2,500 in the second year, totaling to 5,000 biogas units. During implementation, there are many practices on-ground issues as detailed below, due to which there is a delay in construction of the units:

- Though the project got registered on 9th September 2010, after signing the ERPA and obtaining forward funding, the actual construction started only by 4th January 2011.
- Though the end users were identified before the implementation of the project activity, it could not be build for many end users, the main reason being, (a) migrations of families to neighbouring villages, (b) unsuitable site conditions such as rocky or sandy, which prevents excavation of land to construct the biogas dome, etc. For many households, the excavation had to be abandoned mid-way as the site conditions were not conducive. End users have to be identified who had cattle, space to build them and the site conditions are suitable for excavation and construction of biogas units.
- Thus, interested end users within the project boundary of the rural regions in 5 Mandals in Anantapur District are being identified and provided with biogas units.

- Training programs are being conducted for masons, Village Level Volunteers, Biogas Case Workers and the end users about the project activity before implementation in a village. Trained masons to build biogas left in between, thus slowing the progress of construction. New masons had to be trained to replace them.
- There are delays in construction during monsoon season. Also the families take a lot of time for filling in dung into the digester. On an average, the time taken for filling in dung for production of biogas is 102 days. This has also led to delay in commissioning of biogas units.
- As of 31st December 2012, 2403 biogas units are constructed and 786 are under construction. The PP intends to construct the remaining units to achieve the 5,000 mark under the CDM project activity within 31st December 2014.

B.2. Post registration changes

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

There are no temporary deviations from registered monitoring plan or applied methodology.

B.2.2. Corrections

There are no corrections to project information or parameters fixed at validation.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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

B.2.4. Changes to project design of registered project activity

The change to the project design of registered project activity is with regard to addition of multiple sites. The beneficiaries that showed interest and were identified upfront for the project activity during the survey in 2008, which were in 121 villages in 5 Mandals of Anantapur District. During the course of implementation there were (a) migrations to neighbouring villages, (b) unsuitable site conditions such as rocky or sandy nature which prevented excavation of land to construct the dome, etc. Thus, interested end users from within the project boundary of the 5 Mandals in Anantapur District will be identified and provided with biogas unit. The project will still be implemented in the villages of 5 Mandals of Anantapur District, which is in the project boundary, but will be in more than 121 villages as stated in Section A.4.1 and A.4.1.3 of the registered PDD.

This change to the project design of the project activity has been submitted with this monitoring report vide. Version 8 of the PDD dated 26th March 2013.

B.2.5. Changes to start date of crediting period

There are no changes to start date of crediting period.

B.2.6. Types of changes specific to afforestation or reforestation project activity

This section is not applicable.

SECTION C. Description of monitoring system

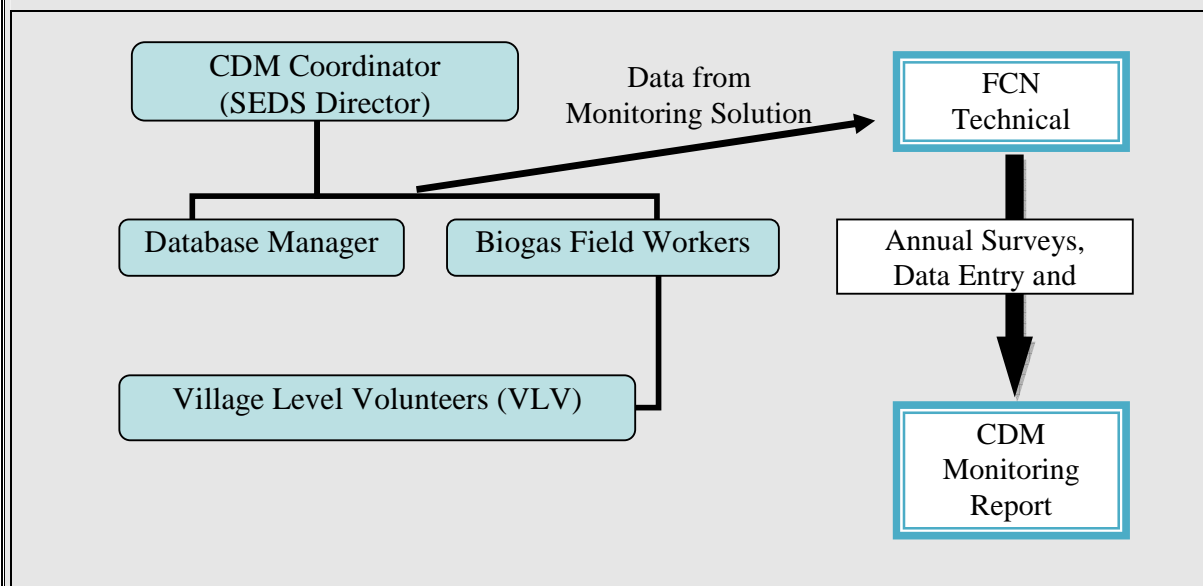
Project Management/Team structure

This biogas CDM project is implemented and monitored by the Social Education and Development Society. So far, the project has been implemented for 2,403 members of the SEDS village organizational network in 170 villages. A Standard Operation Procedure Manual has been prepared for implementation and monitoring of the project activity, which is followed by the CDM Team.

The SEDS CDM Coordinator manages the project on a full time basis. One data manager and 11 biogas field

workers are working full time to ensure movement of material and construction of biogas units in the project area. 90 masons have been trained by masons from the neighboring Chickballapur district (with 2 CDM biogas project activities) to construct biogas units. These masons have been contracted on a piece-rate basis for the construction of the biogas units. The village level volunteers (VLV) have been selected at the village level. They maintain a daily usage register for each of the unit built in their village. This data is collected by the the biogas field workers and entered into the digitized monitoring system on a monthly basis.

The project implementation and monitoring team comprises the following:



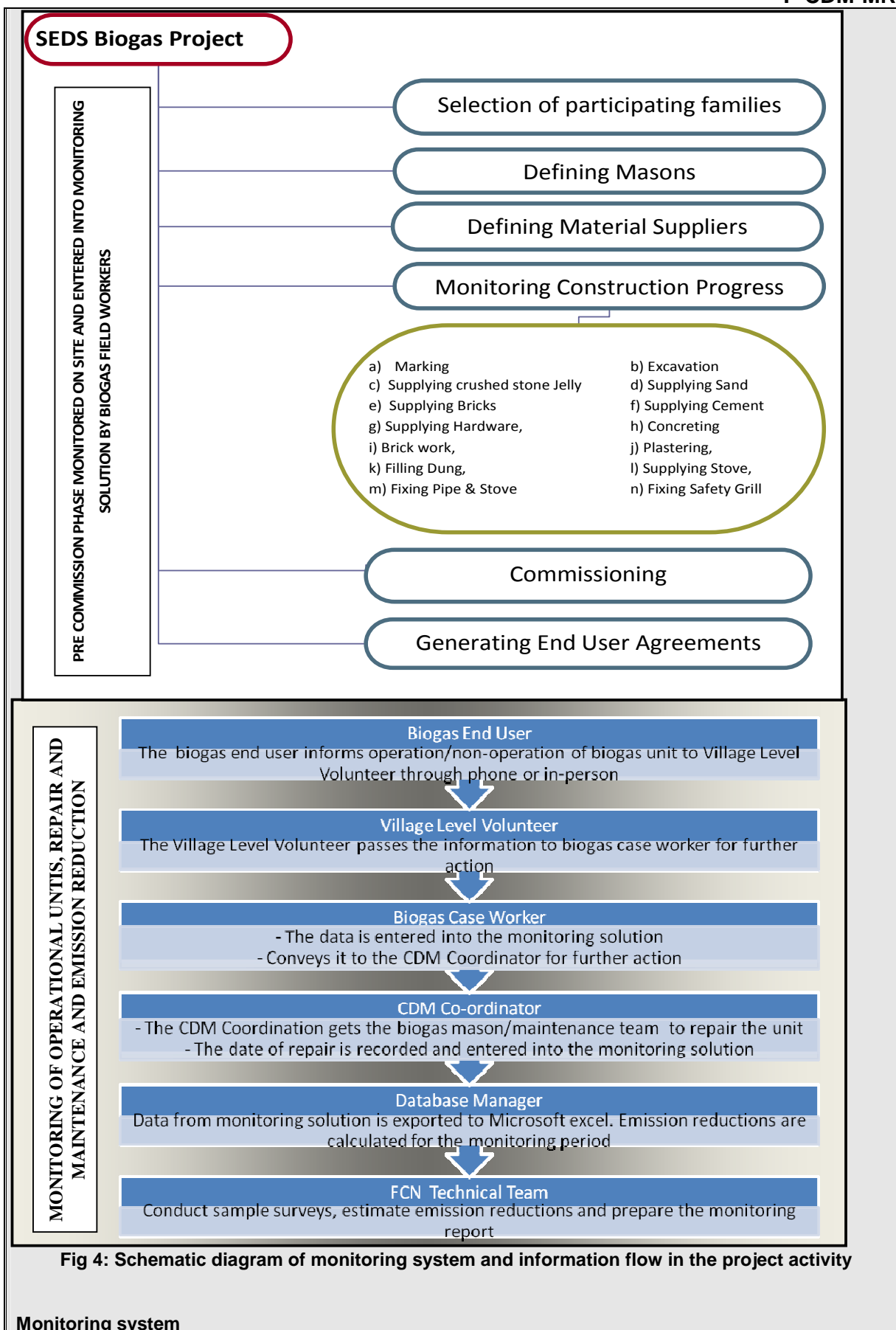
A digitized monitoring system, custom built for monitoring this Biogas CDM Project, has been provided by Tristle Technologies Pvt. Ltd. This is used to enter data on a regular basis, which generates real-time Progress Reports. Inputting data into this monitoring solution is permission driven – i. e. each Biogas Field Worker can record construction progress of only those villages entrusted to them. Progress and Analytical Reports is totally transparent, open for one and all.

After the construction and satisfactory functioning of each biogas plant for a minimum of 7 days, an end user agreement on legal paper has been signed with the respective beneficiary, and this date has been taken as the day of commissioning of that particular biogas unit. Thus, from day 1 of the commissioning of the biogas plant, full account of emission reduction has been considered.

The village level volunteer through undertaking daily usage monitoring will discover if any unit has become dysfunctional. The beneficiaries have also been provided the phone numbers of the village level volunteers/Biogas Field Workers, so that they can phone and report when the units are dysfunctional. They inform the biogas field worker who will visit the unit and assess requirements. Thus all the constructed biogas units are monitored for their operation.

An annual stratified sample survey of non-biogas users was carried out at household level within the project area. The quantity, source and method of fuel wood collection were assessed to derive at the quantity of non renewable biomass being used that can be attributable to the project activity. The findings of this survey provided for any deviation in the quantity of non renewable biomass being used by non project households/users attributable to the project activity to account and adjust B_v when calculating the overall emission reductions.

The monitoring system and information flow is shown schematically if Fig 4.



Data collection procedures

Data Generation: The data of construction processes as shown above from marking for the biogas unit to commissioning the biogas unit is recorded on paper and entered into the monitoring database by the Biogas Field Workers. The end users of biogas units under the CDM project activity sign an end-user agreement, which contains details of the end-user, the Unit ID number, date of commissioning of biogas and other terms and conditions. These agreements are notarized legal agreements countersigned by the End User and SEDS, the NGO.

The non-usage biogas days are also recorded and entered into the monitoring database. The data entered into the monitoring database is exported to excel sheet for analysis. The generated data is used for emission reduction calculations.

Data Aggregation and Recording

Biogas Construction: The biogas construction processes are monitored on a day to day basis and database maintained from its initiation to completion dates for each of the biogas unit. Suppliers and masons are identified with personal data and digital photographs fed into the computerized databank for verification.

A digitized monitoring database system, custom built by Tristle Technologies Pvt. Ltd., is being used to enter data to generate real-time data. Inputting data into this monitoring solution and non-usage days is done on a regular basis.

Each of the biogas unit has been marked with the Unit ID, which makes it distinct. These evidences validate the construction and commission of total 2,403 biogas plants built in the project area.

The list of biogas users are identified by a User ID, the name of the beneficiary, the village and the Mandal (SEDS_ER Calculations.xls). The start date of construction, the processes during construction till the date of commissioning are monitored and entered into the database.

Biogas End User Report

101 002 Padmavathi

Unit ID: 1613
 Name: 002 Padmavathi
 Village: 101 Arumakulapallii
 Gram Panchayat: Tekuldo
 Taluk/Mandal: Chillumathur
 Caste: Kapu / Reddy
 House: Brick Walls Stone Roof – 19 ft x 18 ft
 Family Strength: 4
 Commissioned on: 16 January 2012
 Biogas Unit Age: 12 months
 Mason: 39. Kotlopalli - P. Venkatesulu

Unit Details

Date	Process	Monitored By	Days taken
19 Nov 2011	Mark	venkatesh	0 days
20 Nov 2011	Excavate	venkatesh	1 days
24 Nov 2011	Supply Cement	venkatesh	5 days
25 Nov 2011	Supply Bricks	venkatesh	6 days

Screen Shot of the Monitoring database solution

The database is updated regularly as and when Biogas Field Workers return from their respective villages.

Non-Usage Days: The information on biogas non-usage days are recorded by the VLV or Biogas Field

Workers. The end users also communicate through mobile phones either to VLV or the Biogas Field Workers. The information is updated to the individual biogas user's Monitoring Database on a regular basis.

Data Storage for calculations of emission reductions

The parameters monitored daily during construction of the units are entered on paper which is maintained for each of the unit by the Biogas Field Workers. This is entered into the Monitoring Database for each of the biogas unit.

The non-usage days of biogas units are also recorded on paper and entered into the Monitoring Database on regular basis.

Thus data of all processes of biogas construction and non-usage is stored and maintained at the SEDS head office on the SEDS Monitoring Database.

The data of surveys conducted as described in section D.3 was entered into excel sheets and analysed. This data is stored on paper and electronically.

Calculation and reporting

The data generated through monitoring is stored in the SEDS monitoring database. From this database, data is exported to Microsoft excel sheets, which is used for emission reduction calculations and reporting.

The emission reductions calculations in excel sheet (*SEDS_ER Calculations.xls*) submitted to the DOE is thus transparent and verifiable with the SEDS Monitoring Solution.

QA & QC procedures and emergency procedures for the monitoring system

After selection of the beneficiary, an agreement between SEDS and the Beneficiary of SEDS Biogas Project is signed, wherein SEDS have briefed of the material that will be supplied to the beneficiary for construction of the unit and the beneficiary is made aware of their contribution through kind towards the project activity. For each of the unit, the dates of material supply and the processes are maintained on paper, which is entered into the monitoring database. All the monitoring books are maintained at the SEDS head office. The statutory reports, receipts and payments made for the construction are maintained for verification.

Each unit has the unit ID number and date of construction etched on it for field identification and cross check.

Tristle Monitoring Solution has its own software for data backup and restore. The Data Manager has to just select the path and save the backup. This software will back up the entire Database along with photographs. Data backup is taken once every 15 days as emergency procedure. These back ups are stored in a separate external HDD meant only for backups.

Quality Control is ensured, wherein the end-user supervises the construction, checks the quality of installed biogas plants to ensure that the required materials were used for the construction of biogas units. They endorse the installation through a signed beneficiary acknowledgement, after which the end user agreement is signed.

Suppliers and masons are identified with personal data and digital photographs fed into the computerized databank for verification.

The data from the monitoring solution is analysed and emission reduction calculated independently by FCN Technical Team. Annual surveys are also conducted by the FCN Tech team for inclusion in the Monitoring Report. Thus a third party is involved in preparation of CDM Monitoring Report.

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 /family/year
Description:	Quantity of biomass that is substituted or displaced in tonnes
Source of data:	Registered PDD
Value(s) applied:	3.37 tonnes/year/family
Purpose of data:	According to the “Guidelines on completing the monitoring report”, Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	Based on surveys conducted in the project area and detailed in the registered PDD.
Data / Parameter: $f_{NRB, y}$	
Unit:	-
Description:	Fraction of Non Renewable Biomass
Source of data:	Registered PDD
Value(s) applied:	90% or 0.90
Purpose of data:	According to the “Guidelines on completing the monitoring report”, Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	Calculated as per AMS I.E., Version 1 methodology and described in the registered PDD.
Data / Parameter: $NCV_{biomass}$	
Unit:	TJ/tonne
Description:	Net Calorific Value of Biomass
Source of data:	IPCC
Value(s) applied:	0.015
Purpose of data:	According to the “Guidelines on completing the monitoring report”, Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	As given in AMS I.E., Version 1 methodology
Data / Parameter: $EF_{projected_fossilfuel}$	
Unit:	tCO ₂ /TJ
Description:	Emission Factor for Kerosene
Source of data:	IPCC
Value(s) applied:	71.5

Purpose of data:	According to the "Guidelines on completing the monitoring report", Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	As given in AMS I.E., Version 1 methodology

D.2. Data and parameters monitored

Data / Parameter:	Biogas Units constructed
Unit:	Number
Description:	Number of biogas units constructed
Measured/ Calculated / Default:	Measured
Source of data:	The biogas construction is monitored from the start till completion for all the processes as shown in Fig 4 from marking to fixing safety grill and commissioning of the unit. This is entered into the monitoring database for each of the unit. Thus the timeline of construction of the units is monitored and database maintained.
Value(s) of monitored parameter:	2,403 biogas units have been constructed and operational for the period 1 st January 2011 to 31 st December 2012.
Monitoring equipment:	There are no monitoring equipments. The construction of biogas units are monitored at the field and record maintained. The data for each unit is transferred to the monitoring database.
Measuring/ Reading/ Recording frequency:	The construction processes is monitored on a day to day basis from pre-commission till commissioning for all the biogas units.
Calculation method (if applicable):	There are no calculations involved.
QA/QC procedures:	-100% of the units are monitored from the procurement of material till construction and commissioning of the biogas units. A beneficiary acknowledgment is signed by the beneficiary after construction of the unit. -Each of the units is marked with the Unit ID for field identification. -This can also be triangulated with the End User Agreement.
Purpose of data:	-According to the "Guidelines on completing the monitoring report", Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity. -The data is used to estimate the emission reduction for the number of biogas units constructed and commissioned.
Additional comment:	The emission reductions are calculated after the unit is commissioned and the end users are happy with the usage for at least 7 days. The emission reduction is calculated from the date of commission. This can be triangulated with the end user agreement signed between the end user and SEDS.

Data / Parameter:	Number of biogas plants operating
Unit:	Number
Description:	Number of plants operating in year
Measured/ Calculated / Default:	Measured
Source of data:	Field data monitored on a day to day basis is entered into the monitoring solution. Log books are maintained and entered in the digitized monitoring database. Biogas units non-operating are monitored and recorded. This inversely gives the data of operational units on a day to day basis for each of the unit.
Value(s) of monitored parameter:	2,403 biogas units have been constructed and operating for the period 1 st January 2011 to 31 st December 2012. The duration of non-usage and the reason is monitored. The data of operating days for each and every biogas unit is given in the excel sheet <i>SEDS_ER Calculations.xls</i> . The total biogas days for which emission reduction was calculated is less by 6.3% due to downtime of units.
Monitoring equipment:	There are no monitoring equipments. The biogas units are monitored for non-usage by the Village level volunteers/Biogas Field Workers. All the units are being recorded and entered into the monitoring solution.
Measuring/ Reading/ Recording frequency:	The units are monitored for its usage on a day to day basis for all the units constructed and commissioned.
Calculation method (if applicable):	For a particular day, the number of operating systems is all the units which were functional. The number of operational days during the monitoring period for each of the system was determined to estimate the emission reductions.
QA/QC procedures:	For efficient monitoring, continuous day to day monitoring was done. A user friendly survey sheet for each of the biogas user was maintained at the village level. Hence continuous monitoring of the operational units is being done.
Purpose of data:	According to the "Guidelines on completing the monitoring report", Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity.
Additional comment:	Emission Reductions were deducted or not calculated for non-functional days of the units.
Data / Parameter:	B_y – Confirmation that non-renewable biomass has been substituted
Unit:	tonnes / yr
Description:	Confirmation that non-renewable biomass has been substituted
Measured/ Calculated / Default:	Measured.

Source of data:	Sample survey. Annual stratified sampling was conducted for 2011 and 2012.
Value(s) of monitored parameter:	<p>Based on the stratified sample survey, the extent of replacement of non-renewable fuel wood is complete. Few households use renewable biomass of which the predominant species is <i>Prosopis juliflora</i> and crop residue of Red gram and Mulberry stalks. As per Annex 18 of the EB 23, this is considered renewable.</p> <p>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 there is replacement of non-renewable biomass by the project activity.</p> <p>For non-functional days, there is no replacement of non-renewable biomass and emission reductions are not considered for those days.</p>
Monitoring equipment:	<p>There are no monitoring equipments. It is based on sample surveys conducted annually.</p> <p>Monitoring ensures that whenever biogas in non-operational, it is considered as use of non-renewable biomass and emission reductions are deducted.</p>
Measuring/ Reading/ Recording frequency:	<p>Annually conducted sample surveys.</p> <p>Daily monitoring of non-usage biogas units.</p>
Calculation method (if applicable):	There are no calculations methods. The sample survey is conducted to confirm that non-renewable biomass has been substituted.
QA/QC procedures:	Stratified random sample survey was conducted.
Purpose of data:	The data is not used for estimation of emission reductions.
Additional comment:	In addition, for non-usage biogas days, it is assumed that biomass has been used and emission reductions are not accounted for those days of non-usage.
Data / Parameter:	Non-usage of 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:	<p>The domestic biogas units are in continuous operation after installation. In between, due to repair and maintenance, some of the biogas units were 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 <i>SEDS_ER Calculations.xls</i>). The data was entered into the monitoring solution, which is the basis for emission reduction calculations of operational days of the installed units. The biogas days lost due to repairs and maintenance are as follows:</p>																																																						
	<table border="1" data-bbox="532 485 1286 1306"> <thead> <tr> <th data-bbox="537 491 899 646">Reason for non-usage</th> <th data-bbox="904 491 1089 646">Number of Biogas Units repaired/ under repair</th> <th data-bbox="1094 491 1279 646">Number of total biogas days not functional</th> </tr> </thead> <tbody> <tr> <td data-bbox="537 653 899 688">Empty and Replaster Dome</td> <td data-bbox="904 653 1089 688">516</td> <td data-bbox="1094 653 1279 688">35,036</td> </tr> <tr> <td data-bbox="537 695 899 730">Replaster Dome (outside)</td> <td data-bbox="904 695 1089 730">27</td> <td data-bbox="1094 695 1279 730">2,862</td> </tr> <tr> <td data-bbox="537 737 899 772">Gobar Too Watery</td> <td data-bbox="904 737 1089 772">34</td> <td data-bbox="1094 737 1279 772">2,478</td> </tr> <tr> <td data-bbox="537 779 899 814">Dome crack</td> <td data-bbox="904 779 1089 814">16</td> <td data-bbox="1094 779 1279 814">2,050</td> </tr> <tr> <td data-bbox="537 821 899 856">Gobar Stop</td> <td data-bbox="904 821 1089 856">32</td> <td data-bbox="1094 821 1279 856">2,028</td> </tr> <tr> <td data-bbox="537 863 899 898">Gobar Mixing dry</td> <td data-bbox="904 863 1089 898">12</td> <td data-bbox="1094 863 1279 898">1,200</td> </tr> <tr> <td data-bbox="537 905 899 940">Repair Outlet Tank</td> <td data-bbox="904 905 1089 940">9</td> <td data-bbox="1094 905 1279 940">905</td> </tr> <tr> <td data-bbox="537 947 899 982">Unit Demolished</td> <td data-bbox="904 947 1089 982">3</td> <td data-bbox="1094 947 1279 982">903</td> </tr> <tr> <td data-bbox="537 989 899 1024">Gobar Stop (Migrated)</td> <td data-bbox="904 989 1089 1024">2</td> <td data-bbox="1094 989 1279 1024">239</td> </tr> <tr> <td data-bbox="537 1031 899 1066">Repair Inlet Tank</td> <td data-bbox="904 1031 1089 1066">3</td> <td data-bbox="1094 1031 1279 1066">154</td> </tr> <tr> <td data-bbox="537 1073 899 1108">Repair Stove</td> <td data-bbox="904 1073 1089 1108">21</td> <td data-bbox="1094 1073 1279 1108">62</td> </tr> <tr> <td data-bbox="537 1115 899 1150">Kitchen not Used</td> <td data-bbox="904 1115 1089 1150">6</td> <td data-bbox="1094 1115 1279 1150">50</td> </tr> <tr> <td data-bbox="537 1157 899 1192">Replace Gas Pipe</td> <td data-bbox="904 1157 1089 1192">11</td> <td data-bbox="1094 1157 1279 1192">39</td> </tr> <tr> <td data-bbox="537 1199 899 1234">Repair Gas Pipe</td> <td data-bbox="904 1199 1089 1234">5</td> <td data-bbox="1094 1199 1279 1234">14</td> </tr> <tr> <td data-bbox="537 1241 899 1276">Drain Water in Gas Pipe</td> <td data-bbox="904 1241 1089 1276">2</td> <td data-bbox="1094 1241 1279 1276">4</td> </tr> <tr> <td data-bbox="537 1283 899 1318">Replace Gate Valve</td> <td data-bbox="904 1283 1089 1318">1</td> <td data-bbox="1094 1283 1279 1318">2</td> </tr> <tr> <td data-bbox="537 1325 899 1306">Grand Total</td> <td data-bbox="904 1325 1089 1306">700</td> <td data-bbox="1094 1325 1279 1306">48,026</td> </tr> </tbody> </table> <p data-bbox="532 1339 1339 1501">The various reasons for non-usage of biogas units are as mentioned above. Maximum loss is due to time taken for emptying and re-plastering the inside of the biogas dome, which accounts for 73% of total downtime. It also accounts for 74% of the problems that leads to downtime of biogas units.</p>	Reason for non-usage	Number of Biogas Units repaired/ under repair	Number of total biogas days not functional	Empty and Replaster Dome	516	35,036	Replaster Dome (outside)	27	2,862	Gobar Too Watery	34	2,478	Dome crack	16	2,050	Gobar Stop	32	2,028	Gobar Mixing dry	12	1,200	Repair Outlet Tank	9	905	Unit Demolished	3	903	Gobar Stop (Migrated)	2	239	Repair Inlet Tank	3	154	Repair Stove	21	62	Kitchen not Used	6	50	Replace Gas Pipe	11	39	Repair Gas Pipe	5	14	Drain Water in Gas Pipe	2	4	Replace Gate Valve	1	2	Grand Total	700	48,026
Reason for non-usage	Number of Biogas Units repaired/ under repair	Number of total biogas days not functional																																																					
Empty and Replaster Dome	516	35,036																																																					
Replaster Dome (outside)	27	2,862																																																					
Gobar Too Watery	34	2,478																																																					
Dome crack	16	2,050																																																					
Gobar Stop	32	2,028																																																					
Gobar Mixing dry	12	1,200																																																					
Repair Outlet Tank	9	905																																																					
Unit Demolished	3	903																																																					
Gobar Stop (Migrated)	2	239																																																					
Repair Inlet Tank	3	154																																																					
Repair Stove	21	62																																																					
Kitchen not Used	6	50																																																					
Replace Gas Pipe	11	39																																																					
Repair Gas Pipe	5	14																																																					
Drain Water in Gas Pipe	2	4																																																					
Replace Gate Valve	1	2																																																					
Grand Total	700	48,026																																																					
Monitoring equipment:	There are no monitoring equipments to measure this parameter. This is based on data recorded by the Village level volunteers/Biogas field workers and entered into the monitoring database.																																																						
Measuring/ Reading/ Recording frequency:	It is monitored on a day to day basis by the Village Level Volunteers at village level/Biogas field workers, which is entered into the monitoring solution for all the biogas units.																																																						
Calculation method (if applicable):	The operational days in a year for a biogas unit are 365 days minus non-operational days.																																																						

QA/QC procedures:	<p>-As per the methodology, the number of non-operational days of biogas units need not be measured. To be conservative and reduce uncertainty, the ERs are deducted for the days each of the commissioned biogas unit is not functional.</p> <p>-Also the main objective of the project activity is to provide thermal energy to the rural households thereby reducing drudgery to women in the region. Thus continuous monitoring and repairs are taken up by SEDS, the NGO (PP). This helps to also provide quality data to estimate emission reductions with certainty.</p>
Purpose of data:	<p>To calculate emission reductions for only the operational days for each biogas unit.</p> <p>According to the "Guidelines on completing the monitoring report", Version 3.2, EB 70, the purpose of data needs to be in terms of calculation of baseline emissions, project emissions or leakage. But according to the methodology, the data is directly used to estimate emission reductions for the project activity.</p>
Additional comment:	<p>This information is included in the excel ER calculations sheet (see <i>SEDS_ER Calculations.xls</i>) for each of the unit.</p>

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
Measured/ Calculated / Default:	Stratified annual sample survey
Source of data:	Leakage data is based on sample survey of non biogas users. To be conservative, it is based on latest version of the methodology, I.E, Version 5.
Value(s) of monitored parameter:	<p>-According to the survey conducted during the year 2011 and 2012, there is no diversion of non-renewable biomass saved under the project activity by non-project households.</p> <p>-But to be conservative, B_v is multiplied by a net to gross adjustment factor of 0.95 to account for leakages.</p>
Monitoring equipment:	<p>-There is no monitoring equipment for this monitoring parameter. It is based on sample survey of non-biogas users.</p> <p>-But to be conservative in calculations, B_v is multiplied by a net to gross adjustment factor of 0.95 to account for leakages (based on the latest version of I.E methodology, Version 5)</p>
Measuring/ Reading/ Recording frequency:	Annual stratified sample survey
Calculation method (if applicable):	<p>-Based on the sample survey, there is no discounting factor to be applied.</p> <p>-But based on the latest methodology version, leakage is accounted as $B_v * 0.95 = 6590 \text{ t} \times 0.95 = 6261 \text{ t}$ for the monitoring period.</p> <p>Thus leakage is $6590 - 6261 = 329 \text{ t}$ for the monitoring period.</p>

QA/QC procedures:	Though the survey does not imply diversion of non-renewable biomass saved under the project activity by non-project households, to be conservative, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages.
Purpose of data:	To calculate leakage from the project activity
Additional comment:	Though Version 1 of I.E. methodology does not discount for leakage, to be conservative and decrease uncertainty, B_y has been multiplied by 0.95.

D.3. Implementation of sampling plan

The data monitored for the project activity is as follows:

- (i) Biogas units constructed
- (ii) Number of biogas plants operating
- (iii) Non-usage of biogas units
- (iv) B_y - Confirmation that non-renewable biomass has been substituted
- (v) Diversion of non-renewable biomass saved under the project activity by non-project households

The parameters (i) to (iii) have been collected for all the biogas units constructed and operating. For the parameters (iv), an annual stratified sample survey of biogas users was conducted, while for parameter (v), a sample survey of non-biogas users or households using traditional cook stoves was conducted in the project boundary.

(i) Objectives and Reliability Requirements: The objective of the sampling effort is to;

- a) assess or confirm that non-renewable biomass has been substituted by biogas users and
- b) to assess if there is diversion of non-renewable biomass saved under the project activity by non-project households. The sample size was determined to obtain 90/10 confidence/precision levels.

(ii) Target Population: The target population is 988 rural households in 2011 and 2,403 households in 2012 for which biogas were constructed in 5 Mandals of Anantapur district for parameter (a) above. The target population for parameter (b) above are the non-biogas users within the project boundary.

(iii) Sampling Method: The sampling method chosen for the project area is stratified random sampling, wherein each Mandal is a stratum. It is easy to implement as the sampling frame (household details for which biogas were implemented) was collected and stored in the monitoring database. Each of the five Mandals – Penukonda, Roddam, Somandepalli, Gorantla and Chillamathur was treated as a stratum. Thus sampling was done for each of the Mandal to ensure that all the areas were well represented.

v) Sampling Frame: For (a), sampling frame that was used is the complete listing of all the rural households for which biogas was built under the project activity in Penukonda, Roddam, Somandepalli, Gorantla and Chillamathur mandals, Anantapur District, Andhra Pradesh. Each of the household has a unique identification number with all the required details of the family.

vi) Determination of sample size: Determination of sample size is in accordance with Annex 5, EB 69, "Guidelines for sampling and surveys for CDM project activities and programme of activities", which specifies the reliability requirements and describes appropriate sampling methods applicable to small-scale projects.

The sample frame is homogeneous, wherein the families are from rural region from similar socio-economic strata and similar cooking habits. Thus, the sample size required to achieve a required level of reliability was calculated based on the following formula:

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

Where:

n	Sample size
N	Total number of households (988 for 2011 and 2,403 for 2012)
p	Our expected proportion (0.85) of biogas days operational. (Based on the status of biogas days operational from online monitoring solution). Though, according to the monitoring solution, the value

is 99.95% during 2011 and 93.7% during 2012, to be conservative, 85% is considered for determination of n.

1.645 Represents the 90% confidence required

0.1 Represents the 10% relative precision p

For the year 2011,

$$n \geq \frac{1.645^2 \times 988 \times 0.85 \times (1 - 0.85)}{(988 - 1) \times 0.1^2 + 1.645^2 \times 0.85 \times (1 - 0.85)} = 34$$

If we expect the response rate from the sampled households to be only 80%, then the scale up for the survey would be $34/0.8 = 42$ households.

For year 2012

$$n \geq \frac{1.645^2 \times 2403 \times 0.85 \times (1 - 0.85)}{(2403 - 1) \times 0.1^2 + 1.645^2 \times 0.85 \times (1 - 0.85)} = 35$$

If we expect the response rate from the sampled households to be only 80%, then the scale up for the survey would be $35/0.8 = 43$ households.

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

Mandals	Total Number of Households -	Total Number of Households -
	2011	2012
Penukonda	$\frac{54}{988} \times 42 = 2$	$\frac{196}{2403} \times 43 = 4$
Roddam	$\frac{410}{988} \times 42 = 17$	$\frac{886}{2403} \times 43 = 16$
Somandepalli	$\frac{297}{988} \times 42 = 13$	$\frac{568}{2403} \times 43 = 10$
Gorantla	$\frac{116}{988} \times 42 = 5$	$\frac{403}{2403} \times 43 = 7$
Chillamathur	$\frac{111}{988} \times 42 = 5$	$\frac{350}{2403} \times 43 = 6$
Total	42	43

Firstly questionnaires were prepared and field tested. Based on the field trial, the questionnaires were revised and implemented. 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:

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

Taluks	2011		2012	
	Number of Villages	Total number of households	Number of Villages	Total number of households
Chillamathur	3	12	6	29
Gorantla	3	9	7	31
Penukonda	2	6	4	12
Roddam	15	59	14	51

Somandepalli	7	22	12	44
Grand Total	30	108	43	167

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 beneficiary households sampled

Year 2011			Year 2012	
No of Families Surveyed			No of Families Surveyed	
Mandals	Village	Total	Village	Total
Chillamathur	C.Maravapalli	3	K.Vaddipalli	2
	Kanisettipali	4	Kambalapalli	6
	Madhurepalli	5	Kotlopalli	6
			Settipalli	5
			Tekulodu	6
			Thimmadipalli	4
Gorantla	B. Kothapalli	3	Buchepalli	6
	Puttagundlapalli	3	Budilivandalapalli	5
	Venkatapuram	3	G. Maravapalli	4
			Mallapalli	3
			Narasimpalli	6
			Samulapalli	4
			Venkatapuram	3
Penukonda	Mavaturu	2	Adadakulapalli	4
	Suddabatlapalli	4	Mavaturu	3
			Munimadugu	2
			Venkatareddipalli	3
Roddam	Chinnamanthuru	4	Bucherla	5
	Cholemari	2	Chinnaguvvalapalli	7
	Dandepalli	4	Chinnakodipalli	5
	Dodagatta	4	Cholemari	2
	Kalipi	5	Gowrajupalli	5
	Kallukunta	3	Kallukunta	2
	P. Kothapalli	4	P. Roppala	1
	P. Roppala	4	Patharlapalli	4
	Peddakodipalli	3	Peddakodipalli	1
	Peddipalli	4	R. Locherla	5
	R. Maravapalli	5	Ragimekalapalli	5
	Reddipalli	4	Roddakampalli	4
	Sanipalli	4	Seshapuram	1
	Seshapuram	5	Subbarayappa Kottala	4
Thurkalapatnam	4			
Somandepalli	Brahmanapalli	3	Chakarlapalli	2
	Chinnababaiahpalli	2	Chalakuru	4
	Guddamnagepalli	3	Chinnababaiahpalli	2
	Kugatimanipalli	4	Edulabalapuram	5
	Nallagondrayunipalli	4	Julakunta	6

	Rukalapalli	4	Kavetinagepalli	4
	Thungodu	2	Kolimipalli	5
			Magecheruvu	4
			Manchepalli	3
			Mandli	3
			Nanginayanicheruvu	4
			Thungodu	2
Grand Total		108		167

For parameter (b), i.e. to assess if there is diversion of non-renewable biomass saved under the project activity by non-project households, the sample size was determined to obtain 90/10 confidence/precision levels. The sample size was determined as follows (Bill Godden, 2004)¹:

Sample size of infinite population (where the population is greater than 50,000)

$$SS = \frac{z^2 \times (p) \times (1 - p)}{C^2}$$

Where

SS = Sample size

Z = Z value (e.g. 1.645 for 90% confidence level)

P = 0.5 Percentage of population picking a choice (renewable or non-renewable biomass),
expressed as decimal

C = Confidence interval, expressed as decimal (0.1 - 10% confidence interval)

$$SS = \frac{1.645^2 \times (0.5) \times (1 - 0.5)}{0.1^2} = 67.65 \approx 68$$

The sample survey conducted during 2011 and 2012 to study the diversion of non-renewable biomass saved under the project activity by non-project households was stratified as follows:

Mandal	Total number of HHs surveyed	
	2011	2012
Chillamathur	13	37
Gorantla	22	28
Penukonda	2	22
Roddam	98	81
Somandepalli	35	56
Grand Total	170	224

Thus it can be seen that the number of households covered for the sample surveys is more than adequate to represent the parameters in the project area. Oversampling was done as a good practice to compensate for any attrition, outliers or non response associated with the sample.

The data collected was entered into excel sheet for data storage and analysis.

(b) Data:

(i) Field Measurements: A household level questionnaire was designed to collect information for the parameters of interest. The frequency of measurement was once a year during the monitoring period. Data

¹ <http://williamgodden.com>

was collected for the monitoring year 2011 and 2012.

(ii) Quality Assurance/Quality Control: The QA/QC procedure was to achieve good quality data through field measurements. The household level questionnaire was designed and field tested before administering the actual questionnaire survey. The survey was done by the FCN Technical Team. Oversampling was done to replace non-respondents, if any. The data collected was entered by and further cross-checked by the FCN Team.

(iii) Analysis: The data entry was done in Microsoft excel sheet. The data was cross checked with the filled in questionnaire by FCN as QA/QC procedure. The data was analyzed for responses to the parameters.

(c) Implementation:

(i) Implementation Plan: The implementation of sampling effort was done the FCN Technical Team. 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. The collected data was analysed by the FCN for inclusion in the monitoring report.

D.3.1 Description of implemented sampling design

All the monitoring parameters i.e. (i) Number of installed 2 m³ systems (ii) Number of operating 2 m³ systems and (iii) Non-usage days of installed and operational biogas plants were monitored on a day to day basis for all the installed units for the monitoring period. These parameters which are required for calculations of emission reduction has no sampling plan as 100% units were monitored for all the parameters. Thus, the data used to calculate emission reduction has high precision and less uncertainty.

D.3.2 Collected data

All the monitoring parameters i.e. (i) Number of installed 2 m³ systems (ii) Number of operating 2 m³ systems and (iii) Non-usage days of installed and operational biogas plants were monitored on a day to day basis and data collected for all the installed units. The data collected was entered into the monitoring solution. For the parameters (iv) and (v), the collected data was analyzed.

D.3.3 Analysis of the collected data

The data collected and entered into monitoring solution was exported to excel sheet for data analysis and to calculate the emission reductions of the project activity (*SEDS_ER Calculations.xls*).

(i) Number of installed 2 m³ systems: Of the 5,000 units that were to be constructed under the project, 2,403 units were constructed till 31st December 2012.

(ii) Number of operating 2 m³ systems: The analysis of all the operating systems for each day consolidated is shown in *SEDS_ER Calculations.xls*. The emission reductions are calculated only of units for operational days.

(iii) Non-usage days of installed and operational biogas plants: The non-usage days or non-operating units were monitored on a day to day basis for all the constructed units. Based on the data, which is collected and entered into the monitoring solution, there were repairs, overhaul and maintenance of constructed biogas units. The reasons for the breakdown and total non-operational biogas days for the monitoring period (1st January 2011 - 31 December 2012) are as follows:

Reason For Breakdown/ Non-Usage	Number of Units repaired/under repair for the monitoring period	Non-operational biogas days for the monitoring period (1 st January 2011-31 st December 2012)
Empty and Replaster Dome	516	35,036
Replaster Dome outside	27	2,862
Gobar Too Watery	34	2,478

Dome crack	16	2,050
Gobar Stop	32	2,028
Gobar Mixing dry	12	1,200
Repair Outlet Tank	9	905
Unit Demolished	3	903
Gobar Stop (Migrated)	2	239
Repair Inlet Tank	3	154
Repair Stove	21	62
Kitchen not Used	6	50
Replace Gas Pipe	11	39
Repair Gas Pipe	5	14
Drain Water in Gas Pipe	2	4
Replace Gate Valve	1	2
Grand Total	700	48,026

A detailed breakdown time for each of the biogas unit is shown in excel sheet (*SEDS_ER Calculations.xls*).

(iv) *By - Confirmation that non-renewable biomass has been substituted*

Confirmation that non-renewable biomass has been substituted was through annual sample surveys conducted as described in section above. Based on the survey, there has been complete replacement of non-renewable biomass in the project area. Based on the stratified sample survey, the extent of replacement of non-renewable fuel wood is complete. Few households use renewable biomass of which the predominant species is *Prosopis juliflora* and crop residue of Red gram 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.

(v) *Diversion of non-renewable biomass saved under the project activity by non-project households*

The survey of non-biogas users show that 100% of families respond to no increase in fuelwood use after the project implementation, no increase in cut and carry of fuelwood and no replacement of crop residues (renewable biomass) by fuelwood. In the project area, renewable biomass energy sources such as crop residue, fallen twigs and branches though low are still the easiest to collect. Comparatively, collection of fuel wood from forests involves time and effort as they are beyond the village and agricultural lands. Thus the quantity of non-renewable wood used by the families has remained the same and not increased due to the project activity. Thus the nearest and easily available source of biomass is collected first, which are the renewable sources of energy. Thus all the 100% respondents of the survey continue to use the same quantity of crop residue and fallen twigs and branches even after the project activity and is not getting replaced by non-renewable wood. Thus, the survey of non-biogas users shows that there is no diversion of non-renewable biomass saved under the project activity by non-project households.

There have been no events or situations that occurred during this monitoring period which has impacted the applicability of the methodology.

D.3.4 Demonstration on whether the required confidence/precision has been met

All the parameters which is required for calculations of emission reductions were monitored for all the installed units. Thus there results of the data has very high confidence and precision level, with very low uncertainly levels.

The surveys conducted were for quantitative data for which confidence/precision is not required and is not included into emission reduction calculations. But, even for this parameter, a discount factor for B_y has been

applied based on latest version of the methodology, which is conservative.

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

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

Emission reductions were calculated as:

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

Where:

ER_y = Emission reductions during the year y in tCO₂e

B_y = Quantity of biomass that is substituted or displaced in tonnes

$f_{NRB,y}$ = Fraction of 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 biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)

$EF_{projected_fossilfuel}$ = Emission factor for the projected fossil fuel consumption in the baseline. The fossil fuel likely to be used by similar consumers is taken: 71.5 tCO₂/TJ for Kerosene.

Emissions from the use of fossil fuels for meeting similar thermal energy needs		
Activity Data	Value	ID Ref
Quantity of Biomass that is substituted (t/family/yr)	3.37	B_y
Quantity of biomass that is substituted (t/yr) for the monitoring period after deducting non-operational days (see <i>SEDS_ER Calculations.xls</i> for details).	6,590.22	B_y
Fraction of NRB	90%	$f_{NRB, y}$
NCV Biomass (TJ/t)	0.015	$NCV_{biomass}$
Emission factor Kerosene (tCO ₂ /TJ)	71.5	$EF_{projected_fossilfuel}$
Emission Reductions after discounting for non-operational days (tCO₂/yr)	6,361	ER_y

The total emission reductions for the period 1st January 2011 to 31st December 2012 for the installed and operational 2,403 biogas units are **6,361 tCO₂**. The unit-wise calculations of emission reduction are as enclosed in the excel sheet – *SEDS_ER Calculations.xls*.

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 the methodology AMS I.E. Version 1:

If the project activity includes substitution of non-renewable biomass by renewable biomass, leakage in the production of renewable biomass must be considered using the general guidance on leakage in biomass project activities.

And

If the equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

The project does not involve the substitution of non-renewable biomass with renewable biomass, nor will any equipment be transferred from another activity as all units are to be built new specifically for the project. The project will also not result in the displacement of people or activities. Therefore leakage will not take place.

According to the methodology leakage relating to the non-renewable biomass is due to following potential sources:

- a. *Use/diversion of non-renewable biomass saved under the project activity by non-project households/users who previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable biomass used by the non project households/users attributable to the project activity then B_y is adjusted to account for the quantified leakage.*

Data on the amount of biomass saved under the project activity that is used by non-project households or users was collected through a stratified sample survey conducted in the project area as detailed in section D. In the project area, renewable biomass energy sources such as crop residue, fallen twigs and branches though low are still the easiest to collect. Comparatively, collection of fuel wood from forests involves time and effort as they are beyond the village and agricultural lands. Thus the quantity of non-renewable wood used by the families has remained the same and not increased due to the project activity. Thus the nearest and easily available source of biomass is collected first, which are the renewable sources of energy. Thus all the 100% respondents of the survey continue to use the same quantity of crop residue and fallen twigs and branches even after the project activity and is not getting replaced by non-renewable wood.

- b. *Use of non-renewable biomass saved under the project activity to justify the baseline of other CDM project activities can also be potential source of leakage. If this leakage assessment quantifies a portion of non-renewable biomass saved under the project activity that is used as the baseline of other CDM project activity then B_y is adjusted to account for the quantified leakage.*

Based on web check of UNFCCC and national DNA website, there were no CDM project activities in the region (5 Mandals of Anantapur District) under validation/registration after the registration of this Biogas Project. Thus there are no project activities to justify the baseline of other CDM project activities to be a potential source of leakage. Thus there is no portion of non-renewable biomass saved under the project activity that is being used as a baseline of other CDM project activity to adjust B_y to account for leakage.

- c. *Increase in the use of non-renewable biomass outside the project boundary to create non-renewable biomass baselines can also be potential source of leakage. If this leakage assessment quantifies an increase in use of non-renewable biomass outside the project boundary then B_y is adjusted to account for the quantified leakage.*

Based on web check of UNFCCC and national DNA website, there were no CDM project activities in the region under validation/registration after the registration of SEDS Biogas Project. A CDM biogas project 3779: "Accion Fraterna Biogas CDM project for rural communities in Anantapur, Andhra Pradesh" has been registered in Anantapur District, but not in the project boundary of 5 Mandals. But these Mandals are different and away from this project area to have an impact in the use of non-renewable biomass outside the project boundary to create non-renewable biomass baselines to account for potential source of leakage.

But to be conservative B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages (based on the latest version of I.E methodology).

Emissions from the use of fossil fuels for meeting similar thermal energy needs		
Activity Data	Value	ID Ref
Quantity of Biomass that is substituted after considering leakage (t/family/yr)	3.20	B_y adjusting for leakage
Quantity of biomass that is substituted (t/yr) for the monitoring period after considering non-operational days (see <i>SEDS_ER Calculations.xls</i> for details).	6,260.70	B_y adjusting for leakage

Fraction of NRB	90%	$f_{NRB, y}$
NCV Biomass (TJ/t)	0.015	$NCV_{biomass}$
Emission factor Kerosene (tCO ₂ /TJ)	71.5	$EF_{projected_fossilfuel}$
Emission Reductions after discounting for non-operational days (tCO₂/yr)	6,043	ER_y

The total emission reductions for the monitoring period after considering leakage for the installed and operational 2,403 biogas units are shown in the excel sheet - *SEDS_ER Calculations.xls*.

The total emission reductions after considering leakage for the period 1st January 2011 to 31st December 2012 for the installed 2,403 biogas units are 6,043 tCO₂.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	6,361	0	318	6,043

E.5. Comparison of actual emission reductions or net anthropogenic 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 or GHG removals by sinks (t CO₂e)	24,396	6,043

E.6. Remarks on difference from estimated value in registered PDD

There was no increase in the actual emission reductions achieved during the current monitoring period.

There was a decrease in the emission reductions achieved during the current monitoring period to that projected in the PDD as only 2,403 biogas units are commissioned and operational. During 2011, 990 biogas units and during 2012, 1413 biogas units were commissioned. The biogas units are being constructed in a phased manner during the year spanning throughout the year. There was also nearly 6.3% downtime of units due to repairs. Thus the emission reduction achieved during the monitoring period is less than that estimated in the PDD.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO₂e)	6043	0

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
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 anthropogenic 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.

Decision Class: Regulatory
Document Type: Form
Business Function: issuance
Keywords: monitoring report, performance monitoring
