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	IOT Mabagas Limited power plant, Pudhuchatram	
UNFCCC reference number of the project activity	8288[1]	
Version number of the monitoring report	7.1	
Completion date of the monitoring report	02/05/2016	
Monitoring period number and duration of this monitoring period	Monitoring Period – 01 Duration of Monitoring Period – 01/01/2013 to 31/07/2015	
Project participant(s)	IOT Mabagas Limited (IML) Carbonbay GmbH & Co. KG	
Host Party	India	
Sectoral scope(s)	1 : Energy industries (renewable - / non-renewable sources) 13 : Waste handling and disposal	
Selected methodology(ies)	AMS-III.AO. ver.01 - Methane recovery through controlled anaerobic digestion AMS-I.D. ver. 17 - Grid connected renewable electricity generation	
Selected standardized baseline(s)	NA	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	57,694 tCO_2	
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_2	24,012 tCO_2

[1] https://cdm.unfccc.int/Projects/DB/PJR%20CDM1353323353.49/view

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Project Participants
IOT Mabagas Limited (IML) is a 50: 50 joint venture (JV) company between M/s IOT Infrastructure & Energy Services Limited and Mabagas International, Germany. IOT is group company of M/s Indian Oil Corporation (State Owned Navarathna Oil Company in India) and Mabagas International is 100% subsidiary of Marquard & Bahls, Germany. IML is formed to invest, build, own and operate renewable energy projects in India with specific focus on waste to energy plants. IML believes that waste management and converting the waste into useful energy is on one hand a great challenge to society and on the other hand a great opportunity for a more sustainable future.

Project activity
In the village of Thattayangarpatti, in the Puduchatram block of Namakkal district, the project participant, IML, operates an anaerobic digestion plant. The plant produces biogas with which 2.4 MW of renewable electricity can be generated. Through this project activity the amount of greenhouse gases (methane and carbon dioxide) emitted into the atmosphere is reduced. Date of commissioning of the project activity is 19/12/2012. Since commissioning, the project activity continued in operation and supplying generated electricity to grid.

Pre-Project Scenario
In the pre-project scenario, poultry litter is generated at poultry farms in Namakkal district. The bottom of the cages is open, hence litter is allowed to drop down and pile up continuously. After a period of up to six months the litter will be collected and transported to a nearby drying yard or dumping area where it is allowed to further degrade. Such storage conditions and piling up results in anaerobic conditions, leading to methane emissions into the atmosphere due to anaerobic decomposition of the poultry litter. Further feedstock for the project activity are cow dung, and waste streams from the sugar and tapioca processing industries. These wastes are left to decay or not handled properly (stockpiled or treated in uncovered lagoons without proper aeration as further elaborated in table 4.1.c below) and therefore release methane into the atmosphere. This methane release is avoided by treating it in waste-to-energy plants such as the project activity. However, since the Project Participant cannot properly determine the exact baseline for these additional waste streams, their baseline emissions are not included in the emission reduction calculations as stipulated by the used small-scale methodology.

Post - Project Scenario
In the post-project scenario, the project participant procures the poultry litter from the nearby poultry farms in the district. The other wastes (cow dung and agri wastes.) are also procured from nearby sites. The litter will be collected each 10 to 15 days and will be delivered to a substrate storage area at site and is off-loaded onto a scraper floor (bunker type feeding system) together with the other wastes. All wastes are fed into 4 continuously stirred digesters (two primary digesters having unique identification number as RO2O1 and RO2O3, and two secondary digesters having unique identification number as RO2O2 and RO2O4) with a total working volume of 16,000 m3. Under controlled conditions biogas is produced through a bio-methanation process, which recovers the methane (biogas) from the litter. The biogas that is generated in the digesters is taken out through a common pipe and is then cooled down to remove moisture before it is fed via blowers into 2 x 1.2 MW biogas engines (having unique identification numbers as GG#1 and GG#2 and 2.4 MW total capacity) for the generation of power. The generated electricity (after consuming for internal operation of the plant) is supplied to the state electricity board via a dedicated 22 kV transmission line feeder to the nearby substation. The supplied electricity is sold by the project participant to the distribution licensee as per the modalities of the Energy Biomass Purchase Agreement.

The basic technology concept for the project activity is reaching maturity in western countries especially in Germany (where Mabagas has prior experience with a biogas plant in Lünen) and the Netherlands. IML is aiming to adapt the technology know-how existing in Europe to domestic circumstances and environments. However, the amount of poultry litter to be digested in the planned project activity is unusually high and poses technological challenges since no similar plant exists to serve as a role model. PP have a research lab in Mumbai conducting experiments on Continuous Stirred Tank Reactor (CSTR) models of digesters to simulate operating conditions of a prototype of biogas plant, which is envisaged in the project activity. So far around 10 batch tests are successfully conducted. Also the PP have been sending samples of solid and liquid fertilizers to other reputed labs for substantiations of results.

As mentioned in registered PDD, the plant is designed to operate on a mix of approximately 37,000 metric tonnes per annum of poultry litter, 58,000 metric tonnes per annum of agricultural waste streams from the sugar and tapioca processing industries and 1,825 metric tonnes per annum of cow dung. This should result in generation of around 7.9 million cubic meters per annum of biogas, which is expected to generate around 15.4 GWh of gross electricity. Thus, the project activity contributes to the reduction in GHG emissions on account of:

- Methane Avoidance: The project activity avoids methane release in the atmosphere that would have occurred due to uncontrolled poultry litter disposal / storage practices in the district.
- Power generation: The project activity generates electricity from the biogas generated from the poultry litter and organic wastes thereby replacing equivalent grid mix in the Southern grid.

Emission reduction achieved during the monitoring period is 24,012 tCO_{2e} for current monitoring period.

A.2. Location of project activity

Village - SF. Nos.52/1, 52/2, 53/1A and 53/2A Thattayangarpatti,
Block - Pudhuchatram,
District - Namakkal
State - Tamil Nadu
Host Country - India

The unique coordinates (latitude and longitude) are 11°23'29.64"N by 78°10'41.44"E.

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	IOT Mabagas Limited	No
Germany	Carbonbay GmbH & Co. KG	No

A.4. Reference of applied methodology and standardized baseline

AMS-I.D (version 17) Grid connected renewable electricity generation[2]
AMS-III.AO (version 01) Methane recovery through controlled anaerobic digestion[3]

[2] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[3] https://cdm.unfccc.int/methodologies/DB/F5U41CTG7ENWK9RSSL5BV1LUPDG76W

The tools used in calculating the emission reductions of the project activity are:

- Tool to calculate the emission factor for an electricity system. Ver 02.2.1
- Tool to determine project emissions from flaring gases containing methane. Ver 01
- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion. Ver 02
- Tool to calculate baseline, project and /or leakage emissions from electricity consumption Ver 01

A.5. Crediting period of project activity

Type of crediting period: 10 years fixed crediting period
Starting date of the crediting period: 01/01/2013
Length of the crediting period corresponding to this monitoring period: 10 years and 00 month from 01/01/2013 to 31/12/2022

A.6. Contact information of responsible persons/entities

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(Above person/entity is not the project participant but Project Consultant)

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

In the post-project scenario, the project participant procures the poultry litter from the nearby poultry farms in the district. The other wastes (cow dung and agri wastes.) are also procured from nearby sites. The litter will be collected each 10 to 15 days and will be delivered to a substrate storage area at site and is off-loaded onto a scraper floor (bunker type feeding system) together with the other wastes. All wastes are fed into 4 continuously stirred digesters (two primary digesters having unique identification number as RO2O1 and RO2O3, and two secondary digesters having unique identification number as RO2O2 and RO2O4) with a total working volume of 16,000 m3. Under controlled conditions biogas is produced through a bio-methanation process, which recovers the methane (biogas) from the litter. The biogas that is generated in the digesters is taken out through a common pipe and is then cooled down to remove moisture before it is fed via blowers into 2 x 1.2 MW biogas engines (having unique identification numbers as GG#1 and GG#2

and 2.4 MW total capacity) for the generation of power. The generated electricity (after consuming for internal operation of the plant) is supplied to the state electricity board via a dedicated 22 kV transmission line feeder to the nearby substation. The supplied electricity is sold by the project participant to the distribution licensee as per the modalities of the Energy Biomass Purchase Agreement.
The digested slurry from the secondary digester is pumped by means of extruder pumps to a screw extruder. The solid phase (containing 70-80 % moisture) from the extruder will drop down into a dumper and be taken to the manure-drying yard, which is an open space drying area by natural solar drying process. The dried solid manure is bagged and marketed.
The liquid phase (containing 2 - 3 % dry solids) from the extruder is collected in a liquid filtrate tank. The liquid is rich in organic matter. Part of the liquid is used as process water for dilution; the rest of the liquid phase is spread over the solid fertilizer to add the nutrients to the fertilizer. The expected volume of the liquid fraction is around 85,000 t/y of which 50% is recirculated into the digester system, and 50% is sprayed as liquid fertilizer on the drying compost

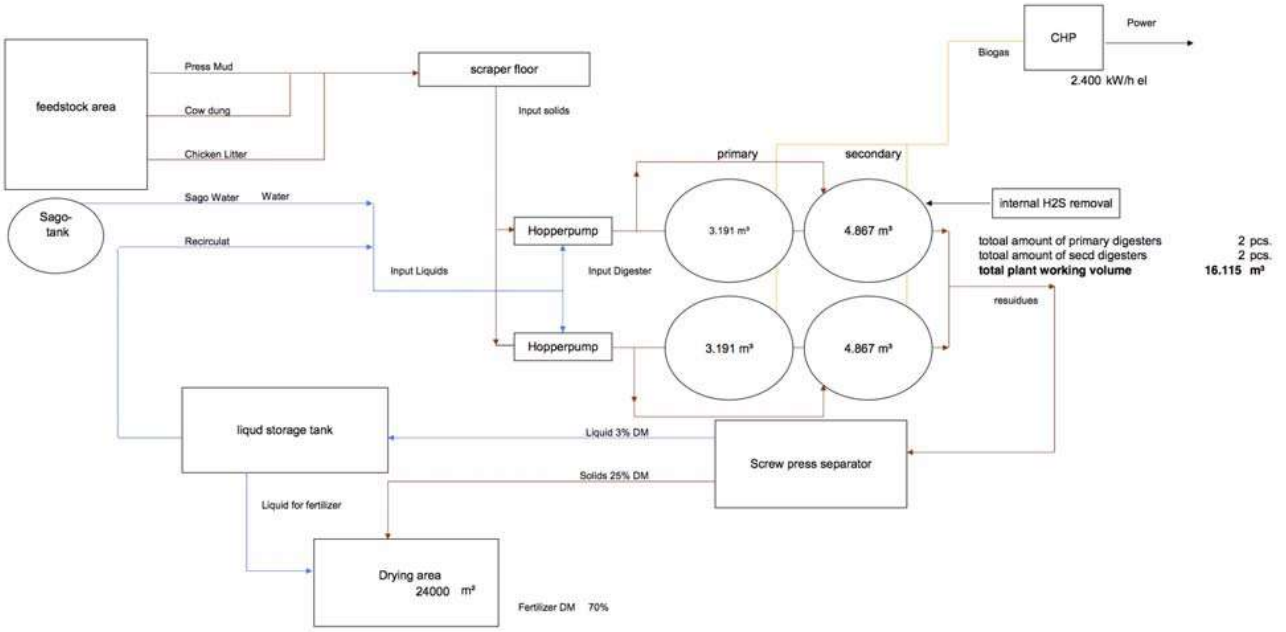
Date of commissioning of the project activity is 19/12/2012. Since commissioning, the project activity continued in operation and supplying generated electricity to grid.

The basic technology concept for the project activity is reaching maturity in western countries especially in Germany (where Mabagas has prior experience with a biogas plant in Lünen) and the Netherlands. IML is aiming to adapt the technology know-how existing in Europe to domestic circumstances and environments. However, the amount of poultry litter to be digested in the planned project activity is unusually high and poses technological challenges since no similar plant exists to serve as a role model. PP have a research lab in Mumbai conducting experiments on Continuous Stirred Tank Reactor (CSTR) models of digesters to simulate operating conditions of a prototype of biogas plant, which is envisaged in the project activity. So far around 10 batch tests are successfully conducted. Also the PP have been sending samples of solid and liquid fertilizers to other reputed labs for substantiations of results.

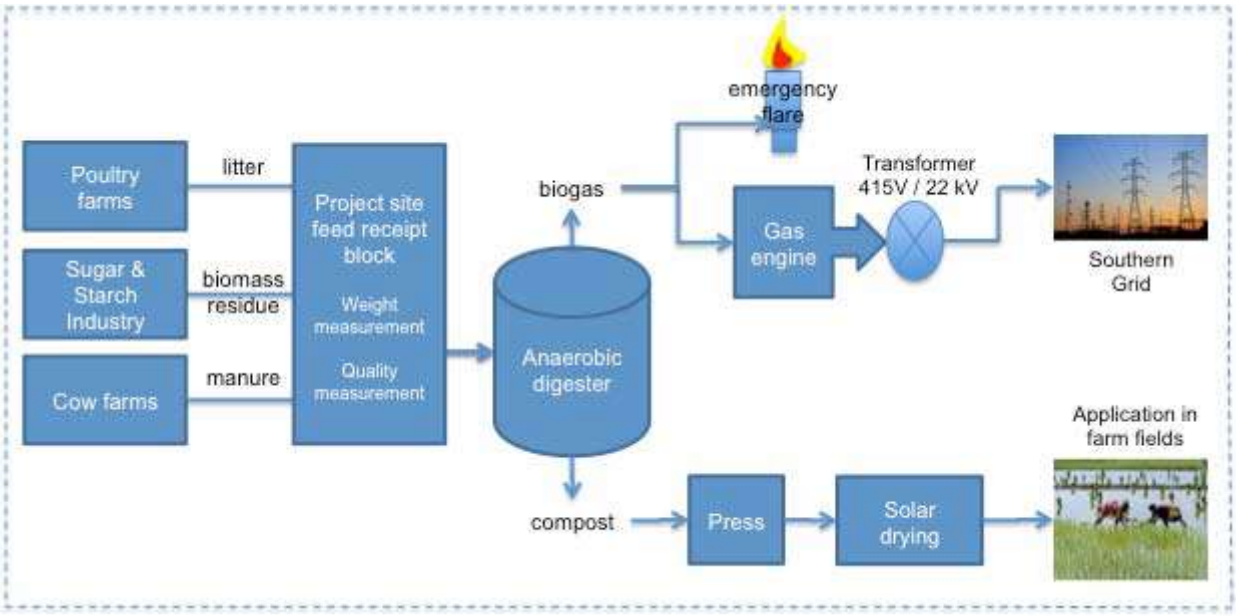
The plant is designed to operate on a mix of approximately 37,000 metric tonnes per annum of poultry litter, 58,000 metric tonnes per annum of agricultural waste streams from the sugar and tapioca processing industries and 1,825 metric tonnes per annum of cow dung. This should result in generation of around 7.9 million cubic meters per annum of biogas, which is expected to generate around 15.4 GWh of gross electricity as mentioned in registered PDD. Thus, the project activity contributes to the reduction in GHG emissions on account of:

- Methane Avoidance: The project activity avoids methane release in the atmosphere that would have occurred due to uncontrolled poultry litter disposal / storage practices in the district.
- Power generation: The project activity generates electricity from the biogas generated from the poultry litter and organic wastes thereby replacing equivalent grid mix in the Southern grid.

The process scheme applied to project activity is as below



The schematic of project boundary is as below



There are no any events or situations that occurred during the monitoring period that impact the applicability of the applied methodology.

B.2. Post-registration changes

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

Not Applicable.

B.2.2. Corrections

Not Applicable.

B.2.3. Changes to start date of crediting period

Not Applicable.

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

Not Applicable.

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

Not Applicable.

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

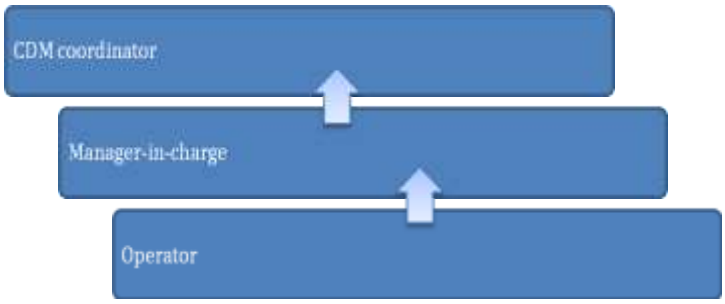
Not Applicable.

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

Not Applicable

SECTION C. Description of monitoring system

IOT Mabagas will ensure accuracy of the measurement system by adopting the following operational and management structure.



The parameters mentioned above are monitored and recorded electronically and / or in log sheets by the Operator. Based on the logged data recorded in the panel log sheets, a monthly report consisting of above parameters is prepared by the manager-in-charge in a soft copy and is forwarded to the CDM coordinator through email on monthly basis. The report received from respective department through e-mail is compiled by the CDM Coordinator. The reports will be retained till two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later. A CDM Manual is prepared, which illustrates the detailed roles and responsibilities of individuals involved in the project activity.

To ensure Quality Control and Quality Assurance of the monitored parameters following procedures is adopted:

- The data used is reviewed by conducting a inter department review meeting once in 6 months. The CDM Coordinator will discuss the data (received from respective departments) with the Operator of concerned departments. Once data is compiled and checked, it will be handed to verifying DOE for verification.

As per §17 of the General Guidelines to SSC CDM methodologies (Version 17):

Monitoring*: while monitoring the emission reductions from the small-scale project activity, project participants shall:*
(a) Electronically archive all data collected as part of monitoring for a period of two years from the end of the crediting period;

All data will be archived until two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

(b) Data variables that are most directly related to the emission reductions (e.g. quantity of the fuel inputs, the amount of heat or electricity produced, gas captured) should be measured continuously. Data elements that are generally constant and indirectly related to the emission reductions (e.g. emission factors, calorific value, system efficiencies) should be measured or calculated at least once a year, unless detailed specifications are provided as part of the indicated methodology;

The measuring of the data variables is in line with this requirement as elaborated in Section B.7.1

(c) Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years

All the measuring equipment will be calibrated as per manufacturers specification and recommendation and the calibration report will be maintained by the project participant. This would be done at a frequency of less than 3 years in line with the guidance.

(d) The measured data with high levels of uncertainty or without adequate calibration should be compared with location/national data and commercial data to ensure consistency;

Not applicable.

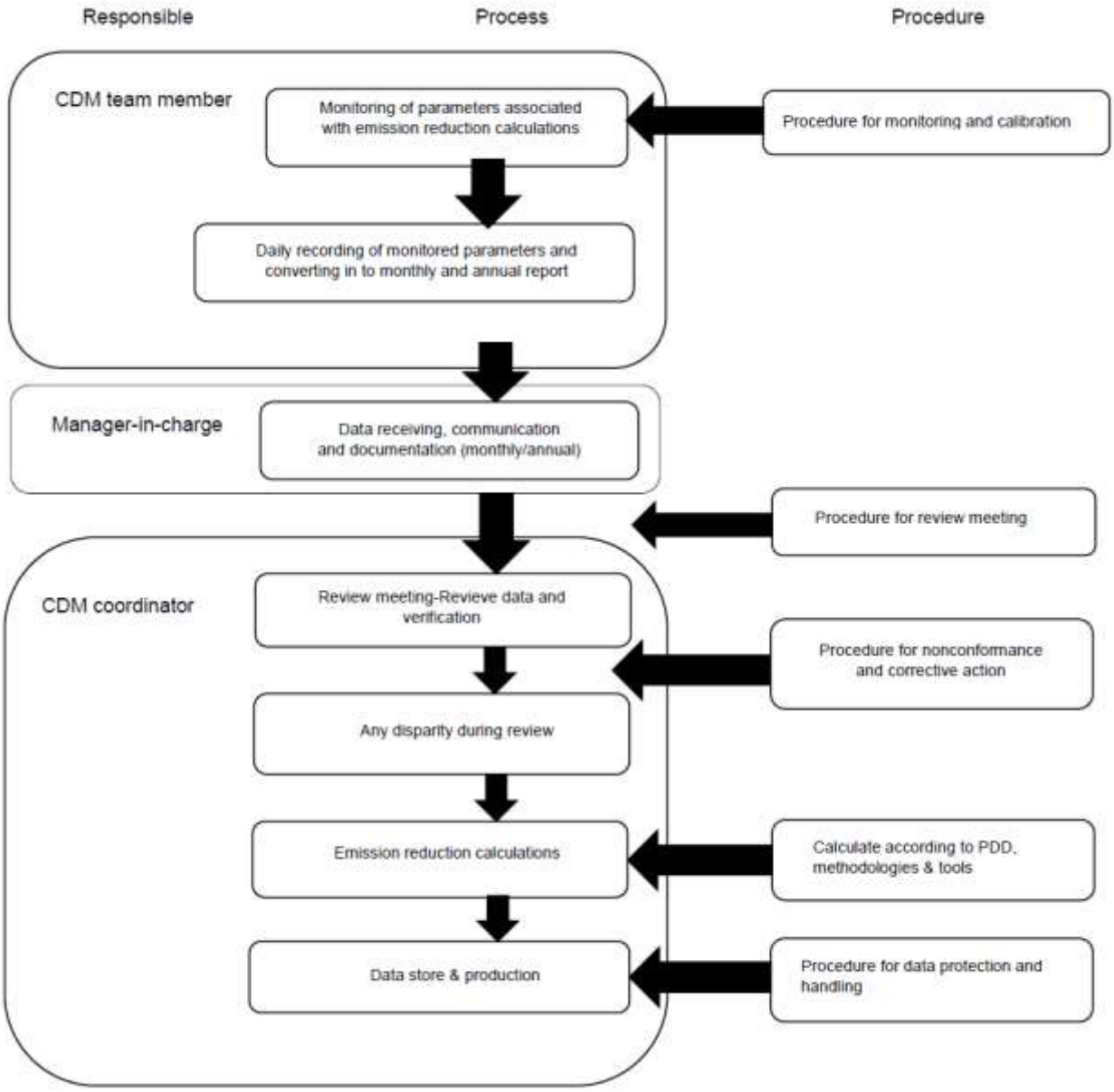
(e) Wherever a statistical sample is proposed for monitoring, the 'General guidelines for sampling and surveys for small-scale CDM project activities' shall be referred.

Project participant will refer to the general guidelines for sampling when using statistical sampling.

Calibration management system: To carry out calibration consistent with the manner and frequency specified in the Monitoring Plan, a calibration mater list is prepared. The plant Manager (Manager in charge) is responsible for ensuring that calibration is done as per plan as stated above. If any equipment is found faulty, the same need to be replaced immediately. In case of delay in calibration, error factor is applied.

Back-up & emergency flare
In case of prolonged maintenance schedules the gas can be stored in four gas holding roofs and if need be burnt in a dedicated on-site enclosed emergency flare to avoid methane emissions
In Case of any data are temporarily not available for reasons such as faulty meters, the values for relevant parameters will be determined most conservative.

Flow chart for CDM Data monitoring & recording is presented as below



Specific monitoring aspects regarding AMS-III.D. Methane recovery in manure management systems – version 18.

The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (MCF) than the MCF for the manure treatment systems used in the baseline situation, therefore the emission reductions achieved by the project activity is limited to the ex post calculated baseline emissions minus project emissions using the actual monitored data for the project activity. The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = min\left[\begin{array}{l}(BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}),(MD_y - PE_{y,power,ex\ post} - \\ PE_{y,transp,ex\ post} - PE_{y,res\ waste,ex\ post} - PE_{y,phy\ leakage,ex\ post} - LE_{y,ex\ post})\end{array}\right]$$

(Equation 19)

Where:

$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year y (tCO_2e)
$BE_{y,ex\ post}$	Baseline emissions calculated using equation 6 using *ex post* monitored values (e.g. Q_y) (tCO_2e)
$PE_{y,ex\ post}$	Project emissions calculated using equation (10) using *ex post* monitored values (e.g. Q_y, transport distances, the amount of electricity/fossil fuels used, emissions from anaerobic storage). This calculation shall include project emissions from physical leakage (tCO_2e)
$LE_{y,ex\ post}$	Leakage emissions calculated using *ex post* monitored values (tCO_2e)
MD_y	Methane captured and destroyed or used gainfully by the project activity in year y (tCO_2e)
$PE_{y,transp,ex\ post}$	Emissions from incremental transportation based on monitored values in the year y (tCO_2e)
$PE_{y,power,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO_2e)
$PE_{y,res\ waste,ex\ post}$	Methane emissions from the anaerobic decay/treatment of the residual waste/products based on monitored values in the year y (tCO_2e)
$PE_{y,phy\ leakage,ex\ post}$	Methane emissions from physical leakages of the anaerobic digester based on monitored values in year y (tCO_2e)

Total biogas production and electricity generation will be monitored as part of standard operating procedures of the project. Methane destruction will occur primarily through the combustion of biogas in the gas engines. Only in case of emergency biogas will be flared. The operations of the flare will be monitored separately.

Formulas to determine $PE_{y,ex\ post}$

$$PE_y = \left\{\begin{array}{l}PE_{transp,y} + PE_{power,y} + PE_{res\ waste,y} \\ + PE_{phy\ leakage,y} + PE_{flaring,y}\end{array}\right\} \quad \text{(Equation 10)}$$

$PE_{power,y}$

Monitoring parameters to determine ex-post methane capture & destroyed (MD_y)

According to paragraph 19 (b) of AMS-III.AO (Version 01): flaring/ combustion MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP\_CH_4 \quad \textbf{(Equation 20)}$$

Where:

$BG_{burnt,y}$	Biogas[89] flared/combusted in year y (m^3)
$w_{CH4,y}$	Methane content in the biogas in the year y (volume fraction)
D_{CH4}	Density of methane at normal conditions (20°C at 1 atmosphere) (tonnes/m^3)
FE	Flare efficiency in the year y (fraction). If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% may be applied (see parameter ID.14)

As per paragraph 19 (c) of AMS-III.AO (Version 01):

> *The method for integration of the terms to calculate MD_y to obtain the results for one year of measurements within the confidence level, as well as the methods and instruments used for metering, recording and processing the data obtained, shall be described in the project design document and monitored during the crediting period;*

The methods and instruments used for metering, recording and processing are described in the relevant parameter boxes for $BG_{flared,y}$, $BG_{combusted,y}$, w_{CH4}, D_{CH4} and FE. The monitored parameters are w_{CH4} (ID.23) $BG_{combusted,y}$ (ID.25), $BG_{flared,y}$ (ID.26) and T_{flare} (ID.29).

ID		Description	Measurement point	How monitored
23	w_{CH4}	Methane content in the biogas	Control room	Values are logged every 10 minute interval. These values are then exported using a CSV file into Excel.
25	$BG_{combusted,y}$	The total amount of the biogas combusted	Control room	Values are logged every 10 minutes. These values are then exported using a CSV file into Excel.
26	$BG_{flared,y}$	The amount of biogas generated that is flared	Control room	Values are logged every 10 minutes. These values are then exported using a CSV file into Excel.
29	T_{flare}	Temperature in the exhaust gas of the flare.	Flare	Using a Type N thermocouple the temperature is monitored continuously; the average value is logged every 10 minutes by the system. These values are then exported using a CSV file into Excel. Here the project participant checks if they should be taken into account (see parameter box ID.14 FE_y) and then averages all values into one annual value.

The data is integrated as per below table. The logged data are matched for each interval. Per interval the FE is determined. The MD is calculated as per equation 23 for each interval. MD_y is calculated by summing all MD values for the monitoring period.

Time interval	**BG_{flared}**	**$BG_{combusted}$**	**T_{flare}**	**w_{CH4}**	**FE**	**MD**
	Monitored	Monitored	Monitored	Monitored	Default (see parameter box ID.14)	Calculated (See equation 23)
00:30:00	M3/hr	M3/hr	Deg. C	%	100%; 90%; 50%; 0%	tCO2e
01:00:00	M3/hr	M3/hr	Deg. C	%	100%; 90%; 50%; 0%	tCO2e
Etc.						
…						
Annual Total						**TOTAL tCO2e/y (sum of above)**

Since BG_{flared}, $BG_{combusted}$ and T_{flare} are monitored continuously, confidence level is 100% (no statistical sampling; entire population is measured), hence the results for one year of measurements are within the confidence level.

As per paragraph 19 (d) of AMS-III.AO (Version 01):

> *Project activities where a portion of the biogas is destroyed through flaring and the other portion is used for energy may consider to apply the flare efficiency to the portion of the biogas used for energy, if separate measurements are not performed; When the amount of methane that is combusted for energy and that is flared is separately monitored, a destruction efficiency of 100% can be used for the amount that is combusted for energy;*

A portion of the biogas is destroyed through flaring and another portion us used for

energy generation. Hence:

$$BG_{burnt,y} = BG_{combusted,y} + BG_{flared,y}$$

Hence equation (18) is rewritten:

$$MD_y = (BG_{flared,y} * w_{CH4,y} * D_{CH4} * FE * GWP\_CH_4) + (BG_{combusted,y} * w_{CH4,y} * D_{CH4} * GWP\_CH_4)$$

As per paragraph 19 (e) of AMS-III.AO (Version 01):

Flow meters, sampling devices and gas analysers shall be subject to regular maintenance, testing and calibration to ensure accuracy;

The devices used to monitor the following parameters are subject to regular maintenance, testing and calibration as per §17 of the General Guidelines to SSC CDM methodologies (Version 17):

ID. 23	**w_{CH4}**	gas analyser	see parameter box
ID. 24	**$FV_{RG,h}$**	flow meter	see parameter box
ID. 25	$BG_{combusted,y}$	flow meter	see parameter box
ID. 26	$BG_{flared,y}$	flow meter	see parameter box

As per paragraph 19 (f) of AMS-III.AO (Version 01):

The monitoring plan should include onsite inspections for each individual digester included in the project boundary where the project activity is implemented for each verification period.

Each individual digester included in the project boundary will be inspected on site for each verification period.

Monitoring requirement for verification of proper soil application

As per AMS-III.F paragraph 25 the project participant will archive all sales records for the treated residue (compost). The conditions for proper soil application ensuring aerobic conditions have been established by a local expert

Baseline emissions (BE) are discussed in table 4.1.c. in the PDD. Since PP cannot demonstrate the BE for agri waste or cow dung, the BE has been set to zero in line with the methodology (conservative approach).

To further show that the methodology is conservative below argument shows that using (Equation 19 will always result in a conservative approach, in line with CDM

$$ER_{y,ex\ post} = min\left[\begin{array}{l}(BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}),(MD_y - PE_{y,power,ex\ post} - \\ PE_{y,transp,ex\ post} - PE_{y,res\ waste,ex\ post} - PE_{y,phy\ leakage,ex\ post} - LE_{y,ex\ post})\end{array}\right]$$

As per registered PDD, the MDy of the gas will be 7.5 mln m^3 * density * methane content * 25 ~ 65,000 CERs. Equation (6) of registered PDD would result in ~ 13,200 CERs claimed ($BE_{y,expost}$), in which case ER would equal MIN ($BE_{y,expost,}$ MD_y) = 13,200 CERs.

$BE_{y,expost}$ will basically always be more conservative than MD_y:

- If $Q_{chickenlitter,expost}$ would be 100% of Q_{total} then MD_y would still be approx 65,000 BE would be approx. 26,400;
- Hence $BE_{y,expost}$ would still be more conservative;
- If $Q_{chickenlitter,expost}$ would be 0%, then $BE_{y,expost}$ would be 0 CERs.
-

In every case $BE_{y,expost}$ would be more conservative; hence project is in line with methodology. The comparision is shown in section E.3 of MR

SECTION D. Data and parameters

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

Data/parameter:	**ID. 1./ $EF_{grid,CM,y} = EF_{EL,y}$**
Unit	tCO_2/GWh
Description	EFy is the CO2 emission factor of the Southern grid, in which the project activity displaced the electricity during the year y.
Source of data	The CEA CO2 Emission Database Version 6.0, March 2011
Value(s) applied)	865
Choice of data or measurement methods and procedures	Since the CEA is the prime authority for publishing all relevant data regarding the Indian power sector, the choice of the data is conservative. The emission factor is calculated from the CEA's OM and BM values of the Indian regional grid systems. The parameter is calculated according to the guidelines of CDM modalities and procedures.
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID. 2./ $EF_{grid,OM,y}$**
Unit	tCO2/GWh
Description	Operating Margin Emission Factor of the Southern grid.
Source of data	The CEA CO2 Emission Database Version 6.0, March 2011[77].
Value(s) applied)	966
Choice of data or measurement methods and procedures	Since the CEA is the prime authority for publishing all relevant data regarding the Indian power sector, the choice of the data is conservative. The emission factor is calculated from the CEA's data. The parameter is calculated according to the guidelines of CDM modalities and procedures.
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID. 3./ $EF_{grid,BM,y}$**
Unit	tCO2/GWh
Description	Build Margin Emission Factor of the Southern grid.
Source of data	The CEA CO2 Emission Database Version 6.0, March 2011[78].
Value(s) applied)	763
Choice of data or measurement methods and procedures	Since the CEA is the prime authority for publishing all relevant data regarding the Indian power sector, the choice of the data is conservative. The emission factor is calculated from the CEA's data. The parameter is calculated according to the guidelines of CDM modalities and procedures.
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID. 4./ GWP_{CH4}**
Unit	CH_4
Description	Global Warming Potential (GWP) of methane. The factor describes the conversion of 1 tCH4 into 1 tCO2equivalent emissions.
Source of data	AMS-III.AO version 01.
Value(s) applied)	25
Choice of data or measurement methods and procedures	as per methodology AMS-III.AO version 01, equations 1 where GWP_{CH4} = 21, however as per UNFCCC standard and IPCC guidelines, the GWP for methane is considered as 25. https://cdm.unfccc.int/faq/Reference/Standards/meth/reg_stan02.pdf https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
Purpose of data	Determination of Baseline and Project Emission
Additional comments	As per below web link, and being second commitment period for current monitoring period, GWP for methane is considered as 25. https://cdm.unfccc.int/faq/Reference/Standards/meth/reg_stan02.pdf

Data/parameter:	**ID. 5./ $D_{CH4} = \rho_{CH4,n}$**
Unit	kg/m^3
Description	Density of methane at normal conditions (20 ºC and 1 atm pressure)
Source of data	IPCC 2006 default factor, see Equation 10.23 on pg.10.41 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use.
Value(s) applied)	0.67
Choice of data or measurement methods and procedures	The value is taken from the IPCC 2006 tables, see above. In absence of choice of data, the IPCC default value is the best option to use.
Purpose of data	Determination of Baseline and Project Emission
Additional comments	In equation 7 and 20 defined as D_{CH4}; in equation 16 defined as $\rho_{CH4,n}$ Data

Data/parameter:	**ID. 6./ MCF_j**
Unit	%
Description	Methane conversion factor for manure management. Only for poultry litter.
Source of data	Department of Bioenergy, Tamil Nadu Agricultural University (Tamil Nadu), Methane Emission Potential of Poultry Litter (October 2011).
Value(s) applied)	22.84%
Choice of data or measurement methods and procedures	The data is derived from a report from Tamil Nadu Agricultural University based on field studies of a sample of poultry farms in the Namakkal district. This report is the most recent relevant source for the project activity.
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID 7./ $B_{o, LT}$**
Unit	$m^3_{CH\ 4}/kg$
Description	Maximum methane production potential (in the baseline situation). LT = Livestock = poultry.

Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories under the volume 'Agriculture, Forestry and other Land use' for 'Emissions from Livestock and Manure Management' Table 10A-9, page 10.82.
Value(s) applied)	0.24
Choice of data or measurement methods and procedures	As no country specific factor is available, the IPCC 2006 default factor is used
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID. 8./ $VS_{default}$**
Unit	Kg/head/day
Description	Volatile solids for livestock LT
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories under the volume 'Agriculture, Forestry and other Land use' for 'Emissions from Livestock and Manure Management', Table 10A-9, page 10.82.
Value(s) applied)	0.02
Choice of data or measurement methods and procedures	As no country specific factor is available, the IPCC 2006 default factor is used.
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID. 9./ $MS\%_{BI,j,y}$**
Unit	%
Description	Fraction of manure handled in baseline animal manure management system j in year y.
Source of data	Department of Bioenergy, Tamil Nadu Agricultural University (Tamil Nadu), Methane Emission Potential of Poultry Litter (October 2011).
Value(s) applied)	100%
Choice of data or measurement methods and procedures	100% of the poultry litter at poultry farms sourced by PP is managed under anaerobic conditions. PP refer to Department of Bioenergy, Tamil Nadu Agricultural University (Tamil Nadu), Methane Emission Potential of Poultry Litter (October 2011). Document made available to the DOE as SD_04.
Purpose of data	Determination of Baseline Emission
Additional comments	-

Data/parameter:	**ID. 10./ $EF_{CO2,diesel,y}$**
Unit	tCO_2/TJ
Description	CO_2 emission factor of diesel used in the year y.
Source of data	IPCC 2006 guidelines.
Value(s) applied)	74.8

Choice of data or measurement methods and procedures	As per tool "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" the following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** a) Values provided by the fuel supplier in invoices — This is the preferred source b) Measurements by the project participants — If a) is not available c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances) d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available As Project Participants do not have invoices from suppliers (option a), they have opted for option (d), the IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Purpose of data	Determination of Project Emission
Additional comments	-

Data/parameter:	**ID. 11./ NCV $_{Diesel}$**
Unit	GJ/t
Description	Net calorific value of diesel.
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Table 1.2
Value(s) applied)	43.3

Choice of data or measurement methods and procedures	As per tool "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" the following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** a) Values provided by the fuel supplier in invoices — This is the preferred source if the carbon fraction of the fuel is not provided (Option A) b) Measurements by the project participants — If a) is not available c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances). d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available As Project Participants do not have invoices from suppliers (option a), they have opted for option (d). The IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Purpose of data	Determination of Project Emission
Additional comments	-

Data/parameter:	**ID. 12./ ρ_{diesel}**
Unit	t/m^3
Description	Density of diesel.
Source of data	CEA's CO_2 Emission Database Version 6.0, March 2011. Appendix B (page 25)of the CO_2 Baseline Database for the Indian Power Sector User Guide, accessed at: http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver6.pdf
Value(s) applied)	0.83

Choice of data or measurement methods and procedures	As per tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" the following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** a) Values provided by the fuel supplier in invoices — This is the preferred source b) Measurements by the project participants — If a) is not available c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). Since (a) is not available to the PP, option (c) is opted and the value from the Central Electricity Authority (CEA) is used. The CEA is the statutory organisation under Ministry of Power who collects and records data concerning the generation, transmission, trading, distribution and utilization of electricity.
Purpose of data	Determination of Project Emission
Additional comments	-

Data/parameter:	**ID. 13./ $EF_{CO2,transport}$**
Unit	$kgCO_2/km$
Description	CO_2 emission factor from fuel use due to transportation.
Source of data	Based on 8 km/ litre of average fuel consumption ($F_{diesel,avg}$) value determined as per contracts obtained from logistics company
Value(s) applied)	0.326
Choice of data or measurement methods and procedures	Transport is subcontracted; value determined as per contracts obtained from logistics company.
Purpose of data	Determination of Project Emission
Additional comments	-

Data/parameter:	**ID. 14./ $\eta_{flare,h} = FE_y$**
Unit	%
Description	Flare efficiency in hour h based on measurements or default values.
Source of data	Default values given in the Methodological Tool to determine project emissions from flaring gases containing methane (Version 01).
Value(s) applied)	90%

Choice of data or measurement methods and procedures	Under the project activity an enclosed flare will be installed. For enclosed flares the Tool to determine project emissions from flaring gases containing methane (Version 01) stipulates two options: a) To use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.; or b) continuous monitoring of the methane destruction efficiency of the flare (flare efficiency). For determination of the flare efficiency option (a) – use of default values – has been chosen for the project activity In case of enclosed flares and use of default values the following flare efficiency values shall be applied: • 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C for more than 20 minutes during the hour h; • 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h; • 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h. • As per paragraph 19 (b) of AMS-III.AO (Version 01) if the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% may be applied Based on continuous measured T_{flare}, η_{flare} is determined based upon above default values.
Purpose of data	Determination of Project Emission
Additional comments	Used to calculate Project Emissions from flaring ($PE_{flare,y}$) as per Methodological Tool to determine project emissions from flaring gases containing methane (Version 01) (formula 15); Used to calculate Methane destructed in year y (MD_y) as per AMS-III.D (formula 18)

Data/parameter:	**ID.15./ $fv_{CH4,RG,h}$**
Unit	mg/m^3
Description	Volumetric fraction of CH4 in the residual gas in the hour h.
Source of data	Page 2, 2nd line below figure 01 of TNAU report
Value(s) applied)	60%
Choice of data or measurement methods and procedures	Only used for ex-ante estimation of the methane content in the residual gas since PP opts to use option (a) page 3 of the "Tool to determine project emissions from flaring gases containing methane" (version 01), $fv_{CH4,RG,h}$ is only required in step 5 to calculate the ex-ante value of $TM_{FG,h}$ since under step 6 PP opts to use default values and enclosed flare.
Purpose of data	Determination of Project Emission
Additional comments	-

Data/parameter:	**ID. 16./ $TDL_{j,y}$**
Unit	-

<table>
<tr><td>Description</td><td>Average technical transmission and distribution losses for providing electricity to source j in year y.</td></tr>
<tr><td>Source of data</td><td>Use as default values of 20% for project or leakage electricity consumption sources as per methodological tool “Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01).</td></tr>
<tr><td>Value(s) applied)</td><td>20%</td></tr>
<tr><td>Choice of data
or measurement methods
and procedures</td><td>As per methodological; “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (Version 01) in case of scenario B and scenario C, case C.II, assume TDLj/k/l,y = 0 as a simplification. In case of other scenarios (scenario A and scenario C, cases C.I and C.III), choose one of the following options:,

• Use recent, accurate and reliable data available within the host country;
• Use as default values of 20% for
(a) project or leakage electricity consumption sources;
(b) baseline electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies.
• Use as default values of 3% for
(a) baseline electricity consumption sources;
(b) project and leakage electricity consumption sources if the electricity consumption by all project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is smaller than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies.

In light of the options above, Project Participants have opted for the following:

<table>
<tr><td rowspan="2">$TDL_{j,y}$</td><td>Grid</td><td>20%</td><td>as per tool 2nd bullet option (a) above</td></tr>
<tr><td>Gen Set</td><td>3%</td><td>as per tool 3rd bullet option (b) above</td></tr>
</table>
</td></tr>
<tr><td>Purpose of data</td><td>Determination of Project Emission</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data/parameter:	**UFb**
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Taken from AMS III.D Version 18 and reference for this value is FCCC/SBSTA/2003/10/Add.2, page 25
Value(s) applied)	0.94
Choice of data or measurement methods and procedures	Default value as per AMS III.D version 18
Purpose of data	Determination of baseline Emission
Additional comments	-

D.2 Data and parameters monitored

Data/parameter:	ID. 18./ $EG_{gross,y}$
Unit	GWh/y
Description	The gross electricity generated by the project activity.
Measured/calculated/default	Measured
Source of data	Energy meter
Value(s) of monitored parameter	18.636 GWh, Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Energy Meter. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	Monthly Report on PLC
Calculation method (if applicable):	The gross electricity generated by the project activity would be monitored based on an energy meter on the generator panel of the engines which is logged on PLC (programmable logic controller).
QA/QC procedures:	The data is monitored continuously. The Operator reports the readings on a monthly basis. Based on the logged data, a monthly report is prepared by Manager-in-Charge and is forwarded to CDM Coordinator through email on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months. The Coordinator CDM will discuss the data (received from respective departments) with the operators of the concerned departments. Accuracy class is 0.2S class as per IEC62053-22. Once the data is compiled and checked, it will be handed over to Verifier for verification. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	This parameter is not directly used for Determination of Baseline Emission However used to compare/cross check net electricity supplied by project to grid.
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	ID. 19./EG_{BL}
Unit	GWh/y
Description	Net electricity supplied by the project activity to the grid.
Measured/calculated/default	Measured
Source of data	TANGEDCO (Tamil Nadu Generation and Distribution Corporation) report based on this which PP will raise the invoice to TANGEDCO along with duly signed report.
Value(s) of monitored parameter	15.818 GWh , Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Energy Meter. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter
Measuring/reading/recording frequency:	Monthly basis

Calculation method (if applicable):	The energy meter operates continuously. TANGEDCO official will check the energy meter (primary) once per month and the reading will be recorded in the log books. The TANGEDCO official will issue a monthly consumption statement, which will be used as source of data. Based on this statement PP will raise the invoice to TANGEDCO along with the monthly consumption statement.
QA/QC procedures:	If primary energy meter fails to read then TANGEDCO will refer the secondary energy meter. If both energy meters fails then source of data will be used from the previous last 3 months reports mutually agreed by PP & TANGEDCO. Based on the logged data, a report is prepared by Manager-in-Charge and is forwarded to CDM Coordinator through email on monthly basis. The data used is reviewed by conducting an inter department review meeting once in 6 months. The Coordinator CDM will discuss the data (received from respective departments) with the operators of the concerned departments. Once the data is compiled and checked, it will be handed over to Verifier for verification. The metering arrangements with facilities to record export and import of energy shall be provided in accordance with the Central Electricity Authority (installation and Operation of Meters) Regulations, 2006, Commission's Intra State Open Access Regulations 2005. Tamil Nadu Electricity Distribution Code, 2004 and Tamil Nadu Grid Code, 2004 in consultation with Distribution Licensee / State transmission Utility. The periodicity of testing, checking, calibration etc., will be governed by the Regulations issued by the Central Electricity Authority / Commission. The energy meters healthiness will be checked by TANGEDCO at regular intervals will be decided by TANGEDCO on time to time basis. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Baseline Emission
Additional comments:	The above methodology is accepted by PP in EPA signed with TANGEDCO. The data will be archived electronically until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later as per § 17.a of the general guidelines to SSC CDM methodologies (version 17).

Data/parameter:	**ID. 20./ $EC_{PJ,y}$**
Unit	GWh/y
Description	Net electricity imported from the grid in case the Power units are not operating.
Measured/calculated/default	Measured
Source of data	TANGEDCO (Tamil Nadu Generation and Distribution Corporation) report based on this which PP will raise the invoice to TANGEDCO along with duly signed report.

Value(s) of monitored parameter	0.294 GWh Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Energy Meter. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter
Measuring/reading/recording frequency:	Monthly basis
Calculation method (if applicable):	The energy meter operates continuously. TANGEDCO official will check the energy meter (primary) once per month and the reading will be recorded in the logbooks. The TANGEDCO official will issue a monthly consumption statement, which will be used as source of data. Based on this statement TANGEDCO will raise an invoice along with duly signed report if the Net electricity supplied by the project activity to the grid minus the net electricity imported is negative over the reporting period (if more electricity is imported than supplied).
QA/QC procedures:	If primary energy meter fails to read then TANGEDCO will refer the secondary energy meter. If both energy meters fail then source of data will be used from the previous last 3 months reports mutually agreed by PP & TANGEDCO. The metering arrangements with facilities to record export and import of energy shall be provided in accordance with the Central Electricity Authority (installation and Operation of Meters) Regulations, 2006, Commission's Intra State Open Access Regulations 2005. Tamil Nadu Electricity Distribution Code, 2004 and Tamil Nadu Grid Code, 2004 in consultation with Distribution Licensee / State transmission Utility. The periodicity of testing, checking, calibration etc., will be governed by the Regulations issued by the Central Electricity Authority / Commission The energy meters healthiness will be checked by TANGEDCO at regular intervals will be decided by TANGEDCO on time to time basis. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Project Emission
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	**ID. 21./ $Q_{i,y}$**
Unit	t/y
Description	Amount of waste type *i* (poultry litter, agricultural wastes, cow dung) used at the plant.
Measured/calculated/default	Measured
Source of data	Weigh bridge records.
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different waste and for different period
Monitoring equipment	Weigh bridge. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	Each truck loading is monitored and then monthly reports
Calculation method (if applicable):	All incoming trucks transporting poultry litter shall be directly measured using the onsite weighbridge. The delta in weight between the empty truck and the loaded truck is taken as the weight of the poultry litter.

QA/QC procedures:	Each weigh instance is monitored and logged in the log book by the Operator. Based on the logged data, a monthly report is prepared by Manager-in-Charge and is forwarded to CDM Coordinator through email on monthly basis. Once the data is compiled and checked, it will be handed over to Verifier for verification. The measuring equipment (electronic weigh bridge) is designed as per IS: 9281 manufacturing standard specifications (+/- 0.025% of FS). The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17)..
Purpose of data:	Determination of Emission Reductions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	**ID. 22./$Q_{res\ waste,y}$**
Unit	t/y
Description	Amount of treated residue (compost) shipped off.
Measured/calculated/default	Measured
Source of data	Weigh bridge records.
Value(s) of monitored parameter	5281.72 tons, Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Weigh bridge. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	Each truck, daily report and monthly report
Calculation method (if applicable):	All trucks transporting compost would be measured for both empty weight and also with loaded compost. The difference is the weights would be measured for amount of treated compost shipped off from the plant. This is also substantiated with invoices/payment receipts to the buyers of the treated compost
QA/QC procedures:	Each weigh instance is monitored and logged in the log book on a daily basis by the Operator. Based on the logged data, a monthly report is prepared by the Manager-in-Charge and is forwarded to the CDM Coordinator through email on monthly basis. Once the data is compiled and checked, it will be handed over to the Verifier for verification. The measuring equipment (electronic weigh bridge) is designed as per IS:9281 manufacturing standard specifications (+/- 0.025% of FS). The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Emission Reductions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	**ID.23./ w_{CH4}**
Unit	%
Description	Methane content in the biogas (dry).
Measured/calculated/default	Measured
Source of data	Gas analyser.

Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Gas analyser. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	10 min values, based on which monthly report is generated
Calculation method (if applicable):	Data is monitored continuously. Values are logged every half hour. The CH4 content is analysed by NDIR (non-dispersive infrared sensor) and is hence measured directly and the measurement point is close to the biogas flow rate measurement point (ID.24).
QA/QC procedures:	The 30 minutes interval assures a confidence/ precision level higher than the 90/10 level required (see appendix 4 of PDD regarding the required sample size). The 10 min value is recorded for the project activity. Based on the logged data, a monthly report is prepared by Manager-in-Charge which is forwarded to the CDM Coordinator. The data used is reviewed by conducting a inter department review meeting once in 6 months. Once the data is compiled and checked, it will be handed over to the Verifier for verification. The measuring equipment (Gas analyser) is designed as per ANSI/API RP 555- 2001 manufacturing standard specifications. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Project Emissions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later as per § 17.a of the general guidelines to SSC CDM methodologies (version 17).

Data/parameter:	**ID. 24./$FV_{RG,h}$**
Unit	m^3/h
Description	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*.
Measured/calculated/default	Measured
Source of data	Measurements by project participants using a Thermal mass flow meter.
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Thermal mass flow meter. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	Half hour values, based on which monthly report is generated from PL
Calculation method (if applicable):	Will be continuously measuring the gas flow rate and the value will be logged in PLC on a half hourly basis. Accuracy measurement: ± 1.8% of reading + 0.1% full scale. PP will ensure that the same basis (dry) is considered for this measurement.

QA/QC procedures:	Data is monitored continuously. Values are logged every half hour. Based on the logged data, a monthly report is prepared by Manager-in-Charge which is forwarded to CDM Coordinator. The measuring equipment is designed using IS/ANSI manufacturing standard specifications. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Project Emissions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later as per § 17.a of the general guidelines to SSC CDM methodologies (version 17). In § III of the "Tool to determine project emissions from flaring gases containing methane" (version 01) in the parameter box for $FV_{RG,h}$ under "Measurement procedures" the following sentence is included ("[…] and the measurement of volumetric fraction of all components in the residual gas ($fv_{i,h}$) when the residual gas temperature exceeds 60 ^{o}C]. Since PP opts to use option (a) page 3 of the "Tool to determine project emissions from flaring gases containing methane" (version 01), this part of the sentence is not relevant and has hence been left out.

Data/parameter:	**ID.25./ $BG_{combusted,y}$**
Unit	m^3/y (normalized)
Description	The amount of the biogas combusted, measured on a dry basis.
Measured/calculated/default	Measured
Source of data	Flow meter.
Value(s) of monitored parameter	8,808,976 m^3 (Refer Emission Reduction Sheet to get values for different period)
Monitoring equipment	Flow meter. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	10 min values, based on which monthly report is generated from PLC
Calculation method (if applicable):	The quantity of biogas generated is measured using a calibrated flow meter. The flow meter values are logged in the system. The accuracy class of the flow meter for is ±0.1% of full scale.
QA/QC procedures:	Data is monitored continuously. Values are logged every 10 min. Based on the logged data, a monthly report is prepared by Manager-in-Charge which is forwarded to CDM Coordinator. The data used is reviewed by conducting a inter department review meeting once in 6 months. Once the data is compiled and checked, it will be handed over to Verifier for verification. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Project Emissions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	ID.26./ $BG_{flared,y}$
Unit	m^3/y (normalized)
Description	The amount of biogas generated that is flared, measured on a dry basis.
Measured/calculated/default	Measured
Source of data	Project participants will monitor which will provide the actual value with flow meter.
Value(s) of monitored parameter	133,333, m^3 (Refer Emission Reduction Sheet to get values for different period)
Monitoring equipment	Flow meter. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	10 min values, based on which monthly report is generated
Calculation method (if applicable):	The quantity of biogas flared is measured using a calibrated flow meter. The flow meter values are logged in the system. The accuracy class of the flow meter for is ±0.1% of full scale.
QA/QC procedures:	Data is monitored continuously. Values are logged every 10 min. Based on the logged data, a monthly report is prepared by Manager-in-Charge which is forwarded to CDM Coordinator. The data used is reviewed by conducting a inter department review meeting once in 6 months. Once the data is compiled and checked, it will be handed over to Verifier for verification. The measuring equipment used for monitoring data is calibrated as per manufacturers specifications, but at least once in three years as per § 17.c of the general guidelines to SSC CDM methodologies (version 17).
Purpose of data:	Determination of Emission Reductions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later

Data/parameter:	ID. 27./ Frequency of tilling
Unit	Number
Description	Number of times each batch is tilled.
Measured/calculated/default	Calculated
Source of data	Plant records (Log book maintained at drying yard).
Value(s) of monitored parameter	Daily Count
Monitoring equipment	Not Applicable
Measuring/reading/recording frequency:	Once per day
Calculation method (if applicable):	The digester sludge output will be separated in a common separation system. The solid phase will be solar dried in a dedicated fertilizer yard. The piles are regularly turned (once or twice in a day) to improve porosity and oxygen content of the piles, thus ensuring that the solids are aerobically handled. Each batch is dried for approximately 12 - 13 days.

QA/QC procedures:	The Operator reports the readings at each tilling in the plant records, as well as when the sludge is removed. Based on the logged data, a monthly report is prepared by the Manager-in-Charge and is forwarded to the CDM Coordinator. The data used is reviewed by conducting a inter department review meeting once in 6 months. Once the data is compiled and checked, it will be handed over to the Verifier for verification.
Purpose of data:	Determination of Emission Reductions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	**ID. 28./FC_{Diesel}**
Unit	Litres
Description	Amount of diesel consumption for operation at site for e.g. tillers and diesel generator set.
Measured/calculated/default	Calculated
Source of data	Plant Records
Value(s) of monitored parameter	96,592 litres , Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	NA
Measuring/reading/recording frequency:	Daily monitoring and Monthly compilation
Calculation method (if applicable):	Consumed during operation of tillers and DG set at the site.
QA/QC procedures:	This can be cross checked with the fuel receipts / invoices raised by the to be applied.
Purpose of data:	Determination of Project Emissions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/parameter:	**ID. 29./ T_{flare}**
Unit	Deg C
Description	Temperature in the exhaust gas of the flare.
Measured/calculated/default	Measured
Source of data	Measurements by project participants.
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Type N thermocouple. Please refer Annexure 1 for meters and calibration details used for this monitoring parameter.
Measuring/reading/recording frequency:	Half hour values, based on which monthly report is generated from PLC
Calculation method (if applicable):	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 ^{O}C indicates that a significant amount of gases are still being burnt and that the flare is operating.

QA/QC procedures:	Data is monitored continuously. Values are logged every half hour. Based on the logged data, a monthly report is prepared by the Accounts Manager in hard or soft copy and is forwarded to the CDM Coordinator through email on monthly basis. Once the data is compiled and checked, it will be handed over to the Verifier for verification. The thermocouples are manufactured as per ANSI standard specifications. Thermocouples are replaced or calibrated every year as per the manufacturer recommendations.
Purpose of data:	Determination of Project Emissions
Additional comments:	An excessively high temperature at the sampling point (above 700 ^{o}C)may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow. The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later

Data/parameter:	**ID. 30./ $N_{LT,y}$**
Unit	Individual bird.
Description	Livestock population.
Measured/calculated/default	Calculated
Source of data	Based on back-calculation of poultry litter requirement of the plant (i.e. design capacity) and average generation data (i.e. 40 g / head / day)
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	NA
Measuring/reading/recording frequency:	Annual report
Calculation method (if applicable):	As per report from Tamil Nadu Agricultural University, poultry produces 35 – 40 grams of litter per day per head. The value $N_{LT,y}$ is determined through back-calculation of the poultry litter requirement of the plant on an annual basis. In addition, each farm has records for its livestock population. Through sampling, the records can be compared with sales records of manure from the respective farm and the data can be compared to calculate livestock population.
QA/QC procedures:	The consistency between these values and indirect information (records of sales, records of food purchases) shall be assessed. Significant changes in livestock population will be explained.
Purpose of data:	Determination of Project Emissions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later. For 100% of the population the used value is then based on the following back calculation: ~ 2.5 million heads * ~ 40 grams per head per day * 365 operational days ≈ 37,000 tonne of poultry litter per year. As the animal manure is not treated in different treatment systems, the parameter $MS\%_{i,y}$ doesn't have to be monitored as is defined in section 26 no. 15 of AMS-III.D version 18.

Data/parameter:	ID. 31./$DAF_{W,i}$
Unit	km/truck
Description	Average incremental distance for waste type *i* (poultry litter, agri waste and cow dung) transportation.
Measured/calculated/default	Measured
Source of data	Records (TRIPSHEETS) showing from which location the waste originates.
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Plant records
Measuring/reading/recording frequency:	Sampling from complete set of records of each truck loading
Calculation method (if applicable):	Since PP cannot calculate the baseline distance; PP has opted to monitor (sample) the distances and use the sampled values without subtracting the baseline (original) distance. The distance travelled by each type of waste is determined on sample basis and same distance is considered for respective type of waste transported. Please refer excel sheet of ER calculations for the distances considered for each type of waste.
QA/QC procedures:	Records (TRIPSHEETS) showing from which location the waste originates. Through statistically sound sampling the distance between those locations and the project (plant) site is determined and verified. The distance considered for project emissions are without subtracting any baseline distance, thus conservative in nature. Also sample size is selected to achieve 90/10 confidence precision level. The average value of distance is considered for project emission calculations.
Purpose of data:	Determination of Project Emissions
Additional comments:	-

Data/parameter:	ID. 32./ $DAF_{res\ waste}$
Unit	km/truck
Description	Average incremental distance for compost transportation.
Measured/calculated/default	Measured
Source of data	Records i.e. TRIPSHEETS
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Plant records
Measuring/reading/recording frequency:	Sampling from complete set of records of each truck loading
Calculation method (if applicable):	The distance travelled by compost is determined on sample basis and same distance is considered for emission due to transportation. Please refer excel sheet of ER calculations for the distances considered for organic compost
QA/QC procedures:	The location of each batch of compost sold will be registered and documented via sales records and TRIPSHEETS. The distances from the project (plant) site to these sample soil application locations of the compost are averaged and cross-referenced with the compost sales records. The sample size is selected to achieve 90/10 confidence precision level. The average value of distance is considered for project emission calculations.
Purpose of data:	Determination of Project Emissions

Additional comments:	-

Data/parameter:	**ID. 33./ APP_{comp}**
Unit	%-age
Description	Proper application of compost
Measured/calculated/default	Measured
Source of data	An external local expert shall execute the sampling.
Value(s) of monitored parameter	Refer Emission Reduction Sheet to get values for different period
Monitoring equipment	Plant records
Measuring/reading/recording frequency:	Sampling from complete set of records of each truck loading
Calculation method (if applicable):	The soil application should be monitored to ensure that there is proper application of compost. A sample of 20 hectares of land per annum to check on proper application of compost and condition during application which does not lead to any further emissions. Final crop for which compost is used should be recorded. Since compost is applied properly, there is no any project emissions due to this parameter.
QA/QC procedures:	The location of each batch of compost sold is registered and documented via sales records and TRIPSHEETS. A statistically sound test sample land area totalling 20 hectares is determined from locations where soil application of the compost takes place (as per SD_32 Tide Compost Report).
Purpose of data:	Determination of Project Emissions
Additional comments:	The data will be archived until two years after the end of crediting period or the last issuance of CERs for this project activity, whichever occurs later as per § 17.a of the general guidelines to SSC CDM methodologies (version 17).

D.3 Implementation of sampling plan

The purpose of sampling is to obtain unbiased and reliable estimates of the mean value of parameters used in the calculations of greenhouse gas emission reductions. 'Unbiased' in this case indicates that the sampling will not systematically underestimate or overestimate the mean value determined. The design of the sampling plan follows the outline set in Appendix 3 of the 'standard for sampling and surveys for CDM project activities and programme of activities (Version 2.0)'.

The sampling plan contains information relating to: (a) sampling design; (b) data to be collected; and (c) implementation plan.

(**a) Sampling design**

(i) Objectives and Reliability Requirements

Objective of determining the**:**

1. Average incremental distance for waste type i (poultry litter, agri waste and cow dung) transportation ($DAF_{w,i}$)
2. Average incremental distance for compost transportation ($DAF_{res\ waste}$)
3. Compost application (APP_{comp})

These values are determined for every monitoring period. As there is no specific guidance in the applicable methodologies, project proponents will use 90/10 confidence/precision as the criteria for reliability of sampling efforts for small-scale project activities as per paragraph 9 of the Standard for sampling and surveys for CDM project activities and programme of activities (Version 2.0).

(ii) Target Population

Target population for $DAF_{w,i}$ comprises the incremental distances (in kilometres) the incoming waste streams (in tonnes) are transported under the project activity. The waste will be transported using trucks. The average capacity is 8 tonnes per truck (CT_y; monitored). The incoming waste (Q_y; monitored) = 168947 tonnes/ year, hence an approximate 21121 truck movements will be required. These consist of the following waste types (stata):

Waste type ($Q_{y,i}$)	Tonnes	expected annual truck movements (rounded)
$Q_{y,poultry\ litter}$	39,391.74	4,924
$Q_{y,cow\ dung}$	1,506.41	189
$Q_{y,press\ mud}$	79,557.43	9,945
$Q_{y,sogo\ water}$	42,643.54	5,331
$Q_{y,fruit\ waste}$	1,441.51	181
$Q_{y,black\ thippi}$	4,406.08	551
Total (rounded up)	168,947	21,121

Target population for $DAF_{res\ waste}$ an approximate 661 truck movements will be required ($Qy_{,treatment}$ ~5281 tonnes per year/ 8 tonnes per truck = 661 trucks).

For compost application the volume is approximately 110.000 hectares on which the compost is applied. This compost is expected to be very homogeneous throughout the year.

(iii) Sampling Method

Parameter	Sampling Method	Comment
$DAF_{W,i}$	Stratified Random Sampling	The average incremental distance is expected to be different for each strata (but homogeneous within the strata).
$DAF_{res, waste}$	Simple Random Sampling	The average incremental distance is expected to be homogeneous within sample group.
APP_{comp} Compost application	Simple Random Sampling	The application is expected to be homogeneous within sample group.

(iv) Sample Size

The sample size is determined based on a 10% error margin at 90% confidence level. Per sample (or stratum) the sample size is determined based on the formula for either percentage data or numerical data. As per Annex 4 of registered PDD, the sample size is determined based on population (N) i.e number of truck movements and for current entire monitoring period, the sample size selected are more than required as compared with number of truck movements. For example, for parameter DAFw,poultry for population of 4,900 truck movements, sample size is selected as 30 truck movements, however in entire current monitoring period, there are 4,924 truck movements and sample size is selected as 90. Thus the sample size is appropriately selected. Also instead of average incremental distance, PP has considered total distance and maximum distance from sample as a conservative approach.

The distance considered for project emissions are without subtracting any baseline distance, thus conservative in nature. Also sample size is selected to achieve 90/10 confidence precision level. The average value of distance is considered for project emission calculations. Please refer excel sheet for 90/10 confidence/precision level.

(v) Sampling Frame

Parameter	Sampling Frame
DAF_W	
$DAF_{W, poultry}$	records of all incoming trucks from poultry farms (Trip sheet)
$DAF_{W,cow\ dung}$	records of all incoming trucks from dairy farms (Trip sheet)
$DAF_{W, agri}$	records of all incoming trucks from agri waste factories (Trip sheet)
$DAF_{res, waste}$	records of outgoing trucks carrying compost (Trip sheet)
APP_{comp}	records of outgoing trucks carrying compost (Trip sheet)

(b) Data

(i) Field measurements

Parameter	Field measurements
DAF_W	
$DAF_{W, poultry}$	the samples is selected randomly from the sample frame. The travelled distance is determined based on GPS/ Google Maps directions or similar of the shortest route between the respective poultry farm and the site.
$DAF_{W,cow\ dung}$	the samples is selected randomly from the sample frame. The travelled distance is determined based on GPS/ Google Maps directions or similar of the shortest route between the respective poultry farm and the site.

$DAF_{W, agri}$	the samples is selected randomly from the sample frame. The travelled distance is determined based on GPS/ Google Maps directions or similar of the shortest route between the respective factory and the site.
$DAF_{res, waste}$	During operations the samples is selected randomly from the sample frame. The distance is measured/ recorded. To derive the incremental distance
APP_{comp}	See Tide report [source] for data form.

(ii) Quality Assurance/Quality Control:

The following Quality Assurance/Quality Control procedures have to be in place**.**

Table 9: QA/QC

Parameter to be sampled	Quality Assurance/Quality Control
$DAF_{W, poultry}$	Tripsheet data was checked on regular basis by Manager In Charge and during the interdepartmental review meeting by the CDM coordinator as per PDD
$DAF_{W,cow\ dung}$	Tripsheet data was checked on regular basis by Manager In Charge and during the interdepartmental review meeting by the CDM coordinator as per PDD
$DAF_{W, agri}$	Tripsheet data was checked on regular basis by Manager In Charge and during the interdepartmental review meeting by the CDM coordinator as per PDD
$DAF_{res, waste}$	If the $DAF_{res, waste}$ value calculated based on the samples is larger than the expected value (50km), then the larger value is used as the new value for $DAF_{res, waste}$.
APP_{comp}	For each improper soil application determined, the related leakage emissions is calculated and taken into account when claiming emission reductions. For current monitoring period, proper soil application of compost is done.

(iii) Analysis: Describe how the data will be used.

Parameter to be sampled	How data will be used
$DAF_{W,i}$	The maximum value calculated from the sample size is used as $DAF_{W,i}$ value as conservative approach
$DAF_{res, waste}$	The maximum value calculated from the sample size is used as conservative approach .
APP_{comp}	Data is used to conclude that soil is properly applied.

(c) Implementation
The PP has trained the CDM team members to perform the sampling. The sampling is embedded in the operational procedures and in the monitoring plan as per PDD.

Verification
Based on the data gathered a written monitoring report is provided to the verifying DOE to demonstrate compliance with the monitoring requirements corresponding to the preceding monitoring period.

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

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

Baseline emissions:

Baseline emissions from electricity generation

EGBL,y : 15.817 GWh - monitored
EFCO2,grid,y: 865 tCO2/GWh – ex-ante
Calculations
*BEElec,y = EGBL,y *EFCO2,grid,y*
Results
BEElec,y = 13,682.50 tCO2e

Baseline emissions from poultry litter

The table below provides the anticipated quantities of substrate to the anaerobic digester:

Sr. No.	Waste	Quantity (tons)
1	Poultry Litter	39,391.74

As per PDD, only Poultry litter is considered for baseline calculations

The table below provides the overview of data used to determine the baseline emission related to avoidance of methane production.

Input data			
Variable	**Value applied**	**Unit**	**Source**
VSdefault	0.02	kg	IPCC
days per year	365	d	Default
Calculations			
$VS_{LT,y}$ = $VS_{default}$ * no of days			
Results			
$VS_{LT,y}$= calculated month wise, please refer ER calculation sheet			

Input data			
Variable	**Value applied**	**Unit**	**Source**
GWP_{CH4}	25	-	IPCC and CDM guideline for 2nd commitment period
D_{CH4}	0.67	kg/m^3	ex-ante; see parameter ID.5 in § B.6.2
UF_b	0.94	-	ex-ante; Model correction factor to account for model uncertainties (0.94)
MCF_j	22.84	%	ex-ante; see parameter ID.6 in § B.6.2
$B_{0,\ LT}$	240	M^3CH_4/t	ex-ante; see parameter ID.7 in § B.6.2
$N_{LT,y}$	Refer ER sheet for month wise calculations	birds	Calculated
$VS_{LT,y}$	-	kg/month	Calculated above, refer excel sheet of ER

$MS\%_{BI,u}$	100%	-	ex-ante; see parameter ID.9 in § B.6.2
Calculations			
$BE_{manure,y} = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{BI,j}$			
Results			
$BE_{manure,y}$ = 16999.07 tCO_2e			

Hence baseline emissions are:

Input data
$BE_{Elec,y}$ = **13,682.50** tCO_2e
$BE_{manure,y}$ = **16999.07** tCO_2e
Calculations
$BE_y = BE_{Elec,y} + BE_{manure,y}$
Results
BE_y = 30,681.57 tCO_2e = 30,681 tCO_2e (Round down value)

Above mentioned calculation is as per Registered PDD. Please refer ER calculation sheet for baseline emission calculations for baseline emissions as per AMS I.D and as AMS III.AO

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

The project emissions are due to electricity import from grid, diesel consumption in DG set, emissions due to transportation of waste used for project activity and residual waste compost transportation. The project emissions due to flaring are also calculated as per registered PDD.
The below formulaes are used for the calculations of project emissions due to project activity.

$$PE_y = \begin{Bmatrix} PE_{transp,y} + PE_{power,y} + PE_{res\ waste,y} \\ + PE_{phy\ leakage,y} + PE_{flaring,y} \end{Bmatrix} \quad \textbf{(Equation 10)}$$

$$PE_{power} = PE_{power\_own\ gen} + PE_{power\_elec} + PE_{power\_DG} \quad \textbf{(Equation 12)}$$

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{i,y}) \quad \textbf{(Equation 13)}$$

$$PE_{power\_DG} = PE_{FC,j,y}$$

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad \textbf{(Equation 14)}$$

$$PE_{transp,y} = (Q_y / CT_y) * DAF_w * EF_{CO2,transport} + (Q_{res\text{-}waste,y} / CT_{res\text{-}waste,y}) * DAF_{res\text{-}waste} * EF_{CO2,transport} \quad \textbf{(Equation 11)}$$

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times \left(1 - \eta_{flare,h}\right) \times \frac{GWP_{CH4}}{1000}$$

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n}$$

Please refer ER calculation spreadsheet for the calculation of project emissions.
As per ER calculations excel sheet,
PEtransport.y = 324.19 tCO_2e
PEpower.y = 570.88 tCO_2e
PEphy.leakage.y=4703.31 tCO_2e
PEflaring.y =1070.59 tCO_2e
Total project emissions = 6725 tCO_2e (Round up value)

As per formula 19 of registered PDD,

$$ER_{y,ex\ post} = min\left[\begin{array}{l}(BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}), (MD_y - PE_{y,power,ex\ post} - \\ PE_{y,transp,ex\ post} - PE_{y,res\ waste,ex\ post} - PE_{y,phy\ leakage,ex\ post} - LE_{y,ex\ post})\end{array}\right]$$

(Equation 19)

Though registered PDD mentioned that in every case BEy,expost would be more conservative, the ex post emission reductions are compared as per equation 19 of registered PDD as below.

As per above formula,	**Value**	**Unit**
MDy calculated for 942 days, 13200 for 365 days	34,066.85	**tCO2e**
PE power	570.88	**tCO2e**
PE transport	324.19	**tCO2e**
PE res waste	0.00	**tCO2e**
PE phy leakage	4,703.31	**tCO2e**
Ley	0	**tCO2e**
First Formula calculations	**24,012**	**tCO2e**
As per above formula,		
Second formula Calculations	28,477	**tCO2e**
ER ex post , Minimum of first formula and second formula	**24,012**	**tCO2e**

E.3. Calculation of leakage

As per registered PDD and methodology applied its considered as Zero.

E.4. 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	30,681	6,669	0	0	24,012	24,012

E.5. 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 or GHG removals by sinks (t CO_2e)	57,694	24,012

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

The actual emission reductions are 58% lesser than the estimated value. This is due to less Plant Load Factor.

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	IOT Mabagas Limited (IML)
Street/P.O. Box	103
Building	Spectra, Hiranandani Business Park, Powai,
City	Mumbai
State/region	Maharashtra
Postcode	400 076
Country	India
Telephone	+91 22 66772700
Fax	+91 22 66919599/ +91 22 2570685
E-mail	marketing.india@oiltanking.com
Website	www.iotinfraenergy.com
Contact person	
Title	Chief Operating Officer
Salutation	Mr
Last name	Ali
Middle name	
First name	Beer
Department	Energy
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	beer.ali@oiltanking.com

Project participant and/or responsible person/ entity	☒ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	**Carbonbay GmbH & Co. KG**
Street/P.O. Box	Admiralitaetstrasse 55
Building	
City	Hamburg
State/region	
Postcode	20459
Country	Germany
Telephone	+49 40 37004 846
Fax	+49 40 37004 829
E-mail	henning.huenteler@carbonbay.com
Website	www.carbonbay.com
Contact person	Henning Huenteler

Title	
Salutation	Mr.
Last name	Huenteler
Middle name	
First name	Henning
Department	
Mobile	+49 172 6369 178
Direct fax	+49 40 37004 829
Direct tel.	+49 40 37004 846
Personal e-mail	henning.huenteler@carbonbay.com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	EKI Energy Services Limited
Street/P.O. Box	Scheme 78 Part-2, Vijay Nagar (Near Brilliant Convention Centre)
Building	EnKing Embassy, Office No. 201, Plot 48
City	Indore
State/Region	Madhya Pradesh
Postcode	452 010
Country	INDIA
Telephone	0731-4289086
Fax	0731-4289086
E-mail	business@enkingint.org
Website	www.enkingint.org
Contact person	Mr. Manish Dabkara
Title	Director
Salutation	Mr.
Last name	Dabkara
Middle name	-
First name	Manish
Department	CDM Services Dept.
Mobile	+91-9907534900
Direct fax	+91-0731-4289086
Direct tel.	+91-0731-4289086
Personal e-mail	manish@enkingint.org

Annexure 1 Calibration Details

ID19,20	Net Electricity Export & Import		Gross Electricity Generated
	Main Meter	**Check Meter**	Energy Meter
Measuring Instrument	Energy Meter, 0.2s	Energy Meter, 0.2s	Energy Meter, 0.5s
Serial Number	TNE59496	TNE59499	205229/270-3310
Class	0.2s	0.2s	0.5s
Make	Secure Meters Ltd	Secure Meters Ltd	Conzerv-EM 6400
Calibration Frequency	3 years	3 years	3 years
Calibration date	30-Aug-12	27-Aug-12	Not Available
Calibration due date	29-Aug-15	26-Aug-15	Not Available

Note - The calibration certificates for Gross electricity generation meter are not available, thus considering the Greenfield project activity, the date of first calibration can be considered as commissioning date conservatively and as per calibration frequency of 3 years, the meters are running accurately. Also this parameter is not considered for ER calculation, thus there is no use to apply any error factor for the readings of this parameter.

ID 21,22	Weigh Bridge 1	Weigh Bridge 2
Measuring Instrument	Weigh Bridge	Weigh Bridge
Machine Number	RH 1151	RH 1152
Class	+/-0.025% of FS	+/-0.025% of FS
Make	Ricelake Weighing Systems	
Calibration Frequency	3 years	3 years
Calibration date	27-Aug-12	27-Aug-12
Calibration due date	26-Aug-15	26-Aug-15

ID.23./	wCH4 Methane content in the biogas (dry).
Measured	Gas Analyzer
Unit	%
Serial Number	94116
Class	+/- 1% of the range
Make	Union Instruments GmbH, INCA4001 T100-02
Calibration Frequency	3 years
Calibration date	25-Sep-12
Calibration due date	24-Sep-15

ID 24 Volumetric flow rate of the residual gas in dry basis at normal conditions in h
ID 26 The amount of biogas generated that is flared, measured on a dry basis

Measuring Instrument	Thermal Mass Flow Meter (FT 1202)
Unit	m3/hr
Serial Number	HAO 3CE02000
Class	+/-1.8% of reading +0.1% full scale
Make	Endress + Hause
Calibration Frequency	3 years
Calibration date	30-Oct-12
Calibration due date	30-Oct-15

ID 25 Amount of the biogas combusted, measured on a dry basis

Measuring Instrument	Flow Meter (FT 1201)
Unit	m3/year
Serial Number	HAO 3CF02000
Class	+/-0.1% of full scale
Make	Endress + Hause
Calibration Frequency	3 years
Calibration date	30-Oct-12
Calibration due date	30-Oct-15

ID 29 Temperature in the exhaust gas of the flare.

Measuring Instrument	Thermocouple
Unit	Deg c
Serial Number	10-TC-80322, 10-TC-80323, 10-TC-80324, 10-TC-80325
class	+/- 0.5%
Make	Tempsens
Calibration Frequency	3 years
Calibration date	5-Jun-12
Calibration due date	4-Jun-15

Note – The calibration validity is up to 04/06/2015 and end date of monitoring period is 31/07/2015. However there is no any gas flared for month of June and July 2015, thus there is no any impact on the ER calculations and no need to apply any error factor for delay calibration.

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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.
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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