CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Methane Capture and use as a fuel at Santosh Starch Products (A unit of Santosh Starch Ltd.), Bhachau, District. Kutch, Gujarat, India.

Version 1 dated 14 November 2007

A.2. Description of the small-scale project activity:

Santosh Starch Products (A unit of Santosh Starch Ltd.) is located at village Morgar of district Kutch of the state Gujarat. Maize Starch, Modified Starch Binders, Liquid Glucose malto dextrin powder are the main products while Gluten, Germ, Fine Bran and Coarse Bran are the byproducts of Santosh Starch Products (hereafter referred as SSP).

Wastewater treatment is an integrated part of the starch-manufacturing unit of Santosh Starch Products. Project deals with the avoidance of methane emissions from wastewater treatment. It also brings about avoidance of the CO_2, SOx & NOx emissions which would have occurred due to use of RFO in flash dryers.

In the project activity, biogas generated through anaerobic wastewater treatment in the digester is captured & collected in the gasholder. This captured biogas is combusted & heat value of the biogas is used to dry the maize products thereby reducing direct on-site emission of CH_4 in addition to the CO_2 due to the combustion of furnace oil for drying the products in flash dryers. This project has the capacity to reduce GHG emissions by 7063 tonnes of CO_2 equivalent per year and 70630 tonnes of CO_2 equivalent over a 10-year time frame. Apart from GHG emissions reductions, the project significantly reduces SO_x emission and NO_x emissions.

The starch unit of SSP generates 1150 m^3/day of the effluent from its various activities with high level of BOD & COD. Therefore, to comply with the norms SSP had installed anaerobic wastewater treatment system to treat the effluent generated. Present wastewater treatment facility meets the statutory requirements of the Gujarat Pollution Control Board (GPCB).
The anaerobic system releases methane having global warming potential of 21 times that of CO_2. Subsequent to attaining the knowledge of the Kyoto Protocol and CDM potential in their plant, the management took the decision to capture the biogas and utilize its heat content in plant operations. The project activity is a small step towards sustainable development.

The project has evident contribution to sustainable development, which are as follows:

1. Reducing methane emissions in the atmosphere.
2. Controlling the undesirable odour pollution by recovering the released methane.
3. Utilizing the heat value of biogas (waste gas) to dry the products in the flash dryer.
4. Reducing petroleum oil requirement by use of sustainable source of energy
5. Reducing petroleum oil import requirement for the country
6. Reducing the amount of GHG emissions and other pollutants.
7. Enhancement of local employment.

A.3. Project participants:

Name of Party involved (*) (host) indicates a host Party	Private and/ or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/ No)
India	Private Entity: Santosh Starch Products, (A unit of Santosh Starch Ltd.),	No
*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting the registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the small-scale project activity:

The project involves two types of activities, recovery of biogas generated from wastewater treatment of the effluent & drying of the products using thermal value of biogas captured.

In the wastewater treatment the effluent generated is collected at the entry point of equalization tank by gravity. Both the effluents are mixed and entered in the equalization tank. From the equalizing tank it is pumped to the Primary clarifier. Clarified effluent is taken to buffer tank to maintain the pH. From the buffer tank, effluent is pumped inside the Upflow Anaerobic Sludge Blanket (UASB) digester. Here the effluent is treated anaerobically. The system releases biogas. The activity involves the recovery of biogas. The gas generated is then collected & hold up in the gasholder. The effluent generated from the anaerobic treatment is then taken into Aeration tank. Aerobic treatment is carried out with the help of aerators. Mixed liquor at the certain content is maintained in aeration tank. Aerobic bacteria in the mixed liquor consume organic matter in present in the effluent in the presence of oxygen and reduces BOD/COD load in the effluent. Outlet of the aeration tank then enters in Secondary Clarifier. Finally the treated wastewater from secondary clarifier with COD content of 200-325 mg/L is utilized in agriculture. Sludge generated from primary and secondary clarifier is collected in a tank and pumped to anaerobic sludge digester. The degraded sludge is taken out from sludge digester by drain valve and disposed out on agricultural land as manure.

The gas collected in the gasholder is then pumped to the biogas burner with the help of blower to boost up the pressure in the biogas line. In biogas burner the biogas is combusted in presence of air. Then the thermal energy generated is carried to the flash dryer where the drying activity is carried out. The heat value of the gas is utilized for the drying of the products. In the project, 2 dryers are used, one Gluten dryer & other Malto dryer.

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Country: India

A.4.1.2. Region/State/Province etc.:

State: Gujarat

A.4.1.3. City/Town/Community etc:

Village- Morgar, Taluka- Bhachau, Dist.- Kutch

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Santosh Starch Products is located at village Morgar in tahsil Bhachau of district Kutch of the state Gujarat. Bhachau town is located on latitude of 23^{O} 17' N and longitude of 70^{O} 20' East from where the plant is at approximately 20 Km away. The biogas plant is installed within the boundary of the industry.

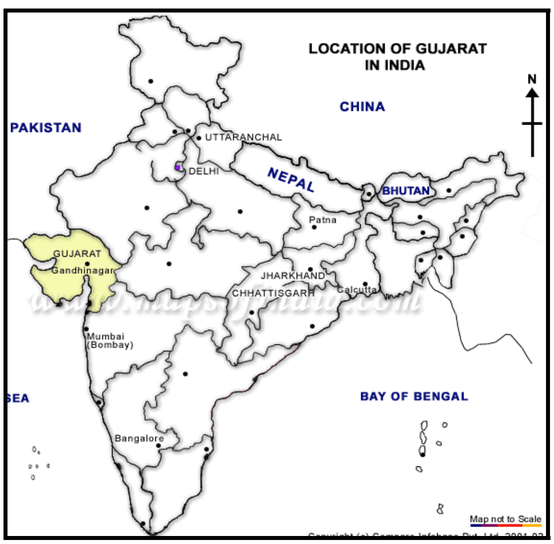


Fig: 1. Map of India Showing Location of Gujarat India

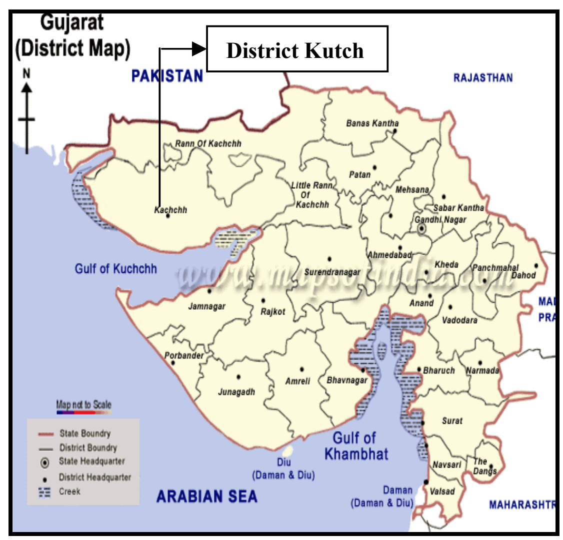


Fig: 2. Map of Gujarat Showing Location of District Kutch

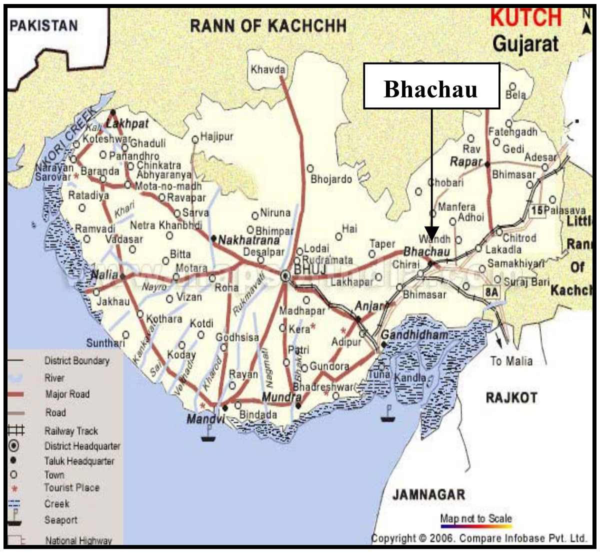


Fig: 3. Map of District Kutch Showing Location of Bhachau town

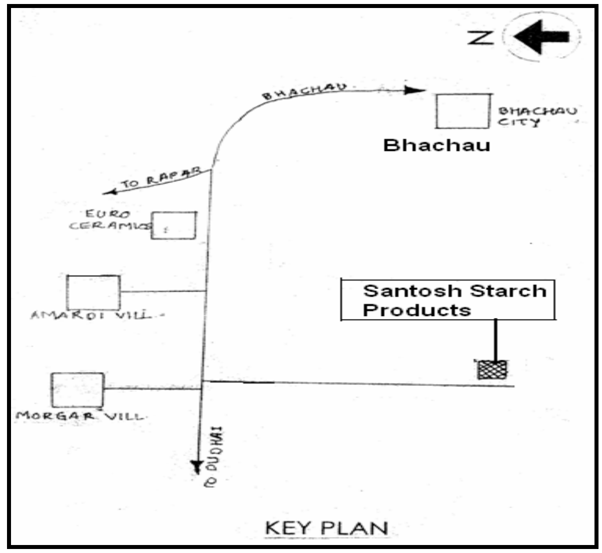


Fig:4. Map Showing key plan of Santosh Starch Products

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Referring to the UNFCCC CDM web-site, as per appendix B to the simplified modalities & procedures (M&P) for small-scale CDM project activities type and category of this project activity are:

Type: Type III: Other Project Activities
Category: III.H: Methane Recovery In Wastewater Treatment (Version 7: Valid from 02 Nov 07 onwards)

and

Type: Type I: Renewable Energy Projects
Category: I.C: Thermal energy for the user with or without electricity (Version 12: Valid from 10 Aug 07 onwards)

Description of environmentally safe & sound technology applied:

The project involves capture of biogas & use of thermal value of biogas for drying.

The wastewater treatment generates biogas, which is recovered & collected in the biogas holder. The treated wastewater from anaerobic treatment is subjected to aeration and then clarification. Finally the treated wastewater from secondary clarifier, with COD content of 200-325 mg/L is used in the agriculture. Also the sludge generated from the wastewater treatment is used as a fertilizer because of the significant amount of nitrogen content.

Biogas from the biogas holder is then pumped to biogas burner with the help of blower to boost up the pressure in the biogas line. The gas is combusted in the burner & thermal energy generated is utilized in the flash dryer for drying the products.

Use of FO in the dryers results in large amount of green house gas emissions, which mainly consists of the emissions of CO_2, CH_4 & N_2O. Also the use of RFO results in emissions of SOx as well as NOx, which are harmful to the environment as these are the cause of acid rain. Use of biogas in the dryers solves the main problem of GHG emissions by carrying out significant reduction in the emissions of these gases. Also SOx & NOx emissions are significantly reduced. The technology used promotes the use of biogas as fuel thereby contributing to solve the problem of energy crisis by reducing the use of petroleum fuel. Thus the technology applied results in safe environmental condition by proper use of biogas instead of GHG emitting fossil fuels.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Years	Estimation of annual emission reductions in tonnes of CO_2 e
Year 2008	7063
Year 2009	7063
Year 2010	7063
Year 2011	7063
Year 2012	7063
Year 2013	7063
Year 2014	7063
Year 2015	7063
Year 2016	7063
Year 2017	7063
Total estimated reductions (Tonnes of CO_2 e)	**70630**
Total number of crediting years	**10 years**
Annual average of the estimated reductions over the crediting period (t CO_2 e)	**7063**

A.4.4. Public funding of the small-scale project activity:

No public funding has been involved in this project. There is no national or international public funding whatsoever for this project. SSP will make all investments from its own sources. Also there is no subsidy element in implementation of the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

Paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small Scale CDM project activities states that:

“2. A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point”

As none of the above condition is applicable to this CDM project activity, it is not a debundled component of a large-scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Referring to the UNFCCC CDM web-site, as per appendix B to the simplified modalities & procedures (M&P) for small-scale CDM project activities type and category applicable to this project activity are:

Type: Type III: Other Project Activities
Category: III.H: Methane Recovery In Wastewater Treatment (Version 7: Valid from 02 Nov 07 onwards)

and

Type: Type I: Renewable Energy Projects
Category: I.C: Thermal energy for the user with or without electricity (Version 12: Valid from 10 Aug 07 onwards)

B.2 Justification of the choice of the project category:

Justification of choice of type & category of the project activity:

Paragraph 1 of "AMS III.H. Methane recovery in wastewater treatment (Version 7: Valid from 02 Nov 07 onwards)" states that

1. This project category comprises measures that recover methane from biogenic organic matter in wastewaters by means of one of the following options:

(i) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with methane recovery and combustion.

(ii) Introduction of anaerobic sludge treatment system with methane recovery and combustion to an existing wastewater treatment plant without sludge treatment.

(iii) Introduction of methane recovery and combustion to an existing sludge treatment system.

(iv) Introduction of methane recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant.

(v) Introduction of anaerobic wastewater treatment with methane recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream.

(vi) Introduction of a sequential stage of wastewater treatment with methane recovery and combustion, with or without sludge treatment, to an existing wastewater treatment system without methane recovery (e.g. introduction of treatment in an anaerobic reactor with methane recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).

Further, Paragraph 3 of "AMS III.H. Methane recovery in wastewater treatment (Version 7: Valid from 02 Nov 07 onwards)" states that

"3. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually"

The present project activity involves the introduction of methane recovery & combustion to the existing anaerobic wastewater treatment such as anaerobic reactors & hence as per the option (iv) of paragraph 1 of Type III.H, the project activity falls under the category Type III.H. Also the emission reductions resulting from the methane recovery are 7063 TCO_2-e/year, which are less than 60 kt CO_2.Therefore; the project activity meets all the applicability criteria of project category III.H.

Also as per the paragraph 2 of Category III.H, "If the recovered methane is used for heat & or electricity generation that component of the project activity can use a corresponding category under type I."

Paragraph 1 of "Type I.C. Thermal energy for the user with or without electricity (Version 12: Valid from 10 Aug 07 onwards)" states that,

"1. This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuels. Examples include solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass for water heating, space heating, or drying, and other technologies that provide thermal energy that displaces fossil fuel. Biomass-based co-generating systems that produce heat and electricity are included in this category."

In this project activity, methane recovered from wastewater treatment is utilized for energy generation (drying), which avoids the corresponding RFO consumption. Thus the project activity generates thermal energy for the user avoiding the use of fossil fuel (RFO). Therefore the project falls under the category I.C.

B.3. Description of the project boundary:

(i) Methane recovery in waste water:

As per paragraph 4 of "Type AMS. III.H: Methane recovery in wastewater treatment" (Version 7: Valid from 02 Nov 07 onwards) of Appendix B of the simplified M&P for small-scale CDM project activities, project boundary considerations are:

"4. The project boundary is the physical, geographical site where the wastewater and sludge treatment takes place."

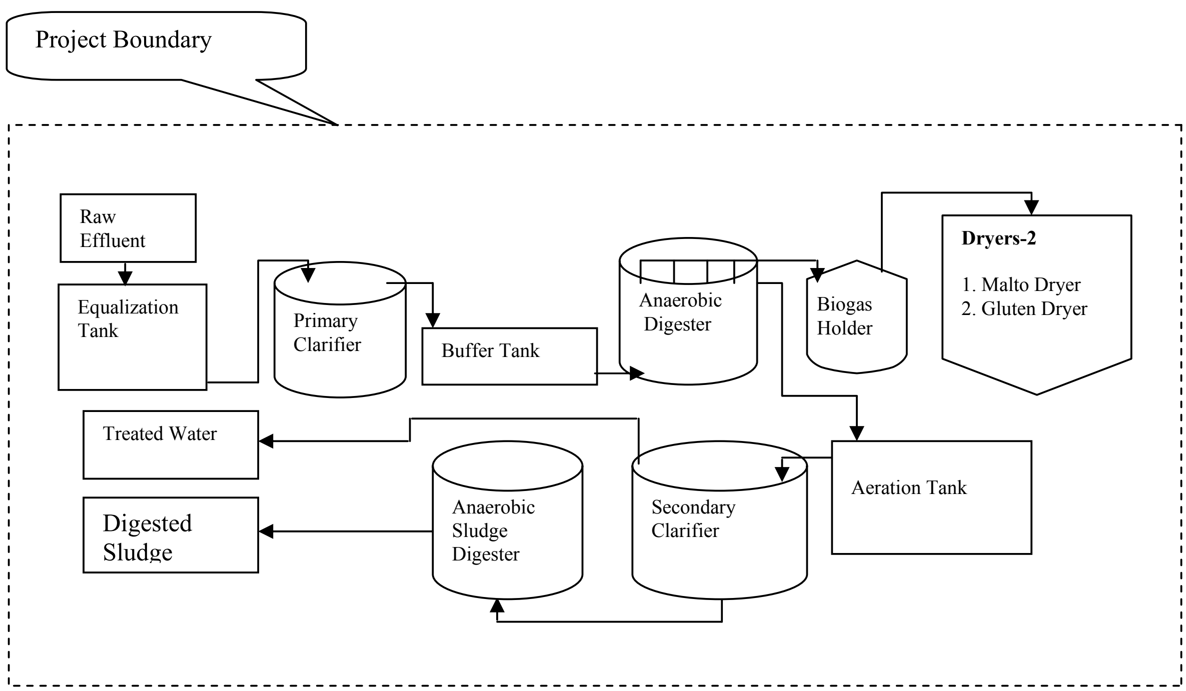
(ii) Use of biogas for drying purpose:

As per paragraph 5 of "Type AMS. I. C. Thermal energy for the user with or without electricity (Version 12: Valid from 10 Aug 07 onwards)" of Appendix B of the simplified M&P for small-scale CDM project activities, project boundary considerations are:

"5. The physical, geographical site of the renewable energy generation delineates the project boundary."

The proposed project activity involves waste water treatment and collection of biogas released from wastewater treatment and utilization of this biogas as a fuel for drying of the maize products in the flash dryers. Therefore, for the project activity the project boundary includes wastewater treatment system, point of biogas collection and supply to the point of heat generation for dryers. Thus, the project boundary covers waste water treatment system, gasholder for collection of biogas, piping and valves for biogas transmission along with a biogas blower for boosting pressure in the biogas line and dryers where biogas is used for heat generation.

Figure: Project Boundary for Project Activity at Santosh Starch Products, Bhachau, India



B.4. Description of baseline and its development:

Paragraph 6 of "Type III.H: Methane recovery in wastewater treatment" (Version 7: Valid from 02 Nov 07 onwards) of appendix B of the simplified M&P for small-scale CDM project activities, states that:

"6. The baseline scenario will be one of the following situations:

(vi) The existing anaerobic wastewater treatment system without methane recovery for the case of introduction of a sequential anaerobic wastewater treatment system with methane recovery."

The project activity involves the introduction of methane recovery & combustion to an existing anaerobic wastewater treatment system such as anaerobic reactors hence baseline scenario is as per option (vi) of paragraph 6 of the AMS III.H.

As per paragraph 7 of "Type III.H: Methane recovery in wastewater treatment" (Version 7: Valid from 02 Nov 07 onwards) of appendix B of the simplified M&P for small-scale CDM project activities:

"7. The baseline emissions are calculated as follows:

(d) For the case 6 (vi) the baseline emissions are calculated as:

BEy = Qy,ww * CODy,ww, untreated * Bo,ww * MCFww, treatment * GWP_CH4

Where,

MCFww,treatment = Methane correction factor for the existing wastewater treatment system to which the sequential anaerobic treatment step is being introduced (MCF lower value in Table III.H.1.)"

As the project activity confirms the option (vi) of paragraph 6 of AMS III.H for baseline scenario, the baseline emissions are quantified as per option (d) of paragraph 7 of AMS III.H based on the methane generation potential of the existing anaerobic wastewater treatment system to which the sequential anaerobic treatment step with methane recovery is being introduced. Thus the project activity meets the applicable conditions of the baseline methodology III H.

Paragraph 6 of "Type I.C: Thermal energy for the user with or without electricity" (Version 12: Valid from 10 Aug 07 onwards) of appendix B of the simplified M&P for small-scale CDM project activities, states that:

"6. For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used."

In this project activity, the baseline is expressed as the RFO consumption that would have been used in the absence of the project activity. Therefore the project activity meets the applicable conditions of the baseline methodology I.C.

<u>Key information and data used to determine the baseline scenario (variables, parameters, data sources etc.) in table form:</u>

Sr.	Key information /Data / Parameters	Average Value	Data Source
1.	Volume of wastewater treated	1150 m^3/day	Records maintained at SSP
2.	Number of working days	300	-
3.	COD of the wastewater entering the anaerobic treatment	7000 mg/lit	Records maintained at SSP
4.	Methane generation capacity of the treated wastewater	0.25 Kg CH_4/Kg COD	Page No. 6.21 of chapter 6 of volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories
5.	Methane correction factor for the existing wastewater treatment (i.e. anaerobic Reactors)	0.8	Page no. 3, Table III.H.1 of methodology AMS III.H (Version 7: Valid from 02 Nov 07 onwards)
6.	Quantity of biogas combusted	2700 m^3/day	Records maintained at SSP
7.	Number of operating days	350	-
8.	NCV of Biogas	5500 Kcal/Nm^3	Records maintained at SSP
9.	CO_2 emission factor for RFO	77.4 Kg/TJ	Table 2.3 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories
10.	Carbon oxidation factor for RFO	1	Table 1.4 of Chapter 1 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories
11.	CH4 emission coefficient for RFO	3 Kg/TJ	Table 2.3 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories
12.	N2O emission coefficient for RFO	0.6 Kg/TJ	Table 2.3 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories
13.	Global Warming Potential for CH4	21	UNFCCC Website http://unfccc.int/ghg_emissions_data/items/3800.php
14.	Global Warming Potential for N2O	310	UNFCCC Website http://unfccc.int/ghg_emissions_data/items/3800.php

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

In the absence of the proposed CDM project activity, the wastewater with high content of BOD & COD generated from starch-manufacturing unit would emits high amount of methane. Also without the project activity the plant would have continued the use of RFO for drying, which would have continued emission of GHG gases (CO_2, CH_4, and N_2O). The proposed project activity involves Biogas capture & utilization of biogas released as a fuel for drying activity. The biogas released from the wastewater treatment is recovered in the gasholder & the same biogas is used as a fuel for drying activity.

Wastewater treatment without methane recovery represents baseline scenario for this project. List of starch factories in India without methane recovery system is as follows:

Sr.No.	Name of the Starch Factory	Region
1	Gayatri Starchkem Ltd, Hyderabad	Andhra Pradesh
2	Gujarat Ambuja Exports Ltd	Gujrat
3	Riddhi Siddhi Starch & Chem. Ltd, Gokak, Dist.Belgaum	Karnataka
4	Sahyadri Starch & Ind. Ltd, Miraj	Maharashtra
5	Sukhjit Starch & Chem. Ltd, Phagwara	Punjab
6	Universal Starch Chem. Allied Ltd, Dondaicha, Dist. Dhule	Maharashtra
7	Bharat Starch Ind. Ltd, Baroda	Gujrat

The proposed project activity is additional (using attachment A to appendix B of the simplified M&P for small-scale CDM project activities) because the project activity would not have occurred anyway due to the following barriers:

Technological & Operational barriers:

The capture of biogas & utilization of captured biogas as a fuel for drying purpose is a new concept in starch industry in India. The technology is less popularly known in starch industry in India. It involves more risks due to the performance uncertainty or low market share. Performance uncertainty is due to relatively smaller quantity of biogas generation and its usage for heat generation, uncertainties related to quantum of methane in biogas, efficiency of the equipments and requirement of skilled manpower.

The project activity involves recovery of methane & use of this recovered methane as a fuel displacing the use of RFO for drying of products. The project activity suffers from some technological & operational risks such as short supply of biogas, maintenance of biogas digester of 20-25 days in every three years.

Operational risk also involves need for more safety precautions due to usage of gas, skilled manpower to operate the system due to gas handling, also the entire system of dryers operates only on gas & hence there is problem of stoppage of operation of dryers in case of any disruption in gas supply thereby resulting in significant production losses to the company.

Barrier due to prevailing practice:

As mentioned earlier the existing activity is a less popularly known technology in starch industry in India. Also it involves more risks due to the performance uncertainty or low market share. But the prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.

Prevailing practice in the region is use of residual furnace oil (RFO) in the flash dryer. Barrier due to technological acceptance, risk of short supply of biogas, prevailing practices and regulatory circumstances would have led continuous release of methane in the atmosphere & also continuous RFO consumption, which emits higher GHG emissions.

Therefore the proposed project activity is additional due to these two barriers.

CDM Consideration:

This methane capture from waste water and its use as a fuel in dryers project was seriously considered as CDM project activity in the Santosh Starch Product's Board of Directors meeting held on 30/01/2004 and the project was planned as a CDM project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

1. Baseline Emissions:

As described in the item B.4, the proposed baseline is the GHG emissions that would have occurred due to the release of methane in atmosphere in waste water and use of FO in the dryers in absence of this project activity. Baseline emissions are calculated based on the methane generation potential of the existing wastewater treatment system and the equivalent FO consumption in the dryers in the absence of the project activity. Equivalent FO consumption in the dryers in the absence of the project activity is calculated based on the quantity of biogas consumed in the project activity.
The baseline methodology is applied in the context of the project activity as follows:

(a) For Emission from Waste Water:

$[BEy]_1$ = Methane emissions from the existing wastewater treatment system to which the sequential anaerobic treatment step is being introduced

$[BEy]_1$ = Qy,ww *CODy,ww,untreated * Bo,ww * MCFww,treatment * GWP_CH_4…….**(Eq. 1)**

Where,

Qy,ww = Volume of wastewater treated in m^3/year

CODy,ww,untreated = Chemical oxygen demand of the wastewater entering the anaerobic treatment, tonnes/m^3

Bo,ww = Methane producing capacity of the wastewater
(IPCC Default value of 0.25 Kg CH_4/Kg COD is used)

MCFww,treatment = Methane correction factor for the existing wastewater treatment system to which sequential anaerobic treatment step is being introduced (MCF lower value in table III.H.1)

(The project activity involves the introduction of anaerobic reactor to the existing anaerobic wastewater treatment hence lower value of MCF for anaerobic reactor without methane recovery i.e. 0.8 is used)

GWP_CH_4 = Global Warming Potential of methane

(b)For Emission from Dryer:

$[BEy]_2$ = GHG emissions due to RFO combustion in dryer in tons of CO_2-e per year

$[BEy]_2$ = (Energy generated from biogas combustion in TJ/year x Carbon oxidation factor for RFO x IPCC default value for CO_2 emission coefficient for RFO in T/TJ) + (Energy generated from biogas combustion in TJ/year x IPCC default value for CH_4 emission coefficient for RFO in T/TJ x GWP for CH_4) + (Energy generated from biogas combustion in TJ/year x IPCC default value for N_2O emission coefficient for RFO in T/TJ x GWP for N_2O))

$[BEy]_2$ = ((BH in TJ/year x 1 x 77.4 TCO_2/TJ)
+ (BH in TJ/year x 0.003 TCH_4/TJ x 21 TCO_2/TCH_4)
+ (BH in TJ/year x 0.0006 TN_2O/TJ x 310 TCO_2/TN_2O))..........**(Eq. 2)**

BH = Net heat generated by biogas combustion in the dryer in TJ/year

= Quantity of biogas combusted in the dryer (Nm^3/year) x Net Calorific Value of Biogas (TJ/Nm^3)
= Quantity of biogas combusted in the dryer (Nm^3/day) x Number of operating days x Net calorific value of biogas (TJ/Nm^3)

Total baseline emission: -

GHG (yr) = $[BEy]_1$+ $[BEy]_2$..................................…(Eq.3)

1. Project Emissions:

(a) For Emission from Waste Water:

In this case, only the category Type III.H. indicates specific formulae to calculate the GHG emissions reductions by sources. These are as follows:

1. Project emissions (TCO_2-e per yr):

$[PEy]_1$ = PEy,power + PEy,ww,treated +PEy,s,final+ PEy,fugitive + PEy,dissolved

(As final sludge generated is used for soil application, emission from anaerobic decay of final sludge produced PEy,s,final is neglected)

Where,

PEy - Project activity emissions in the year "y" (TCO_2-e)
PEy,power - Emissions from electricity consumption in the year "y"
PEy,ww,treated - Emissions from degradable organic carbon in treated wastewater in the year "y"
PEy,s,final - Emissions from anaerobic decay of sludge produced in the year "y"
PEy, fugitive - Emissions from methane release in Capture & flare system in the year "y"
PEy, dissolved - Emissions from dissolved methane in treated wastewater in the year "y"

Emissions from electricity consumption (TCO_2-e per year):

PEy, power = Py (KWh/year) * 0.81 (TCO_2/MWh) * 0.001……………… **(Eq. 4)**

Where,

Py = Power requirement of the methane recovery activity in KWh/year

0.81 = CO_2 emission factor for combined margin for Western Grid Region in TCO_2/MWh
0.001 = Conversion from KWh to MWh

Emissions from degradable organic carbon in treated wastewater (TCO_2-e per year):

PEy,ww,treated = Qy,ww * CODy,ww,treated * Bo,ww * MCFww,final * GWP_CH_4…..**(Eq. 5)**

Where,

Qy,ww = Volume of wastewater treated in m^3/year
= Volume of wastewater treated in m^3/day * Number of working days of the plant

CODy,ww,treated = Chemical oxygen demand of the treated wastewater in tonnes/m^3 (here COD content of the wastewater leaving the secondary clarifier is used)

Bo,ww = Methane producing capacity of the wastewater in kg CH_4/kg COD

(Referring page number 6.21 of chapter 6 of volume 5 of 2006 IPCC Guidelines, default value of 0.25 Kg CH_4/Kg COD is used for industrial wastewater)

MCFww,final = Methane correction factor based on type of treatment & discharge pathway of wastewater (MCF higher value in table III.H.1)

(As per table III.H.1 of AMS III.H, MCF higher value of '1' for anaerobic reactor without methane recovery i.e. 0.8 is selected)

GWP_CH_4 = Global warming potential for methane

Emissions from anaerobic decay of sludge produced (TCO_2-e per year):

PEy,s,final = Sy,final * DOCy,s,final * MCFs,final * DOCf * F * 16/12 * GWP_CH_4**…….(Eq. 6)**

This term is not taken into consideration, as the sludge produced is digested anaerobically and used for soil application. So as per the methodology, this term can be neglected.

Emissions from methane release in Capture & flare system (TCO_2-e per year):

PEy,fugitive = PEy,fugitive,ww + PEy,fugitive,s…………………………..**(Eq. 7)**

PEy,fugitive,ww = Fugitive emissions through capture & flare inefficiencies in the anaerobic wastewater treatment in TCO_2-e/year
PEy,fugitive,s = Fugitive emissions through capture & flare inefficiencies in the anaerobic sludge treatment in TCO_2-e/year

PEy,fugitive,ww = ((1- CFEww) * (MEPy,ww,treatment) * GWP_CH4)

Where,

CFEww = Capture & Flare efficiency of methane recovery & combustion equipment in wastewater treatment (Default value of 0.9 is used)

MEPy,ww,untreated = Methane emission potential of the wastewater treatment plant in tones/year
= Qy,ww * CODy,ww,untreated * Bo,ww * MCFww,treatment

Where,
Qy,ww = Volume of wastewater treated in m^3/year

CODy,ww,untreated = Chemical oxygen demand of the wastewater entering the anaerobic treatment in tones/m^3

Bo,ww = Methane generation capacity of wastewater (IPCC Default value of 0.25 Kg CH_4/Kg COD is used for industrial wastewater)

MCFww,treatment = Methane correction factor for the wastewater treatment system that will be equipped with methane recovery & combustion (MCF higher values in Table III.H.1)
(In the project, wastewater treatment is carried out in the anaerobic reactor hence from table III.H.1 of AMS III.H , MCF higher value of '1' is used)

GWP_CH4 = Global warming potential of methane

PEy,fugitive,s = (1 – CFEs) * MEPy,s,treatment * GWP_CH4

Where:

CFEs = Capture and flare efficiency of the methane recovery and combustion equipment in the sludge treatment (a default value of 0.9 is used)

MEPy,s,treatment = Methane emission potential of the sludge treatment system in the year "y" (tonnes)
= Sy,untreated * DOCy,s,untreated * DOCF * F * 16/12 * MCFs,treatment
Where:

Sy,untreated = Amount of untreated sludge generated in the year "y" (tonnes)

DOCy,s,untreated = Degradable organic content of the untreated sludge generated in the year y (fraction). It shall be measured by sampling and analysis of the sludge produced, and estimated ex-ante using the IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent)

MCFs,treatment = Methane correction factor for the sludge treatment system that will be equipped with methane recovery and combustion (MCF Higher value of 1.0 as per table III.H.1).

Emissions from dissolved methane in treated wastewater (TCO_2-e per year):

PEy,dissolved = Qy,ww * [CH_4]y,ww,treated * GWP_CH_4…………..**(Eq. 8)**

Where,

Qy,ww = Volume of wastewater treated, m^3/year

[CH_4]y,ww,treated = Dissolved methane content in the treated wastewater, tonnes/m^3 (here we are referring to the dissolved methane content of the wastewater leaving the anaerobic reactor & entering the anaerobic lagoons) (Default value of 10e-4 tonnes/m^3 is used)
GWP_CH_4 = Global warming potential of methane

(c) For Emission from Dryer:

Project activity involves the combustion of biogas recovered resulting into emission of CO_2, which is estimated on the basis of stoichiometry by following formula.

$[PEy]_2$ = (Quantity of biogas consumed in m^3/year) * (Fraction of methane content in biogas) * (Density of methane in Kg/m^3) * 0.001 * (44/16(TCO_2/TCH_4))

$[PEy]_2$ = $[Q_{biogas}]$ * $[CH_4]_f$ * $(\rho)_m$ *0.001* [44/16]………………..**(Eq. 9)**

$[Q_{biogas}]$ = Quantity of biogas consumed in m^3/year
= Quantity of biogas consumed in m^3/day * Number of operating days
$[CH_4]_f$ = Fraction of Methane in biogas
$(\rho)_m$ = Density of biogas

Total GHG emissions that will occur due to the project activity are calculated from summation of GHG emissions obtained from Eq.4 and Eq.9.

Total project activity emissions = $[PEy]_1$ + $[PEy]_2$…………..….. (Eq.10)

3. Leakages:

Paragraph 8 of "AMS III.H. Methane Recovery in Wastewater Treatment (Version 7: Valid from 02 Nov 07 onwards)" states that

"8. If the used technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects at the site of the other activity are to be considered."

In the project activity, there is no transfer of the existing equipment to another activity hence no leakage is considered.

Paragraph 10 of "AMS I.C. Thermal energy for the user with or without electricity (Version 12: Valid from 10 Aug 07 onwards)" states that

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

In the project activity, there is no transfer of energy generating equipment from another activity and no transfer of the existing equipment to another activity hence no leakage is considered

4. Emission reductions:

Emission reduction due to the project activity is the difference between baseline emissions & project activity emissions.

Emission reductions due to the project activity = Baseline emissions – Project activity emissions

= [(GHG emission through Eq.3) - (GHG emission through Eq.10)]……… (Eq. 10)

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	CO_2 emission factor for FO
Data unit:	TCO_2/TJ
Description:	Qty of CO_2 emitted in tones per TJ of energy generated by burning of FO.
Source of data used:	Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	SSP is basically a manufacturing industry. Therefore CO_2 emission factor for FO has been chosen from the Default emission factors for Stationary combustion in Manufacturing Industries.
Any comment:	Referring table 2.3 of chapter 2 of volume 2 of 2006 IPCC guidelines, value for CO_2 emission factor for FO is 77400 $KgCO_2/TJ$, which is equal to 77.4 TCO_2/TJ

Data / Parameter:	Carbon oxidation factor for FO
Data unit:	-
Description:	-
Source of data used:	Table 1.4 of chapter 2 of volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source selected is an official & authentic source
Any comment:	-

Data / Parameter:	CH_4 emission factor for FO
Data unit:	TCH_4/TJ
Description:	Qty of CH_4 emitted in tones per TJ of energy generated by burning of FO.
Source of data used:	Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	0.003
Justification of the choice of data or description of measurement methods and procedures actually applied :	SSP is basically a manufacturing industry. Therefore CH_4 emission factor for FO has been chosen from the Default emission factors for Stationary combustion in Manufacturing Industries.
Any comment:	Referring table 2.3 of chapter 2 of volume 2 of 2006 IPCC guidelines, value for CH_4 emission factor for FO is 3 $KgCH_4/TJ$, which is equal to 0.003 TCH_4/TJ

Data / Parameter:	N_2O emission factor for FO
Data unit:	TN_2O/TJ
Description:	Qty of N_2O emitted in tones per TJ of energy generated by burning of FO.

Source of data used:	Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	0.0006
Justification of the choice of data or description of measurement methods and procedures actually applied :	SSP is basically a manufacturing industry. Therefore N_2O emission factor for FO has been chosen from the Default emission factors for Stationary combustion in Manufacturing Industries.
Any comment:	Referring table 2.3 of chapter 2 of volume 2 of 2006 IPCC guidelines, value for N_2O emission factor for FO is 0.6 KgN_2O/TJ, which is equal to 0.0006 TN_2O/TJ

Data / Parameter:	Global Warming Potential for CH_4
Data unit:	TCO_2/TCH_4
Description:	Qty of CO_2 generated in tones per tone of CH_4 generated
Source of data used:	UNFCCC website http://unfccc.int/ghg_emissions_data/items/3800.php
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source selected i.e. UNFCCC website is an official & authentic source.
Any comment:	-

Data / Parameter:	Global Warming Potential for N_2O
Data unit:	TCO_2/TN_2O
Description:	Qty of CO_2 generated in tones per ton of N_2O generated
Source of data used:	UNFCCC Website http://unfccc.int/ghg_emissions_data/items/3800.php
Value applied:	310
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source selected i.e. UNFCCC website is an official & authentic source.
Any comment:	-

Data / Parameter:	Net calorific value of FO
Data unit:	TJ/KT
Description:	Capacity of producing energy in TJ per KT of FO burnt
Source of data used:	Table 1.2 of Chapter 1 of Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories

Value applied:	40.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source used is an official & authentic source
Any comment:	-

Data / Parameter:	Net calorific value of biogas
Data unit:	Kcal/Nm^3
Description:	Capacity of producing energy in Kcal per Nm^3 of biogas burnt
Source of data used:	Table 1.2 of Chapter 1 of Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	5500
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source used is an official & authentic source
Any comment:	-

Data / Parameter:	Baseline CO_2 emission factor EF
Data unit:	TCO_2/MWh
Description:	CO2 emissions generated per MWh of power produced at the fossil fuel fired Power plants supplying electricity to the grid
Source of data used:	Central Electricity Authority (CEA) website
Value applied:	0.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source selected i.e. CEA website is an official and authentic source.
Any comment:	Baseline CO_2 emission factor is similar to that of combined margin emission factor. Combined Margin emission factor data for the year 2005-06 for Western Grid from Baseline Carbon Dioxide Emission Database Version 2.0 – Latest from Central Electricity Authority (CEA) website is referred. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Data / Parameter:	Methane generation capacity of the treated wastewater
Data unit:	Kg CH_4/Kg COD
Description:	Capacity of wastewater to produce methane per kg of COD
Source of data used:	Table 6.2 of Page No. 6.21 of chapter 6 of volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories. IPCC lower default value
Value applied:	0.25

Justification of the choice of data or description of measurement methods and procedures actually applied :	SSP is Starch manufacturing industry. Therefore factor for methane producing capacity for industrial wastewater is used.
Any comment:	-

Data / Parameter:	Methane correction factor for the existing wastewater system
Data unit:	-
Description:	Methane correction factor based on type of treatment and discharge pathway
Source of data used:	Page no. 3, Table III.H.1 of methodology AMS III.H (Version 6: Valid from 10 Aug 07 onwards)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Wastewater is treated anaerobically fallowed by aerobically, therefore factor for anaerobic reactor without methane recovery is used.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

1. Baseline Emissions:

(a) For Emission from Waste Water:

Referring to equation no. 1 Baseline emissions are calculated as:

$[BEy]_1$ = Qy,ww *CODy,ww,untreated * Bo,ww * MCFww,treatment * GWP_CH_4
= 345000 × 0.007 × 0.25 × 0.8 × 21
= 10143 TCO_2-e/year

$[BEy]_1$ = 10143 TCO_2-e/year

(b) For Emission from Dryer:

$[BEy]_2$ = ((BH in TJ/year x 1 x 77.4 TCO_2/TJ)
+ (BH in TJ/year x 0.003 TCH_4/TJ x 21 TCO_2/TCH_4)
+ (BH in TJ/year x 0.0006 TN_2O/TJ x 310 TCO_2/TN_2O))

BH = ((18.65 × 1 × 77) + (18.65 × 0.003 × 21) + (18.65 × 0.0006 × 310))
= 1446.91 TCO_2-e/year

$[BEy]_2$ = 1446.91 TCO_2-e/year

Total baseline emission: -

GHG (yr) = $[BEy]_1$+ $[BEy]_2$
= 10143 + 1446.19
= **11590 TCO_2-e/year**

2. Project Emissions:

(a) For Emission from Waste Water:

Emissions from electricity consumption (TCO_2-e per year):

PEy, power = Py (KWh/year) * 0.81 (TCO_2/MWh) * 0.001
= (500000 × 0.81 × 0.001)
= 405.00 TCO2-e/year

PEy, power= 405.00 TCO2-e/year

Emissions from degradable organic carbon in treated wastewater (TCO_2-e per year):

PEy,ww,treated = Qy,ww * CODy,ww,treated * Bo,ww * MCFww,final * GWP_CH_4
= (345000 × .000026 × 0.25 × 1 × 21)
= 470.93 TCO2-e/year

PEy,ww,treated = 470.93 TCO2-e/year

Emissions from anaerobic decay of sludge produced (TCO_2-e per year):

PEy,s,final = Sy,final * DOCy,s,final * MCFs,final * DOCf * F * 16/12 * GWP_CH_4

This term is not taken into consideration, as the sludge produced is digested anaerobically and used for soil application. So as per the methodology, this term can be neglected.

Emissions from methane release in Capture & flare system (TCO_2-e per year):

PEy,fugitive = PEy,fugitive,ww + PEy,fugitive,s

PEy,fugitive,ww = Fugitive emissions through capture & flare inefficiencies in the anaerobic wastewater treatment in TCO_2-e/year

PEy,fugitive,s = Fugitive emissions through capture & flare inefficiencies in the anaerobic sludge treatment in TCO_2-e/year

PEy,fugitive,ww = ((1- CFEww) * (MEPy,ww,treatment) * GWP_CH4)
= ((1- 0.9) × (603.75) × (21))
= 1267.88 TCO2-e/year

MEPy,ww,untreated = Qy,ww * CODy,ww,untreated * Bo,ww * MCFww,treatment
= (345000 × 0.007 × 0.25 × 1)
= 603.75

PEy,fugitive,s = (1 – CFEs) * MEPy,s,treatment * GWP_CH4
= ((1-0.9) × (336.65) × (21))
= 708.75 TCO2-e/year

MEPy,s,treatment = Sy,untreated * DOCy,s,untreated * DOCF * F * 16/12 * MCFs,treatment
= (45 × 22.5 × 0.5 × 0.5 × 16/12 × 1)
= 336.65
PEy,fugitive = (1267.88 + 708.75)
= 1976.63 TCO2-e/year

PEy,fugitive = 1976.63 TCO2-e/year

Emissions from dissolved methane in treated wastewater (TCO_2-e per year):

PEy,dissolved = Qy,ww * $[CH_4]$y,ww,treated * GWP_CH_4
= 345000 × 0.0001 × 21
= 724.50 TCO2-e/year

PEy,dissolved = 724.50 TCO2-e/year

$[PEy]_1$ = 405.00 + 470.93 + 0 + 1976.63 + 724.50
= 3577 TCO2-e/year

$[PEy]_1$ = 3577 TCO2-e/year

(b) For Emission from Dryer:

$[PEy]_2$ = $[Q_{biogas}]$ * $[CH_4]_f$ * $(\rho)_m$ *0.001* [44/16]
= ((810000) × (65 %) × (0.656) × (0.001) × (44/16))
= 949.81 TCO2-e/year

$[PEy]_2$ = 949.81 TCO2-e/year

Total project activity emissions = $[PEy]_1$ + $[PEy]_2$
= 3577 + 949.81
= 4527 TCO2-e/year

Total project activity emissions = 4527 TCO2-e/year

Emission reductions due to the project activity = Baseline emissions – Project activity emissions
= 11589.91 – 4527
= 7063 TCO2-e/year

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
Year 2008	4527	11590	0	7063
Year 2009	4527	11590	0	7063
Year 2010	4527	11590	0	7063
Year 2011	4527	11590	0	7063
Year 2012	4527	11590	0	7063
Year 2013	4527	11590	0	7063
Year 2014	4527	11590	0	7063
Year 2015	4527	11590	0	7063
Year 2016	4527	11590	0	7063
Year 2017	4527	11590	0	7063
Total (tonnes of CO_2e)	**45270**	**115900**	**0**	**70630**

B.7 Application of a monitoring methodology and description of the monitoring plan:

Monitoring methodology and plan as per Paragraphs 10-13 of "Type AMS. III. H. Methane Recovery in Wastewater Treatment" of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities (Version 7: Valid from 02 Nov 07 onwards) states that:

"10. For the cases of (ii) introduction of anaerobic sludge treatment with methane recovery and combustion to untreated sludge; (iii) and (iv) introduction of methane recovery and combustion unit to an existing anaerobic wastewater or sludge treatment system, and (vi) introduction of a sequential stage of wastewater treatment with methane recovery and combustion to an existing wastewater treatment, the calculation of emission reductions shall be based on the amount of methane recovered and fuelled or flared, that is monitored ex-post. Also for these cases, the project emissions and leakage will be deducted from the emission reductions calculated from the methane recovered and combusted.

11. In all cases, the amount of methane recovered, fuelled or flared shall be monitored ex-post, using continuous flow meters. The fraction of methane in the gas should be measured with a continuous

analyser or, alternatively, with periodical measurements at a 95% confidence level. Temperature and pressure of the gas are required to determine the density of methane combusted.
12. Regular maintenance should ensure optimal operation of flares. The flare efficiency, defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process, shall be monitored. One of the two following options shall be used to determine the efficiency of the flaring process in an enclosed flare:

(a) To adopt a 90% default value, or
(b) To perform a continuous monitoring of the efficiency.

If option (a.) is chosen continuous check of compliance with the manufacturers specification of the flare device (temperature, biogas flow rate) should be done. If in any specific hour any of the parameters is out of the range of specifications 50% of default value should be used for this specific hour. For open flare 50% default value should be used, as it is not possible in this case to monitor the efficiency. If at any given time the temperature of the flare is below 500ºC, 0% default value should be used for this period.

13. If the methane emissions from anaerobic decay of the final sludge were to be neglected because the sludge is controlled combusted, disposed in a landfill with methane recovery, or used for soil application, then the end-use of the final sludge will be monitored during the crediting period."

Monitoring methodology and plan as per Paragraph 17 of "Type AMS. I. C. Thermal energy for the user with or without electricity" of Appendix B of the Simplified M&P for Small-Scale CDM Project activities (Version 12: Valid from 10 Aug 07 onwards) states that:

"(a) Metering the energy produced by a sample of the systems where the simplified baseline is based on the energy produced multiplied by an emission coefficient."

The project activity comprises capturing of biogas in wastewater and use of it as fuel in dryers, therefore choice of monitoring methodology as given in Paragraphs 10-13 of "Type AMS. III. H. Methane Recovery in Wastewater Treatment" and Paragraph 17 of "Type AMS. I. C. Thermal energy for the user with or without electricity" of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities is justified.

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	Qy,ww
Data unit:	M^3
Description:	Volume of wastewater treated in the year
Source of data to be used:	Record maintained at SSP
Value of data	345000
Description of measurement methods and procedures to be applied:	Estimation of wastewater treated per day is done by fill and draw method by deleting the quantity of digester recycle to buffer tank.
QA/QC procedures to be applied:	-
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread

	sheet (Electronic) for 12 years.

Data / Parameter:	CODy,ww,untreated
Data unit:	Tonnes/M^3
Description:	Chemical Oxygen Demand of the untreated wastewater
Source of data to be used:	Record maintained at SSP
Value of data	0.007
Description of measurement methods and procedures to be applied:	Sample of the wastewater will be weekly analysed in the in-house laboratory for estimation of its COD content & verified twice in a year by accredited laboratory.
QA/QC procedures to be applied:	-
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread sheet (Electronic) for 12 years.

Data / Parameter:	CODy,ww,treated
Data unit:	Tonnes/M^3
Description:	Chemical Oxygen Demand of the treated wastewater
Source of data to be used:	Record maintained at SSP
Value of data	0.00026
Description of measurement methods and procedures to be applied:	Sample of the wastewater will be weekly analysed in the in-house laboratory for estimation of its COD content & verified twice in a year by accredited laboratory.
QA/QC procedures to be applied:	-
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread sheet (Electronic) for 12 years.

Data / Parameter:	Volume of biogas recovered
Data unit:	M^3
Description:	Volume of biogas recovered from waste water treatment system
Source of data to be used:	Record maintained at SSP
Value of data	873000
Description of measurement methods and procedures to be applied:	Quantity of biogas recovered is estimated by time taken to fill gas holder to its minimum capacity and calculating interlinked biogas production per day
QA/QC procedures to be applied:	-
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread sheet (Electronic) for 12 years.

Data / Parameter:	Volume of biogas combusted
Data unit:	M^3
Description:	Volume of biogas combusted in dryers
Source of data to be used:	Record maintained at SSP
Value of data	810000
Description of measurement methods and procedures to be applied:	Volume of biogas combusted will be calculated by mathematical calculations based on the volume of biogas holder.
QA/QC procedures to be applied:	-
Any comment:	The data monitored will be archived in Logbook (Paper) for 3 years and Spread sheet (Electronic) for 12 years.

Data / Parameter:	Net calorific value of biogas
Data unit:	$Kcal/Nm^3$
Description:	Capacity of producing energy in Kcal per Nm^3 of biogas burnt
Source of data used:	Table 1.2 of Chapter 1 of Volume 2 of 2006 IPCC guidelines for National Greenhouse Gas Inventories
Value applied:	5500
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data source used is an official & authentic source
Any comment:	-

Data / Parameter:	$[CH_4]_f$
Data unit:	%
Description:	Percentage of methane gas present in biogas
Source of data used:	Record maintained at SSP
Value applied:	65
Justification of the choice of data or description of measurement methods and procedures actually applied :	Tested in accredited laboratories. The frequency of testing will be reduced if there is no wide variation in the values.
Any comment:	-

Data / Parameter:	$(\rho)_m$

Data unit:	Kg/M^3
Description:	Density of biogas
Source of data used:	Technical literature
Value applied:	0.656
Justification of the choice of data or description of measurement methods and procedures actually applied :	Tested in accredited laboratories. The frequency of testing will be reduced if there is no wide variation in the values.
Any comment:	-

Data / Parameter:	Py
Data unit:	KWh
Description:	Quantity of Power consumed for the methane recovery activity
Source of data used:	Record maintained at SSP
Value applied:	500000
Justification of the choice of data or description of measurement methods and procedures actually applied :	Meter installed at project site will monitor power consumed.
Any comment:	-

Data / Parameter:	Sy,untreated
Data unit:	Tonnes
Description:	Quantity of untreated sludge produced
Source of data used:	Record maintained at SSP
Value applied:	45
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured and recorded as necessary
Any comment:	-

Data / Parameter:	DOCy,s,untreated
Data unit:	Tonnes
Description:	Quantity of Dissolved Organic Content of untreated sludge produced
Source of data used:	Record maintained at SSP

Value applied:	22.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measured and recorded as necessary
Any comment:	-

B.7.2 Description of the monitoring plan:

Operational & Management Structure:

The operational and management structure basically consists of three levels:

A. Project Owner
B. Project Manager
C. Project Operator

A. Project Owner:

The owner of the project represents the project activity, which is Santosh Starch Products Management.

Their specific responsibilities:

1. Handling of the project performances.
2. Ensure that recording & monitoring procedure followed at the project site is in line with the verification requirement of the project
3. To keep the records of the data monitored by outside agencies.
4. To provide the records of the data monitored by outside agencies to Project Operator.

B. Project Manager: Manager, Santosh Starch Products

His specific responsibilities:

1. Appointment of project operators.
2. Ensure that project operators have undergone initial training to create awareness about the process.
3. Assure that the project operators have received proper training regarding the process
4. To direct the project operators on key maintenance aspects
5. Ensure proper & timely calibration of the monitoring equipments & also the data acquisition
6. Ensure that annual monitoring report is as per requirement of the verification of the project.
7. Submission of the annual monitoring report for verification to the Designated Operational Entity (DOE).

C. Project Operators: Operators (ETP & Drying Section Incharge), Santosh Starch Products

Their specific responsibilities will include:

1. Collect the necessary data as required by the monitoring methodology.
2. Store relevant data in a systematic & reliable way in logbook (paper) and spread sheet (electronic).

3. Keep the record of collected data in a logbook for at least three years and in a spreadsheet for at least twelve years.
4. Reporting & recording of any distinguishing event as a special log.
5. Ensure that the data is entered properly and to take proper care to avoid any loss of information.
6. Evaluate the monitored data regularly & ensure the availability of pertinent information for verification.
7. Prepare the annual monitoring report.
8. Check that CER calculation is carried out as per the monitoring methodology.
9. Submit the annual monitoring report to the Project Manager.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completing the final draft of the baseline section & monitoring methodology:
26th May 2007

Name of person/entity determining the baseline:

Mr. Sambhav Chowdhary,
Santosh Starch Products,
(A unit of Santosh Starch Ltd.)
Santoshdham, Sukhpar Road, Village- Morgar,
Taluka- Bhachau, Dist.- Kutch,
Gujarat, India. Pin- 370020

Mr. Sambhav Chowdhary is working with the Santosh Starch Products (Project Participant) and contact information is given in Annex I of the PDD.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date of the project is 13th May 2004

C.1.2. Expected operational lifetime of the project activity:

15 Years 0 Months

C.2 Choice of the crediting period and related information:

Fixed crediting period is selected.

C.2.1. Renewable crediting period

Not applicable

C.2.1.1. Starting date of the first crediting period:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2008 or on date of registration of the project to the UNFCCC

C.2.2.2. Length:

10 Years 0 Months

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Environmental impact assessment for such type of projects is not required by the existing regulations in India. The intended philosophy of this project activity is based on the concept of providing low cost energy with minimum impacts on the environment. Since the project activity is capturing methane from wastewater and using it as fuel for heat production, it does not lead to green house gases. It also results in lesser emission of other pollutants like carbon mono-oxide, SOx and NOx into the atmosphere. The project has no significant effect on water or air pollution. However the project is conserving fossil fuels. Thus it can be concluded that the project activity has no significant negative impacts on the environment.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The project activity does not have any significant negative environmental impact. Therefore the environmental impact assessment undertaken in accordance with the procedures as required by the host Party is not necessary for this project.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The process followed to collect stakeholder comments for the Project, Methane Capture & its use as a Fuel, at Santosh Starch Products, Dist: Kutch, Gujarat

The following set of questions are sent to stakeholders:

1. Do you believe that the socio-economic situation of the region will improve due to the project activity?

2. Is the implementation of Methane Capture project and it's use as a fuel instead of RFO consumption able to improve the environmental situation in the plant surrounding area of this Region?

3. How does the development of the project affect you or your environment?

4. Would you recommend private companies or authorities to develop projects of this nature?

5. Do you think the project activity will contribute to local employment generation in lower economic sector of this region?

6. Do you think the project activity will contribute to foreign exchange savings?

7. Do you think the project activity will contribute to Sustainable Development in this Region?

8. Any additional comments on the project activity and suggestions to improve Sustainable Development through this project?

E.2. Summary of the comments received:

The questionnaire was sent to the following persons/agencies for their comments:

Name	Position	Company/Institution
Mr. Suyash Toraskar	CEO	Polcon Environmental Services, Pune
Mr. J. R. Jadega	Member	Taluka Panchayat, Bhachau, Dist: Kutch, Gujarat
Mr. Chandubhai	Farmer	Village Morgar, Bhachau, Dist: Kutch, Gujarat
Mr. Arjunbhai	Farmer	Village Morgar, Bhachau, Dist: Kutch, Gujarat
Mr. Sambhav Chowdhary	V.P. (Operations)	Santosh Starch Products, Gujarat
Mr. Mohanlal Vishnoi	Production Manager	Santosh Starch Products, Dist: Kutch, Gujarat
Mr. Mahash Parmar	ETP Chemist	Santosh Starch Products, Dist: Kutch, Gujarat

In response to our questionnaire sent to the stakeholders, the following comments are received so far:

Question	Comments Received
1.	Yes. Employment and economic developments have started in nearby villages of this project.
2.	Yes, Due to capture from waste-water smell problem reduced and use of biogas as fuel in dryers significantly reduces stack emissions. By saving fuel cost , production cost also lowered.
3.	Positively as it has created no problem from pollution view point.
4.	Yes
5.	Yes. Unskilled and labour employment has increased in nearby areas.
6.	Yes. There is savings of furnace oil resulting in foreign exchange savings.

7.	Yes. Project activity results in savings petroleum resources, maintaining environment clean, thereby contributing towards sustainable development of India.
8.	Government should promote industries to implement such projects before startup of project and there should be relaxation on interest rate on capital cost of project. Seminars and trainings should be organized in industries.

E.3. Report on how due account was taken of any comments received:

Overall, the comments from the stakeholders' were positive and supportive of the project. Further, discussions with local representatives have resulted in a commitment of full support. Since all comments were positive, no reaction was required.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Santosh Starch Products
Street/P.O.Box:	Near Mahalaxmi Char Rasta
Building:	201, Karma Complex, Paldi
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State/Region:	Gujarat
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URL:	www.santoshstarch.com
Represented by:	
Title:	Vice President (Operation)
Salutation:	Mr.
Last Name:	Chaudhary
Middle Name:	-
First Name:	Sambhav
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funds from national or international public sources are used for any activity in the proposed project. Santosh Starch Products (A Unit Of Santosh Starch Ltd.), Bhachau shall meet all project expenses.

Annex 3

BASELINE INFORMATION

The project activity involves capture of biogas and its use as a fuel in dryers. As per the methodology of Type AMS. III.H: Methane Recovery In Wastewater Treatment (Version 7: Valid from 02 Nov 07 onwards) and Type AMS. I.C: Thermal energy for the user with or without electricity (Version 12: Valid from 10 Aug 07 onwards)" the simplified baseline is the methane released in atmosphere and fuel consumption of the technologies that would have been used in the absence of the project activity.

Baseline emissions of the project activity involves emissions due release of methane from wastewater to the atmosphere and equivalent FO consumption in dryers. This methane released calculations are based on the methane generation potential of wastewater and equivalent FO consumption is estimated based on the quantity of biogas consumed is considered for base line emission calculations.

Baseline emissions are estimated as follows:

Release of methane in atmosphere and burning of FO results in emissions of CO_2, CH_4 & N_2O as major green house gases. The baseline GHG emissions involve estimation of emissions of these gases in absence of the project activity.

(a) For Emission from Waste Water:

$[BEy]_1$ = Methane emissions from the existing wastewater treatment system to which the sequential anaerobic treatment step is being introduced

$[BEy]_1$ = Qy,ww *CODy,ww,untreated * Bo,ww * MCFww,treatment * GWP_CH_4

Where,

Qy,ww = Volume of wastewater treated in m^3/year

CODy,ww,untreated = Chemical oxygen demand of the wastewater entering the anaerobic treatment, tonnes/m^3

Bo,ww = Methane producing capacity of the wastewater (IPCC Default value of 0.25 Kg CH_4/Kg COD is used)

MCFww,treatment = Methane correction factor for the existing wastewater treatment system to which sequential anaerobic treatment step is being introduced (MCF lower value in table III.H.1)

(The project activity involves the introduction of anaerobic reactor to the existing anaerobic wastewater treatment hence lower value of MCF for anaerobic reactor without methane recovery i.e. 0.8 is used)

GWP_CH_4 = Global Warming Potential of methane

(b)For Emission from Dryer:

$[BEy]_2$ = GHG emissions due to RFO combustion in dryer in tons of CO_2-e per year

$[BEy]_2$ = (Energy generated from biogas combustion in TJ/year x Carbon oxidation factor for RFO x IPCC default value for CO_2 emission coefficient for RFO in T/TJ) + (Energy generated from biogas combustion in TJ/year x IPCC default value for CH_4 emission coefficient for RFO in T/TJ x GWP for CH_4) + (Energy generated from biogas combustion in TJ/year x IPCC default value for N_2O emission coefficient for RFO in T/TJ x GWP for N_2O))

$[BEy]_2$ = ((BH in TJ/year x 1 x 77.4 TCO_2/TJ)
+ (BH in TJ/year x 0.003 TCH_4/TJ x 21 TCO_2/TCH_4)
+ (BH in TJ/year x 0.0006 TN_2O/TJ x 310 TCO_2/TN_2O))

BH = Net heat generated by biogas combustion in the dryer in TJ/year
= Quantity of biogas combusted in the dryer (Nm^3/year) x Net Calorific Value of Biogas (TJ/Nm^3)
= Quantity of biogas combusted in the dryer (Nm^3/day) x Number of operating days x Net calorific value of biogas (TJ/Nm^3)

Total baseline emission: -

GHG (yr) = $[BEy]_1$ + $[BEy]_2$

References:

Methane producing capacity of the wastewater = 0.25 Kg CH_4/Kg COD
(IPCC Default value of 0.25 Kg CH_4/Kg COD is used)

Tonnes of CO_2 per ton of CH_4 = 21
(Referring UNFCCC website)

Tonnes of CO_2 per ton of N_2O = 310
(Referring UNFCCC website)

<u>Calculation for CO_2 emission Coefficient for FO in TCO_2/TJ = 77.4</u>

(Referring Table 2.3, page 2.18 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories,
CO_2 Emission Factor for Residual Fuel Oil= 77400 Kg/TJ
Therefore CO_2 Emission Factor for Oil=77.4 T/TJ

<u>Calculation for CH_4 of emission Coefficient for FO in TCH_4/TJ = 0.003</u>

(Referring Table 2.3, page 2.18 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories,
CH_4 Emission Factor for Oil = 3 Kg/TJ
Therefore CH_4 Emission Factor for Oil = 0.003 T/TJ)

<u>Calculation for N_2O emission Coefficient for FO in TN_2O/TJ = 0.0006</u>

(Referring Table 2.3, page 2.18 of Chapter 2 of Volume 2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories,
N_2O Emission Factor for Oil = 0.6 Kg/TJ]
Therefore N_2O Emission Factor for Oil = 0.0006 T/TJ)

Annex 4

MONITORING INFORMATION

As per the Paragraphs 10-13 of "Type AMS. III. H. Methane Recovery in Wastewater Treatment" (Version 7**:** Valid from 02 Nov 07 onwards) and as per 17 of "Type AMS. I. C. Thermal energy for the user with or without electricity" (Version 12: Valid from 10 Aug 07 onwards) of Appendix B of the Simplified M&P for Small-Scale CDM Project Activities, monitoring will involved metering of waste water treated and the energy produced by the burning of biogas. The project activity will involve following data monitoring:

1. Volume of waste water treated
2. Weekly analysis of COD of waste water (Treated and Untreated)
3. Volume of biogas recovered
4. NCV of biogas recovered
5. Methane content of biogas
6. Recording daily biogas consumption, similar to the lines of monitoring FO Consumption
7. Quantity of Power consumed for the methane recovery activity
8. Quantity of untreated and treated sludge generated.

Qualitative explanation regarding quality control & quality assurance procedures that have been undertaken:

Procedures identified for maintenance of Methane Recovery system and dryers:

SSP has already contracted an agency for maintenance of the ETP and dryers. The maintenance agency identified by SSP is technology provider and their team is fully trained for maintenance.

Procedures identified for monitoring, measurements & reporting:

Volume of biogas generated & also its consumption in the dryer, volume of wastewater treated will be monitored on daily basis. Weekly monitoring involves the monitoring of the COD content of the wastewater entering & leaving the anaerobic digester. Calorific value of the biogas & also its methane content will be monthly monitored by accredited laboratories. Monitoring of pressure & temperature of biogas will be carried out twice in a shift daily to estimate the density of methane. All the data monitored will be recorded & maintained in the logbook & will be regularly reviewed & checked by the project operator.

The annual monitoring report should be worked out & checked by project manager. It will be submitted to the DOE. The report will be archived to make it available for the external audit & verification purposes.

Procedures identified for dealing with possible monitoring data adjustments and uncertainties:

The important parameters in calculating project emissions are biogas consumption & also the volume of wastewater treated. Both the parameters are metered continuously. If meter readings are not available then the estimated values will be used.

Procedures identified for internal audits of GHG project compliance with operational requirements as applicable:

In order to check the project's compliance with operational requirements, internal audit can be carried out. For this purpose, a team will be formed under the supervision of the Project Manager.

Procedures identified for day-to-day record handling (including what records to keep, storage area of records and how to process performance documentation):

Procedures identified for day-to-day record handling are as follows:

1. Daily record of quantity of the biogas consumed should be maintained properly in the format provided.
2. Daily record of quantity of the wastewater treated should be maintained properly in the format provided.
3. Records of the parameters that are monitored monthly should be maintained properly in the format provided.
4. All these records should be placed properly at the place provided.
5. Performance parameters are to be monitored by the outside accredited agencies. Monitored data should be collected from the agencies and stored properly for further reference.

Procedures identified for Project performance reviews:

Project performance depends upon performance parameters like methane content of biogas, calorific value of biogas etc. For reviewing project performance, following procedures are identified:

1. Methane content of the biogas is estimated monthly once by sample analysis in accredited laboratory to check whether it is in line with the optimum or not. Frequency of testing will depend on project performance.
2. Calorific value of the biogas is estimated monthly once by sample analysis in accredited laboratory so as to check whether it is line with monitoring methodology requirements. Frequency of testing will depend on project performance.

Procedures identified for corrective action:

If any of the performance parameter monitored above is not found as per the monitoring methodology then the following corrective actions shall be taken:

1. Operating procedures will be reviewed.
2. System will be checked whether it is in proper working condition or not.
3. Check that the data monitoring is properly done or not.
4. If necessary, changes should be made accordingly in the emission calculation workbook.

Procedures identified for training:

Training procedures identified are as follows:

1. Initial training is given to the project operators to create awareness about the project activity.
2. Detailed training should be given to the project operators including:
   - Information about data to be collected and its quality
   - Proper data collecting procedures
   - Correct data entry procedures
   - Maintenance of data records in logbook and spreadsheet
   - Proper storage of data records
   - Emission reduction calculation as provided in the emission calculation workbook
   - Checking whether the emission reduction is as per the monitoring methodology or not
   - Preparation of annual monitoring report

SSP has already contracted an agency for training of monitoring personnel with respect to monitoring of all parameters to be checked at SSP & CER calculation. This agency will carry out training program-giving details about data to be monitored, correct ways of data monitoring & CER calculation procedure. The agency will itself do data monitoring & perform the CER calculation accordingly during the training of the monitoring personnel. The agency identified by SSP is the CDM Consultant and their team is fully trained for training activities.

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NOTATIONS

Notation	Representing	Unit
%	Percentage	
BE	Baseline Emissions	TCO_2-e
BEy	Baseline Emissions in the year 'Y'	TCO_2-e/year
Bo,ww	Methane generation capacity of the treated wastewater	
BOD	Biological Oxygen Demand	ppm
CDM	Clean Development Mechanism	
CER	Certified Emissions Reduction	
CFE	Capture & Flare Efficiency	
CH_4	Methane	
[CH_4]y,ww,treated	Dissolved methane content in the treated wastewater	Tonnes/m^3
CO_2	Carbon-di-oxide	
CO_2-e	CO_2 equivalent	
COD	Chemical Oxygen Demand	ppm
CODy,ww,treated	COD of the treated wastewater in the year 'Y'	Tonnes/m^3
DOCy,s,final	Degradable Organic Content of the final sludge generated by the wastewater treatment in the year 'Y'	
DOCy,s,untreated	Degradable Organic Content of the untreated sludge generated by the wastewater treatment in the year 'Y'	
DOC_f	Fraction of DOC dissimilated to biogas	
DOE	Designated Operational Entity	
ETP	Effluent Treatment Plant	
F	Fraction of CH_4 in landfill gas	
FO-e (yr)	Equivalent RFO Consumption per year	KT/year
FOH-e (yr)	Net Heat generated by Equivalent RFO Consumption	TJ/year
GHG	Green House Gas	
GHG Emissions	Green House Gas Emissions	TCO_2-e/year
GPCB	Gujarat Pollution Control Board	
GWP	Global Warming Potential	
GWP_CH_4	Global Warming Potential of methane	
GWP_N_2O	Global Warming Potential of nitrous oxide	
IPCC	Intergovernmental Panel on Climate Change	
Kcal/kg	Kilo Calorie Per Kilo Gram	
Kg	Kilogram	Kg
Kg/Kg	Kilogram Per Kilogram	Kg/Kg
Kg/lit	Kilogram Per Liter	
Kg/m^3	Kilogram Per cube of meter	
Kg/TJ	Kilogram Per Tera Joule	

Notation	Representing	Unit
Kg CO_2/KWh	Kilogram of CO_2 per Kilo Watt Hour	
KL	Kilo Liter	
KL/day	Kilo Liter Per Day	
KL/yr	Kilo Liter Per Year	
Kms	Kilometers	
KT	Kilo Ton	
KT/year	Kilo Ton Per Year	
KWh	Kilo Watt hour	
m	Meter	
m^3	Cubic Meter	
m^3 /Day	Cubic Meter Per Day	
m^3 /yr	Cubic Meter Per Year	
MCF	Methane Correction Factor	
MCFww	MCF of the anaerobic decay of the wastewater	
MCFs	MCF of the anaerobic decay of the sludge	
ME	Methane Emission	TCH_4
MEy	Methane Emission in the year 'Y'	
MEPy,ww,treatment	Methane emission potential of waste water plant in year "Y"	tonnes
MEPy,s,treatment	Methane emission potential of sludge treatment system in year "Y"	tonnes
MJ/m^3	Mega Joule Per Cubic meter	
M & P	Modalities and Procedures	
MT/day	Metric Tonnes Per Day	
No.	Number	
NCV	Net Calorific Value	
NTP	Normal Temperature Pressure	
N_2O	Nitrous Oxide	
Nm3	Normal Cubic meter	
PDD	Project Design Document	
PE	Project Emission	TCO_2-e
PEy	Project Emission in the year 'Y'	TCO_2-e/year
ppm	Part Per Million	
Qy,ww	Volume of the wastewater treated	m^3
RFO	Residual Furnace Oil	
SSP	Santosh Starch Products	
SO_x	Oxides of Sulphur	
Sr.No.	Serial Number	

Notation	Representing	Unit
Sy,final	Amount of final sludge generated by the wastewater treatment in the year ‘Y’	Tonnes
Sy,untreated	Amount of untreated sludge generated in the year ‘Y’	Tonnes
T	Ton	
T/day	Ton Per Day	
T/yr	Ton Per Year	
T/m^3	Ton Per Cubic Meter	
TCH_4-e	Tonnes of CH_4 equivalent	
TCO_2-e	Tonnes of CO_2 equivalent	
TCO_2-e/yr	Tonnes of CO_2 equivalent Per Year	
TJ	Tera Joule	
TJ/m^3	Tera Joule Per cubic meter	
T/TJ	Ton Per Tera Joule	
TC/TJ	Ton of Carbon Per Tera Joule	
TCH_4/TJ	Ton of Methane Per Tera Joule	
TN_2O/TJ	Ton of Nitrous Oxide Per Tera Joule	
TJ/yr	Tera Joule Per Year	
T-CO_2-e/TJ	Tonnes of CO_2 equivalent Per Tera Joule	
TJ/KT	Tera Joule Per Kilo Ton	
TJ/Kg	Tera Joule Per Kilo Gram	
TCO_2/TCH_4	Tons of CO_2 Per Ton of CH_4	TCO_2-e
TCO_2/T N_2O	Tons of CO_2 Per Ton of N_2O	TCO_2-e
UNFCCC	United Nations Framework Convention on Climate Change	
yr.	Year	