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

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SECTION A. General description of small-scale project activity

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

Title : Waste water treatment and biogas recovery project
Version : 12
Date : 30/08/2012

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

Purpose of the project activity:

Schreiber Dynamix Dairies Ltd., (SDDL) (henceforth called as Project Proponent) a fully integrated dairy industry is located at Baramati in the state of Maharashtra, India. The daily processing capacity of plant is 800,000 -1,000,000 litres of milk/day which is sourced from surrounding districts. It produces various dairy products through superior technology and process. The products include cheese, butter, ghee, casein, dairy whitener, lactose, whey protein concentrate, whey powder and baby food products.

There are two streams of wastewater generation, (i) wastewater generated through processing of milk, yogurt and other dairy products and (ii) wastewater generated from production of dairy products such as cheese and casein.

Pre-project activity scenario:

(i) Wastewater generated through processing of milk, yogurt and other dairy products: This wastewater is having the organic load, COD in the range of 4500 mg/litre to 6000 mg/litre and treated in the existing 2000 m^3/day Waste Water Treatment Plant (WWTP). The wastewater is treated with aerobic as well as anaerobic treatment. The biogas generated from anaerobic treatment through 3 nos. of anaerobic digesters is captured and flared in the atmosphere in the baseline scenario.

(ii) Wastewater generated from production of dairy products such as cheese and casein: This wastewater is having the organic load, COD in the range of 350,000 mg/litre to 390,000 mg/litre and is treated in the existing anaerobic deep lagoons without methane recovery.

Project Activity scenario:

(i) Wastewater generated through processing of milk, yogurt and other dairy products will continue to be treated in the existing 2000 m^3/day Waste Water Treatment Plant (WWTP) along with new 1000 m^3/day WWTP having aerobic as well as anaerobic treatment. The biogas generated from anaerobic treatment is captured and will be use to fire in the retrofitted boiler.

(ii) The wastewater generated from production of dairy products such as cheese and casein. A by product called ‘whey’ is generated during manufacturing of these products. During Lactose recovery from whey, Mother Liquor (De-Lactose Permeate (DLP)) is generated. The Mother liquor has a typical characteristics of 95.62% organic matter having organic load, COD in the range of 350,000 mg/litre to 390,000 mg/lire. This mother liquor is treated in a specially designed newly constructed anaerobic treatment plant (Mother Liquor Treatment Plant – MLTP) with methane recovery.

(iii) Mother liquor after treatment requires further treatment due to its high organic load. Hence, it is further treated in the existing as well as newly constructed 1000 m^3/day WWTP. A new 1000 m^3/day WWTP is required as the existing 2000 m^3/day WWTP is not having a capacity to treat more than 2000 m^3/day waste water. Outlets from MLTP get mixed with other stream of waste water at equalization tank and are further treated in 2000 m^3/day and 1000 m^3/day WWTP.

(iv) The newly constructed 1000 m^3/day WWTP has same operational conditions as that of existing 2000 m^3/day WWTP.

(v) The biogas generated from three anaerobic digesters of 2000 m^3/day WWTP, one anaerobic digester of proposed 1000 m^3 WWTP and two anaerobic digesters of proposed 45 m^3/day MLTP will be captured and fired in the existing retrofitted boiler partially along with Furnace oil (FO).

Purpose of the project activity is to install anaerobic digesters for primary treatment of this waste water (namely Mother Liquor) and subsequently recovering methane rich biogas generated during the process at Schreiber Dynamix Dairies Ltd.

Green House Gas Reduction:

Project activity will reduce green house gas emissions in two ways,

1. The project activity diverts the flow of Mother Liquor form anaerobic lagoons to closed anaerobic digesters. Thus, it prevents methane (CH_4) emissions into the atmosphere. Methane emission reductions from new 1000 m^3 will not be claimed.

2. Generated biogas from 45 m^3/day[1] MLTP as well as existing 2000 m^3/day[2] WWTP and new 1000 m^3/day[2] WWTP will be used in boilers replacing equivalent quantity of FO. This will reduce Carbon Di-oxide (CO_2) emissions into the atmosphere.

<u>**Contribution to sustainable development:**</u>

Social well-being

The project activity will create employment opportunities for both skilled and unskilled labours in the operation and maintenance of the plant.

Economic well being

The project activity will improve the economic standard of the people residing in and around the local area as it provides direct and indirect employment opportunities during erection & commissioning and subsequent operation and maintenance of the plant.

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[1] Designed capacity of Mother Liquor Treatment Plant (MLTP)

[2] Designed capacity of Waste Water Treatment Plants (WWTP)

Environmental well-being

The project activity improves the local environment by controlling the bad odour, by proper disposing of the wastewater. Direct releasing of mother liquor into the environment attracts flies and insects which cause public nuisance and they should be eradicated. The project activity envisages both local and global environmental benefits. It will result in reduced GHG emissions due to avoidance of methane emissions from waste water and reduced emissions of flue gases equivalent to the replaced FO consumption in the boiler for steam generation. The project activity ensures environmental cleanliness due to treatment of COD rich mother liquor.

Technological well being

The project activity involves treatment of Mother Liquor and recovery of biogas which will be utilized in the boilers for steam generation, by displacing equivalent FO consumption in the boiler. The proposed project activity promotes such upgraded technologies and facilitates spreading of such technologies in the region as well as in the country. This also enables employees of SDDL to know about such new technology and provides an opportunity to work in such advanced mother liquor treating system.

A.3. Project participants:

Name of party involved (*) (host) indicates a host party)	Private and/ or public entity(ies) project participants(*)	Kindly Indicate if the party involved wishes to be considered as project participant (Yes/No)
India (Host)	Schreiber Dynamix Dairies Ltd. (Private entity)	No

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

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

A.4.1.1. Host Party (ies):

India

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

State – Maharashtra. District – Pune, Taluka – Baramati

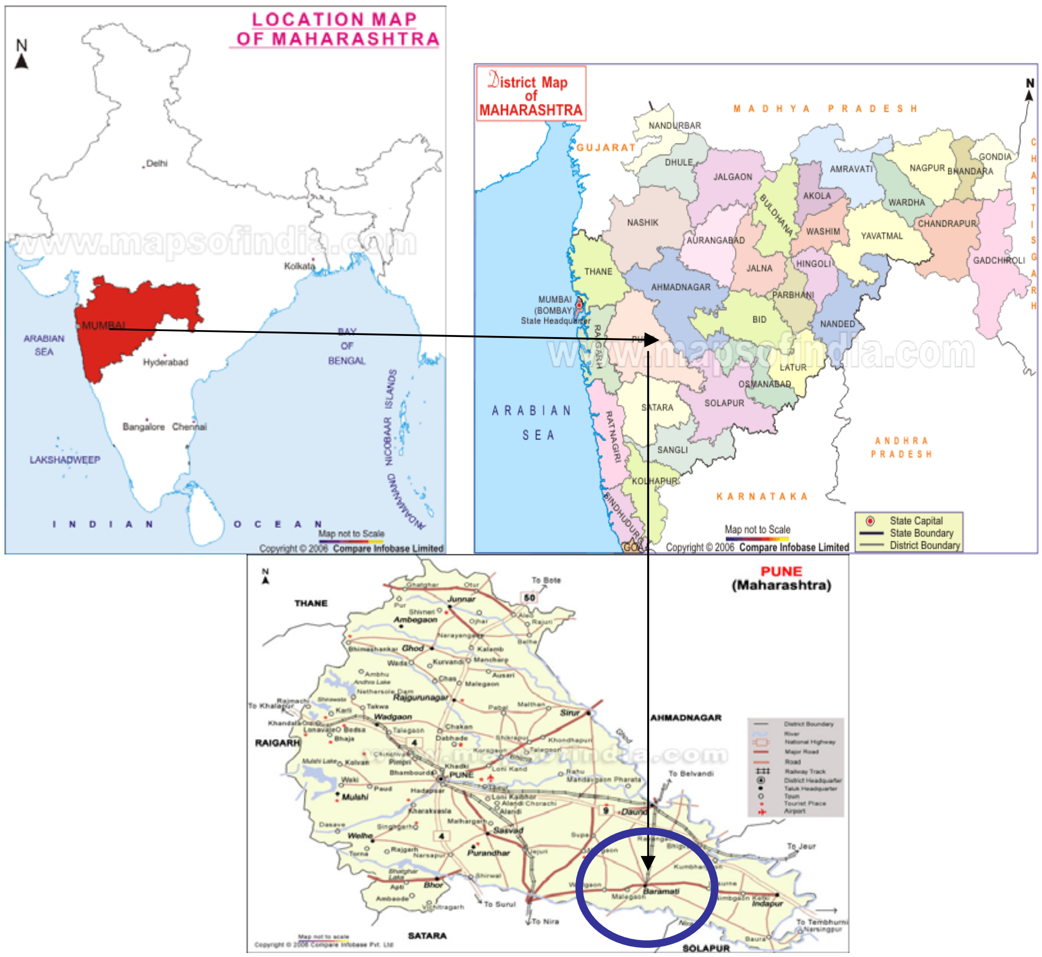
A.4.1.3. City/Town/Community etc:

Town - Baramati

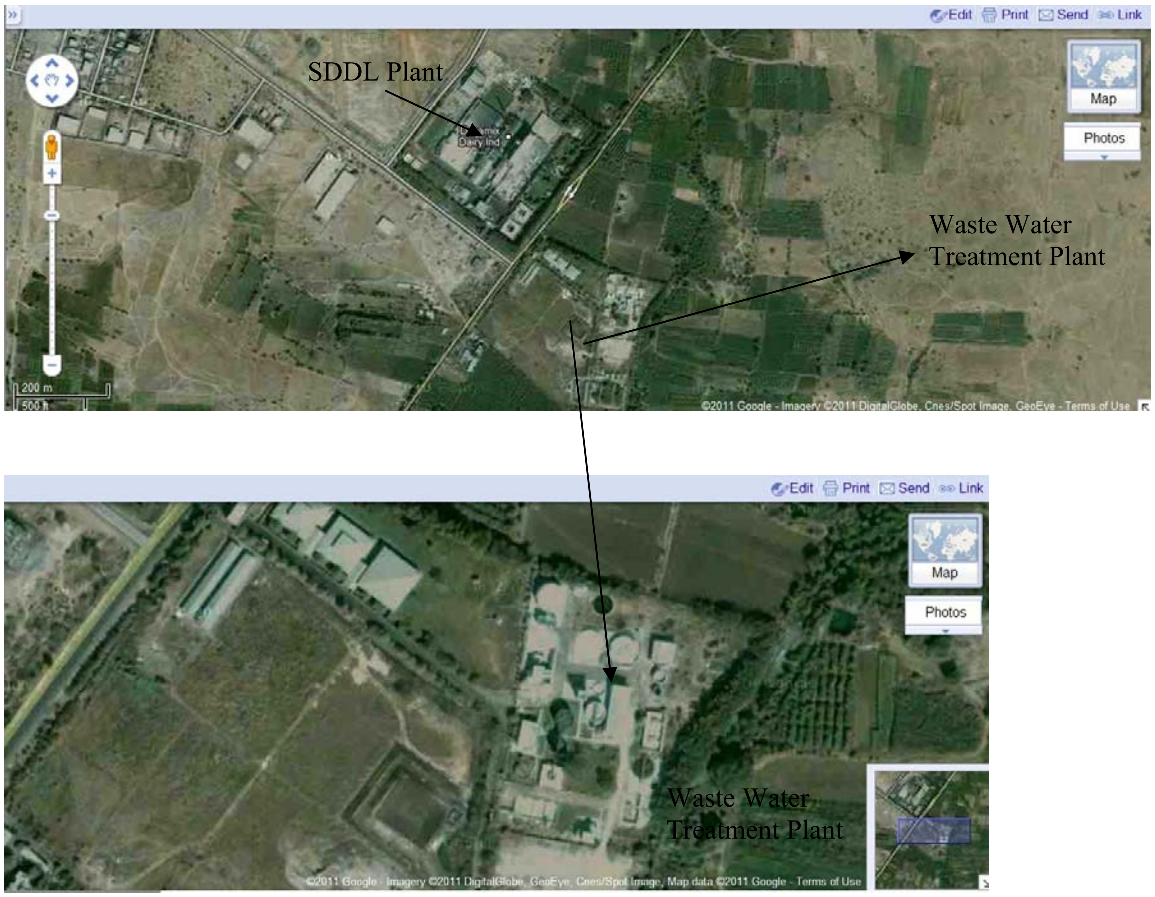
A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

The project activity is located at Plot no: E – 94, Bhigwan road, MIDC Baramati, Baramati taluka, Pune district, 100 km towards east from Pune in the state of Maharashtra - 413133, India. The latitude and longitude of the project activity is 18° 11′ 24.16″ N & 74° 37′ 06.04″ E. The nearest major airport to the project location is Pune airport and the nearest major railway station is Baramati.

The source of waste water for the proposed project activity is process units for manufacturing of dairy products and other products at Schreiber Dynamix Dairies Ltd.



Location of Project Activity:



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

Type and Category:
According to the simplified modalities and procedures described in Appendix B for small-scale CDM project activities, the proposed project activity falls under the following:

Type	*Category/Version*	*Sectoral Scope*
III – Other project activities	III.H. Methane Recovery in Wastewater Treatment, version 16.	13
I – Renewable energy projects	I.C. Thermal energy production with or without electricity, version 19.	01

Description of project activity:

Proposed project activity involves treatment of mother liquor through following major stages:

1) Mother Liquor Treatment with anaerobic digesters.

2) Biogas Generation, Capture and Transfer to Boilers.
3) Utilization of biogas in boilers as a fuel for partial displacement of furnace oil.
4) Treatment on waste water generated from mother liquor treatment plant

Each of the above stages of the project activity is briefly explained below:

1) Mother Liquor Treatment with Anaerobic Digesters:
Mother Liquor (ML) is first received in a mixing tank where, hot cow water[3] is added to maintain the temperature requirement of anaerobic digesters. It is then stored in intermediate storage tank prior to buffer tank. In the buffer tank, it is mixed with dilute caustic (approx. 10 % strength) / soda ash to adjust pH from initial 3 - 4 and bring it to neutral. The overflow from the buffer tank enters digester feed sump. Neutralized ML is then pumped to two nos. of anaerobic digesters for degradation of organic matter. The anaerobic digesters have been specially designed with reinforced cement concrete (RCC) to take care of low pH of the Mother Liquor and are equipped with special media for better recovery of biogas from Mother Liquor.

2) Biogas Generation, Capture and Transfer
Further, biogas is generated through decomposition by methanogenic bacteria resulting in about 80% COD reduction. Biogas generated is first collected in the top dome of anaerobic digesters and then conveyed to Gas-Holder (GH) via knock-out drum. Retention time of one hour is provided in the GH, so that any fluctuations in gas generation will not hamper downstream gas utilization.

The biogas is then pressurized with blowers and transferred to boilers for consumption, which is located away at around 800 meter distance. To remove moisture from biogas, moisture traps are installed on biogas line. Thus, biogas becomes moisture free and clean which can now be used as a fuel.

3) Utilization of biogas in boilers for partial displacement of furnace oil, in steam generation
The pressurized biogas is then received at knock-out drum installed at boiler house and fed to boilers through dual fuel burner system where-in, both the fuels i. e. biogas and FO are fired simultaneously in varying quantities which are controlled during combustion.

Two old furnace oil fired boiler burners are replaced by advanced imported dual fuel burners for combustion of furnace oil and biogas together in both the boilers. These burners have fully automatic PLC controlled mechanism for monitoring and controlling combustion parameters.

Biogas is fed only to a one boiler at a time. Total biogas generated through the process will reduce approximately 10% of furnace oil consumption i. e. approx. 4,000 kg/day and thus will reduce CO_2 emissions.

4) Treatment on waste water generated from Mother Liquor Treatment Plant
The treated Mother Liquor (waste water) after digesters has COD up to 80,000 mg/litre which is then sent to an equalisation tank of existing WWTP.

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[3] Cow water is extracted from evaporation of milk and also contains condensate from condenser during heat exchange. It has a negligible Chemical Oxygen Demand (COD).

The waste water coming out of Mother Liquor Treatment Plant which has COD content of around 80,000 mg/litre is equivalent to 800m³/day hydraulic load[4] with respect to waste water treatment plant of average COD load handling capacity of 4,500 mg/litre.

Hydraulic Load = (45[5]*80,000)/4,500 = 800 m³/day

Existing waste water treatment plant is handling 2000 m^3/day waste water and it can not cater additional 800 m^3 treated Mother Liquor from MLTP. Therefore, it is essential to install additional 1,000 m³/day capacity waste water treatment plant to handle the waste water outlet from Mother Liquor Treatment plant.

Thus in the project activity, Mother Liquor generated through process is treated in a specially designed anaerobic digesters. Treated Mother Liquor is then mixed with existing waste water flow and finally treated water is ozonized and discharged. Existing boilers are modified so that they can fire biogas generated from waste water treatment along with FO to generate steam.

Technology / measure of the small-scale project activity:
The waste water treatment system consists of the following equipment:

Characteristics of the equipment installed:

Design basis for 45m^3/day mother liquor:
The design basis considered to size the various units for Mother Liquor treatment is as follows:

Characteristics	**Mother Liquor**	**Cow water**
Total flow	45 m^3/day	75 m^3/day
COD	390,000 mg/litre	<100 mg/litre
BOD	220,000 mg/litre	<10 mg/litre
TSS	5 % (w/v)	-
pH	3 – 5.5	6.6 – 7.3

Technical specification of boilers: (MR13343, MR13450)

Appliance	: Steam boiler
Type	: 3 pass, conventional, smoke tube type
Make	: Thermax Ltd.
Model	: SM 140 B
Sr. No.	: MR13343, MR13450
Steam generation capacity	: 13200 kg/hr (F&A 100^{0}C)
Designed pressure	: 23.5 kg/cm^2g
Design temperature	: 250.0^{0}C
Combustion air temperature	: Ambient
Present thermal efficiency considered	: 89% [6]@ NCV with economizer

[4] Hydraulic Load = (Quantity of Waste Water * COD) / Average COD handling

[5] Designed capacity of mother liquor treatment plant – 45 m^3/day

[6] As per para 26 (b) of AMS I.C. version 19

Technical specification of burner:

Type	Vane air register, constant atomizing media
Suitable fuel	Furnace oil cum Biogas simultaneously
Regulation	Fully Modulating (Stepless)
Turn down	4 : 1
Suitable firing orientation	Horizontal / Vertical downward / upward
Fuel firing percentage	Option 1 – Combination firing i.e. Available Biogas quantity as mentioned under "Basis of the offer" & balance furnace oil for full load operation & at turn down
	Option 2 - 100% Furnace oil

Safe and sound technology:
The technology employed will result in improved and safer environmental conditions due to treatment of Mother Liquor and utilization of recovered biogas by displacing equivalent FO with an advanced combustion technology to fire biogas & FO in combination with necessary safety features.

Technology transfer:
The project activity does not involve technology transfer. However, PP has imported and installed Oilon (Finland) make steam/air atomised burner suitable for firing either FO or biogas and a combination of both.

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

Years	Estimation of annual emissions reductions in tCO_2e
01/07/2012 – 30/06/2013	14324
01/07/2013 – 30/06/2014	14324
01/07/2014 – 30/06/2015	14324
01/07/2015 –30/06/2016	14324
01/07/2016 – 30/06/2017	14324
01/07/2017 – 30/06/2018	14324
01/07/2018 – 30/06/2019	14324
01/07/2019– 30/06/2020	14324
01/07/2020 – 30/06/2021	14324
01/07/2021 – 30/06/2022	14324
Total estimated reductions (tCO_2e)	**143240**
Total number of crediting years	**10**
Annual average of estimated reductions over the crediting period (tCO_2e)	**14324**

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

There is no public funding involved in the project activity.

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

According to paragraph 2 of Guidelines on assessment of debundling for SSC Project Activities (EB54 Annex 13 Ver. 03), *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:*

(a) With the same project participants;

(b) In the same project category and technology/measure; and

(c) Registered within the previous 2 years; and

(d) Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point

The project proponent confirms that there is no registered small-scale project activity registered within the previous two years with them in the same project category and technology, whose project boundary is within 1 km of the project boundary of the proposed small scale activity. Thus the proposed project activity is not a debundled component of any other 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:

Title : Methane Recovery in Wastewater Treatment
Version : 16, EB 58
Methodology : AMS III.H.

Title : Thermal Energy Production With or Without Electricity
Version : 19, EB 61
Methodology : AMS I.C.

The tools applied to proposed small scale project activity include,

1. Title : Tool to determine project emissions from flaring gases containing methane
   Version: : 01 (EB 28 Annex 13)

2. Title : Tool to calculate baseline, project and/or leakage emissions from electricity consumption
   Version : 01 (EB 39 Annex 07)

3. Title : Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion
   Version : 02 (EB 41 Annex 11)

Following guideline/tools are also used for the proposed small scale project activity.

1. Information on additionality as per Attachment A to appendix B as per general guidelines for small scale projects

2. Title : Demonstration and assessment of Additionality
   Version : 06.0.0 (EB 65 Annex 21)

3. Title : Guidelines on assessment of debundling for SSC Project Activities
   Version : 03 (EB 54 Annex 13)

4. Title : Tool to calculate the emission factor for an electricity system
   Version : 02.2.1 (EB 63 Annex 19)

5. Title : Guidance on the assessment of investment analysis
   Version : 05 (EB 62 annex 5)

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

For AMS III.H. Version 16

Applicability Criteria	Project activity
This methodology comprises measures that recover biogas from biogenic organic matter in wastewaters by means of one, or a combination, of the following options:	The methodology comprises measures that recover biogas from biogenic organic matter in the waste water (Mother Liquor composing of Carbohydrates, proteins & fat) by means of applicability criteria option (f).
(a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion.	This criterion is not applicable since the project activity involves replacement of existing anaerobic system.
(b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment.	This criterion is not applicable since the project activity does not involve installation of anaerobic sludge treatment system.
(c) Introduction of biogas recovery and combustion to a sludge treatment system.	This criterion is not applicable since the project activity does not involve introduction of biogas recovery and combustion to an existing sludge treatment system.

(d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant. (e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream. (f) Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	This criterion is not applicable since the project activity does not involve introduction of biogas recovery to an existing treatment system i. e. anaerobic lagoon. This criterion is not applicable since the project activity involves installation of Up flow Anaerobic Sludge Blanket digesters with methane recovery and combustion to a waste water stream which was previously treated in an existing anaerobic wastewater treatment system i.e., anaerobic lagoon. This criterion is applicable since the project activity involves installation of Up flow Anaerobic Sludge Blanket digesters with methane recovery and combustion followed by further treatment in aerobic as well as anaerobic process.
In cases where baseline system is anaerobic lagoon the methodology is applicable if; (a) The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken (b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis	 The anaerobic lagoons are ponds with a depth greater than two meters, without aeration[7] Ambient temperature of the Project site is above 15^0C on a monthly average basis[8]

[7] Design specification drawing of anaerobic lagoons is submitted to DoE

[8] http://www.weatherreports.com/India/Baramati/averages.html

(c) The minimum interval between two consecutive sludge removal events shall be 30 days	The minimum interval between two consecutive sludge removal events is 30 days[9]
The recovered biogas from the above measures may also be utilized for the following applications instead of combustion/flaring. (a) Thermal or mechanical, electrical energy generation directly; or (b) Thermal or mechanical, electrical energy generation after bottling of upgraded biogas; or (c) Thermal or mechanical, electrical energy generation after upgrading and distribution: (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; or (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or (iii) Upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users. (d) Hydrogen production (e) Use as fuel in transportation applications after upgrading.	This criterion is applicable since the project activity involves utilization of recovered biogas for thermal energy generation directly in boilers for steam generation. This criterion is not applicable since the recovered biogas is utilized for thermal energy generation directly without bottling. This criterion is not applicable since the recovered biogas is utilized for thermal energy generation directly without upgrading and distribution. This criterion is not applicable since there is no upgrading and injection of biogas into a natural gas distribution grid. This criterion is not applicable since there is no up gradation and transportation of biogas via a dedicated piped network to a group of end users. This criterion is not applicable since there is no upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users. This criterion is not applicable since there is no hydrogen production from the recovered biogas. This criterion is not applicable since biogas is not used as fuel in transportation applications after upgrading
If the recovered biogas is used for project	The recovered biogas is used for thermal (steam)

[9] Supportive documents for support of sludge removal are submitted to DoE

activities covered under paragraph 3 (a), that component of the project activity can use a corresponding methodology under Type I	energy generation in project activities covered under paragraph 3 (a) and hence the project activity can use a corresponding methodology under Type I and the methodology AMS I.C. is used.
For project activities covered under paragraph 3 (b), if bottles with upgraded biogas are sold outside the project boundary, the end-use of the biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO_2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C “Thermal energy production with or without electricity”.	This criterion is not applicable since project activity is not covered under paragraph 3 (b).
For project activities covered under paragraph 3 (c) (i), emission reductions from the displacement of the use of natural gas are eligible under this methodology, provided the geographical extent of the natural gas distribution grid is within the host country boundaries	This criterion is not applicable since project activity is not covered under paragraph 3 (c) (i).
For project activities covered under paragraph 3 (c) (ii), emission reductions for the displacement of the use of fuels can be claimed following the provision in the corresponding Type I methodology, e.g. AMS-I.C	This criterion is not applicable since project activity is not covered under paragraph 3 (c) (ii).
In particular, for the case of 3 (b) and (c) (iii), the physical leakage during storage and transportation of upgraded biogas, as well as the emissions from fossil fuel consumed by vehicles for transporting biogas shall be considered. Relevant procedures in paragraph 11 of Annex 1 of AMS-III.H “Methane recovery in wastewater treatment” shall be followed in this regard	This criterion is not applicable since project activity is not covered under paragraph 3 (b) and (c) (iii).

For project activities covered under paragraph 3 (b) and (c), this methodology is applicable if the upgraded methane content of the biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96% (by volume)	This criterion is not applicable since project activity is not covered under paragraph 3 (b) and (c).
If the recovered biogas is utilized for production of hydrogen (project activities covered under paragraph 3 (d), that component of project activity shall use corresponding category AMS III.O "Hydrogen production using methane extracted from biogas".	This criterion is not applicable since the recovered biogas is not utilised for production of hydrogen.
If the recovered biogas is used for project activities covered under paragraph 3 (e), that component of the project activity shall use corresponding methodology AMS-III.AQ "Introduction of Bio-CNG in road transportation"	This criterion is not applicable since the recovered biogas is not used for project activities covered under paragraph 3 (e).
New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the requirements in the "General Guidance for SSC methodologies". In addition the requirements for demonstration of the remaining lifetime of the equipment replaced as described in the general guidance shall be followed.	The project activity is not a green field project and it does not involve any change of equipment resulting in a capacity addition of the wastewater treatment system compared to the designed capacity of the baseline treatment system.
The location of the wastewater treatment plant shall be uniquely defined as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	The location of the wastewater treatment plant is defined in section A.2. The source generating the wastewater is process units for manufacturing of dairy products and other products at SDDL as described in section A.2 of the PDD.

Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.	The project activity will result in emission reduction of 9.530 kt CO_2 annually which is less than 60 kt CO_2 equivalent annually.

For AMS I.C. Version 19

Applicability criteria for AMS I.C.	**Justification**
Biomass-based cogeneration systems are included in this category. For the purpose of this methodology "cogeneration" shall mean the simultaneous generation of thermal energy and electrical energy in one process.[10] Project activities that produce heat and power in separate element processes (for example heat from a boiler and electricity from a biogas engine) do not fit under the definition of cogeneration project.	The project activity does not involve biomass based cogeneration system and hence this criterion is not applicable.
Emission reductions from a biomass cogeneration system can accrue from one of the following activities: (a) Electricity supply to a grid; (b) Electricity and/or thermal energy (steam or heat) production for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).	The project activity does not involve biomass cogeneration and hence none of the activities is applicable.
The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal[11]	The total installed/rated thermal energy generation capacity of the project equipment is 16.56[12] MW

[10] This methodology however does not preclude production of heat and power from the same heat generating equipment, for example a portion of steam produced in a boiler is used for process heat and another portion of steam from the same boiler is used for electricity production.

[11] Thermal energy generation capacity shall be manufacturer's rated thermal energy output, or if that rating is not available the capacity shall be determined by taking the difference between enthalpy of total output (for example steam or hot air in kcal/kg or kcal/m^3) leaving the project equipment and the total enthalpy of input (for example feed water or air in kcal/kg or kcal/m^3) entering the project equipment. For boilers, condensate return (if any) must be incorporated into enthalpy of the feed.

(see paragraph 6 for the applicable limits for cogeneration project activities).	thermal which is less than 45 MW thermal.
For co-fired[13] systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel, shall not exceed 45 MW thermal (see paragraph 6 for the applicable limits for cogeneration project activities).	The Proposed Project activity is a co-fired system and the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel is 16.56 MW thermal and does not exceed 45 MW thermal.

[12] As per technical specifications, steam output of a boiler F&A 100^{0}C is 13200 kg/hr and heat output is 7.12 *10^6 kCal/hr i. e. 7120000 kCal/hr. Thus for two boilers, total heat output will be (7120000*2) 14240000 kCal/hr. Assuming 1 kCal//hr = 4.186 kJ/hr; the heat output will be 59608640 kJ/hr i. e. 16557.96 kJ/s. Assuming 1 kJ/s = 1 kW, the heat output will be 16557.96 kW i. e. 16.56 MW thermal.

[13] A co-fired system uses both fossil and renewable fuels, for example the simultaneous combustion of both biomass residues and fossil fuels in a single boiler. Fossil fuel may be used during a period of time when the biomass is not available and due justifications are provided.

The following capacity limits apply for biomass cogeneration units: (a) If the project activity includes emission reductions from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to thermal energy (i.e. for renewable energy project activities, the maximal limit of 15 MW(e) is equivalent to 45 MW thermal output of the equipment or the plant); (b) If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e. no emission reductions accrue from the electricity component), the total installed thermal energy production capacity of the project equipment of the cogeneration unit shall not exceed 45 MW thermal; (c) If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e. no emission reductions accrue from the thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.	The project activity does not involve biomass co-generation and hence none of the activities is applicable. .
The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should	The project activity does not involve addition of renewable energy units at existing renewable energy facility.

comply with capacity limits in paragraphs 4 to 6, and should be physically distinct[14] from the existing units.	
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category.	The project activity involves retrofitting the existing facilities (Furnace Oil fired boilers) for renewable energy generation though firing biogas.
New Facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the “General Guidelines to SSC CDM methodologies”.	The project activity does not involve capacity addition.
If solid biomass fuel (e.g. briquette) is used, it shall be demonstrated that it has been produced using solely renewable biomass and all project or leakage emissions associated with its production shall be taken into account in the emissions reduction calculation.	The project activity does not involve solid biomass fuel (e.g. briquette).
Where the project participant is not the producer of the processed solid biomass fuel, the project participant and the producer are bound by a contract that shall enable the project participant to monitor the source of the renewable biomass to account for any emissions associated with solid biomass fuel production. Such a contract shall also ensure that there is no double-counting of emission reductions.	The project activity does not involve solid biomass fuel.
If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into that ensures there is no double-counting of emission reductions.	The steam produced by the project activity is not delivered to a third party i.e. another facility or facilities within the project boundary.

[14] Physically distinct units are those that are capable of producing thermal/electrical energy without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered “physically distinct”.

If the project activity recovers and utilizes biogas for power/heat production and applies this methodology on a stand alone basis i.e. without using a Type III component of a SSC methodology, any incremental emissions occurring due to the implementation of the project activity (e.g. physical leakage of the anaerobic digester, emissions due to inefficiency of the flaring), shall be taken into account either as project or leakage emissions.	The project activity recovers and utilizes biogas for heat production and type III component of a SSC methodology is considered i. e. AMS III.H.
Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources[15] provided: (a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or (b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology AMS-III.K.[16] Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g. source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.	The project activity does not involve charcoal based biomass energy generation.

B.3. Description of the project boundary:

15 Refer to EB 23, annex 18 for the definition of renewable biomass.

16 AMS-III.K “Avoidance of methane release from charcoal production by shifting from traditional open-ended methods to mechanized charcoaling process”

According to Appendix B of the simplified modalities and procedures of small scale project activity and as per paragraph 15 and 16 of AMS III. H. Version 16 and Paragraph 15 of AMS I. C. Version 19 the project boundary delineates the following:

As per AMS III. H -

- The project boundary is the physical, geographical site where the wastewater and sludge treatment takes place in baseline and project situation. It covers all facilities affected by the project activity including sites where the processing, transportation and application or disposal of waste products as well as biogas takes place.
- Implementation of the project activity at a wastewater and/or sludge treatment system will affect certain sections of the treatment systems while others may remain unaffected. The treatment systems not affected by the project activity, i.e. sections operating in the project scenario under the same operational conditions as in the baseline scenario (e. g. wastewater inflow and COD content, temperature, retention time, etc.), shall be described in the PDD, but emissions from those sections do not have to be accounted for in the baseline and project emission calculations (since the same emissions would occur in both baseline and project scenarios). The assessment and identification of the systems affected by the project activity will be undertaken *ex ante*, and the PDD shall justify the exclusion of sections or components of the system. The treatment systems (lagoons, reactors, digesters, etc.) that will be covered and/or equipped with biogas recovery by the project activity, but continue to operate with the same qty. of feed inflow, volume (retention time), and temperature (heating) as in the baseline scenario, may be considered as not affected i.e., the methane generation potential remains unaltered.
    - As per the above statement, the systems affected / unaffected by this project activity is as follows

Sr. No	**Systems**	**Affected / Unaffected**	**Emissions (Excluded / Included)**	**Reason for inclusion / exclusion**
1.	Anaerobic lagoons	Affected	Included in baseline emissions	Anaerobic lagoon has been replaced by mother liquor treatment plant
2.	2 x 13.2 TPH (F&A 100^{0}C) Boilers	Affected	Included in baseline and project emissions	Part of the Furnace consumption in the boiler has been replaced by Biogas
3.	Flaring system	Affected	Excluded from baseline emissions and included in project emissions	Flaring system has been affected by diverting the Biogas to the boiler for steam generation

4.	Existing 2000 m^3/day WWTP	Affected	Excluded from baseline emissions and included in project emissions	Operational conditions of baseline systems are affected in project scenario
5.	1000 m^3/day WWTP	Affected	Excluded from baseline emissions and included in project emissions	Part of project scenario, not present in baseline scenario
6	45 m^3/day Mother Liquor treatment plant	Affected	Excluded from baseline emissions and included in project emissions	Part of project scenario, not present in baseline scenario
7	Sludge removal system	Unaffected	Excluded from baseline emissions and project emissions	The Project activity does not affect sludge removal system hence, the parameter is excluded
8	Discharge pathway of treated waste water	Unaffected	Excluded from baseline emissions and project emissions	Treated wastewater in baseline as well as project scenario is discharged and used for irrigation and gardening purpose. Hence, the parameter is excluded.
9	Disposal of final sludge generated	Unaffected	Excluded from baseline emissions and project emissions	Final generated sludge is used for land application in both, baseline and project scenario. Hence, the parameter is excluded.

As per AMS I.C –

The special extent of the project boundary encompasses:

(a) All plants generating power and/or heat located at the project site, whether fired with biomass, fossil fuels or a combination of both;

(b) All power plants connected physically to the electricity system (grid) that the project plant is connected to;

(c) Industrial, commercial or residential facility, or facilities, consuming energy generated by the system and the processes or equipment affected by the project activity;

(d) The processing plant of biomass residues, for project activities using solid biomass fuel (e.g. briquette), unless all associated emissions are accounted for as leakage emissions;

(e) The transportation itineraries, if the biomass is transported over distances greater than 200 kilometres, unless all associated emissions are accounted for as leakage emissions;

(f) The site of the anaerobic digester in the case of project activity that recovers and utilizes biogas for power/heat production and applies this methodology on a stand alone basis i.e. without using a Type III component of a SSC methodology.

For the purpose of determining GHG emissions in the project activity, the following sources are included:

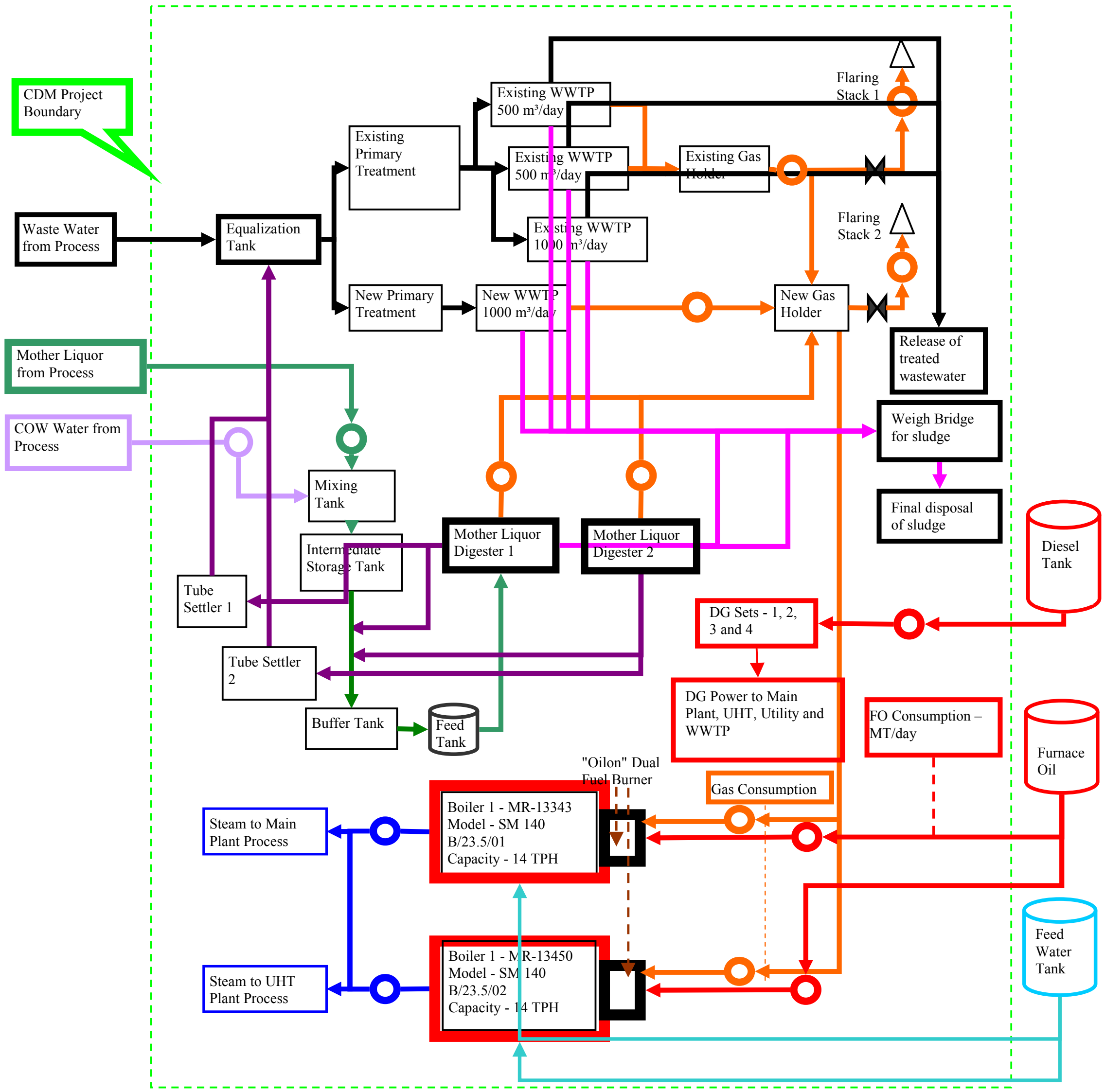
i. Baseline emissions due to Mother Liquor treatment in anaerobic deep lagoons.
ii. Baseline emissions due to combustion of furnace oil in the boiler which otherwise would have been utilized in the boilers.
iii. Project emissions due to electricity consumption by project activity from grid as well as captive source for 2000 m^3/day WWTP, 1000 m^3/day WWTP, 45 m^3/day MLTP and the boilers.
iv. Project emissions due to on-site fossil fuel consumption due to project activity.
v. Methane emissions due to wastewater treatment systems affected by the project activity for 2000 m^3/day WWTP and 1000 m^3/day WWTP.
vi. Methane emissions on account of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater in the project activity for 2000 m^3/day WWTP, 1000 m^3/day WWTP.
vii. Methane emissions due to inefficiencies in capture systems for 2000 m^3/day WWTP, 1000 m^3/day WWTP and 45 m^3/day MLTP.
viii. Project emissions due to biogas flaring system

The following table summarizes the source and type of emissions associated with the project activity:

	Source	**Gas**	**Included**	**Justification /Explanation**
Baseline	**Combustion of Furnace Oil (FO) for steam generation**	CO_2	Included	Emissions due to Furnace oil combustion for the steam generation.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Mother Liquor treatment in Anaerobic Lagoon	CO_2	Excluded	Excluded for simplification
		CH_4	Included	Emissions due to mother liquor treatment in anaerobic lagoons

		N_2O	Excluded	Excluded for simplification
	Existing Waste water treatment System	CO_2	Excluded	Excluded for simplification
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
Project activity	**Combustion of Furnace Oil (FO) for steam generation**	CO_2	Included	Emissions due to Furnace oil combustion for the steam generation.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Diesel consumption in Captive Power Plant	CO_2	Included	Emissions due to Diesel combustion for captive power generation.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Electricity consumption	CO_2	Included	Emission due to electricity consumption in the project activity
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	45 m^3/day Mother Liquor treatment system	CO_2	Excluded	Excluded for simplification
		CH_4	Included	Emissions due to mother liquor treatment
		N_2O	Excluded	Excluded for simplification
	2000 m^3/day and 1000 m^3/day Waste water treatment systems	CO_2	Excluded	Excluded for simplification
		CH_4	Included	Emissions due to affected part of waste water treatment
		N_2O	Excluded	Excluded for simplification
	Biogas flaring system	CO_2	Excluded	Excluded for simplification
		CH_4	Included	Emissions due to inefficiency in the flaring system
		N_2O	Excluded	Excluded for simplification

Project Boundary:



B.4. Description of baseline and its development:

The baseline of the project activity is identified as per paragraph 17, 18, 20, 21, 26 of AMS III.H ver. 16. As per paragraph 17 AMS III. H ver.16, "*wastewater and sludge treatment systems equipped with a biogas recovery facility in the baseline shall be excluded from the baseline emission calculations*". Existing 2000 m^3/day WWTP has three anaerobic digesters which are equipped with biogas recovery units and recovered biogas was flared into atmosphere. Hence, this existing WWTP is excluded from the baseline emission calculations. Further, new 1000 m^3/day WWTP with an anaerobic digester equipped with biogas recovery unit is also excluded from baseline emission calculations[17]. Mother Liquor was treated in anaerobic lagoons which was not equipped with biogas recovery and hence, baseline emissions for the systems affected by the project activity are considered a per paragraph 18 equation 1 of the methodology and subsequently as per paragraph 20 equation 2. As per para 21, the applicable Methane Correction Factor (MCF) will be determined based on the given table III.H.1. As per para 26, while determining baseline emissions using equation 1, historical records of one year prior to the project implementation will be used.

And baseline of the project activity is identified as per paragraph 42 of AMS I.C. Version 19 as, *For project activities that seek to retrofit or modify an existing facility for the purpose of fuel switch from fossil fuels to biomass in heat generation equipment, the baseline emissions shall be calculated as per equation 2".* The equation 2 refers to paragraph 22 of the methodology. Thus, paragraph 22 is identified as baseline scenario. Other paragraphs 17, 30 and 44 of the methodology are also applicable for the project activity.

The project activity involves mother liquor treatment in anaerobic digesters that otherwise would continue to be treated in anaerobic deep lagoons without any biogas recovery. Generated biogas in the project activity shall be used in the boiler thereby replacing corresponding quantity of FO.

Hence, simplified baseline for the project activity is, continued treatment of Mother Liquor in anaerobic deep lagoons without biogas recovery and consumption of equivalent quantity of FO that otherwise would have been consumed in the boiler to generate corresponding quantity of steam.

The following data are used to determine the baseline emissions:

Key variables	Data used	Data source
Quantity of waste water (Mother Liquor)	38 m^3/day	Historical data for last one year
COD of the wastewater (Mother Liquor)	387855 mg/litre	Historical data for last one year
COD removal efficiency of baseline treatment system	80%	Historical data for last one year
Methane correction factor for baseline treatment system	0.8	
Methane generation capacity of wastewater	0.25	kg CH_4/kg COD
Methane correction factor	0.89	
Total steam flow of boilers	100717803 kg/year	[18]Historical data for last 3 years
Steam pressure	16 kg/cm^2g	Historical data for last 3 years

[17] The wastewater inflow of 2000 m^3/day and 1000 m^3/day WWTP is through common equalization tank. Hence, on a conservative approach, 1000 m^3/day WWTP is excluded from baseline emission calculations under AMS III.H.

[18] Steam generation from existing boilers from April, 20005 to May, 2008

Steam temperature	230^0C	Historical data for last 3 years
Feed water temperature	105^0C	Historical data for last 3 years
Enthalpy at 16.00 kg/cm^2g & 230^0C	684.25 kCal/kg	Calculated
Enthalpy of feed water	105 kCal/kg	Historical data for last 3 years
Thermal efficiency of boiler	89%	Technical specification of boiler
Net calorific value of FO	9650 kCal/kg	http://www.pcra.org/English/latest/book/02-Chapter%20-%202.pdf
Emission factor of FO	77.40	IPCC default value
Expected biogas generation from MLTP and WWTPs	2607096	Calculated based on COD values of wastewater and standard formulae

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:

National Policies and circumstances relevant to the baseline:

No national policies and circumstances which are relevant to the baseline are available. The project baseline is in compliance with Maharashtra Pollution Control Board norms.

There are some promotional schemes available for renewable energy based projects such as "*Accelerated programme on recovery of energy / power generation from industrial and commercial wastes and effluents for implementation in 2005-06*"[19] This scheme was promoted by Ministry of New and Renewable Energy, Government of India in year 2005-06.

This policy was proposed with following objectives,

- To access and upgrade various conversion technologies
- To create conductive environment for the development of the sector in the country
- To accelerate the installation of energy recovery projects for industrial wastes with a view to harness the available potential by 2017.

This scheme proposed by Government is a promotional scheme and not a mandate.

Chronology of events:

Sr. No.	Date	Project Activity	Documentary Evidence
1.	30/06/2008	Investment decision	Copy of Extract of Board

[19] http://mnre.gov.in/energy-iwaste.htm

			Resolution dt. d 30/06/2008
2.	22/08/2008	Issue of Purchase Order for Supply of equipments to Thermax	PO No. LPJ0135 dt. 22/08/2008 and LPJ0136 dt. 22/08/2008
3.	12/12/2008	CDM Stakeholders Meeting	Stakeholder attendance & Stakeholders Questionnaire documents
4.	12/01/2009	CDM Intimation to National CDM authority	Copy of letter dated 12/01/2009
5.	17/07/2009	Host Country Approval Received towards "waste Water Treatment and Biogas recovery project"	Host Country Approval Letter from DNA dt. 17/07/2009
6.	17/08/2009	Intimation letter to UNFCCC as per Annex 61 of EB 48	E-mail dt. 17/08/2009 and acknowledgement from UNFCCC Secretariat dt. 18/08/2009
7.	29/10/2009	Intimation letter (Revised) to UNFCCC as per Annex 61 of EB 48	E-mail dt. 25/09/2009 and acknowledgement from UNFCCC Secretariat dt. 29/10/2009
8.	09/02/2010 10/03/2010	Web hosting of PDD on the website for Global Stakeholder Comments	Intimation E-mail from DOE dt. 09/02/2010

Since the project start date is 22nd August 2008 which is after 2nd August 2008, the PP had intimated to the DNA within six months from the start date as per EB 41 Annex 46 which requires intimation to either DNA or UNFCCC. Since paragraph (2) of Annex 22, EB 49, which requires the PP to intimate both UNFCCC and DNA was adopted almost 8 months after the PP sent intimation to DNA, intimation was sent to UNFCCC immediately after the adoption of Annex 61 in EB 48, which has been duly acknowledged by UNFCCC.

Barrier Analysis

As per Attachment A to the Appendix B of the simplified modalities and procedures for small-scale CDM project activities, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier
(b) Technological barrier
(c) Barrier due to prevailing practice
(d) Other barriers

The project's additionality is demonstrated through barrier (a) Investment barrier.

(a) Investment barrier

The investment barrier is demonstrated based on the investment analysis Sub-step 2a and 2b of the 'Tool for the demonstration and assessment of additionality' as per the EB 65 annex 21.

Step 2: Investment analysis

Sub-step 2a: Determine appropriate analysis method

Since the project activity generates savings from the replacement of furnace oil by biogas, the simple cost analysis (Option I) cannot be applied. The alternative to carry on with the prior-situation does not require investment: hence the Investment Comparison Analysis (Option II) is not appropriate. The Benchmark Analysis (Option III) is the right approach to demonstrate that the project is not economically or financially feasible without the sale of CER revenues.

Benchmark analysis has been considered as a suitable approach since the baseline scenario does not require investment as per paragraph 19 of 'Guidance on the assessment of investment analysis' (EB 62 annex5, version 05). Since project IRR has been chosen as a suitable approach, as per paragraph 12 and 13 of guidance on the assessment of investment analysis (EB 62 annex 5, version 05), local commercial lending rate (Prime lending rate of RBI) has been considered as a suitable benchmark.

PP has 3 approaches for investment analysis i.e. IRR, NPV and Unit Cost of Generation. Out of which, IRR has been chosen as it is the most widely used financial indicator by banks and financial institutions. For this project activity the project IRR and equity IRR are same since the project is entirely funded by equity. Hence equity IRR has been chosen to demonstrate additionality.

Sub-step 2b: Option III- Benchmark Analysis

The project activity is the replacement of existing wastewater treatment system (anaerobic lagoon) with Mother Liquor treatment system for methane recovery and utilization, so in order to assess the financial viability of the project activity, IRR analysis will be the suitable approach.

For the project activity local commercial lending rate (Prime lending rate of RBI) has been considered as a suitable Benchmark[20] .Prime lending rate of RBI at the time of investment decision was 12.25%.

The following parameters have been used to calculate the IRR of the project activity,

Sr. No.	Parameter	Unit	Value	Reference
1	Operating period	Years	20	As per guidance 03 EB51 Annex58
2	Capital cost (Including Mother liquor treatment and biogas utilization)	INR	129117051	Based on technical offers received from equipment manufacturers
3	Operation & Maintenance cost	INR/year	15104876	Based on technical offers received from equipment manufacturers
4	Furnace oil savings	kg/year	1364335	Calculated
5	Furnace oil cost	INR/kg	21.67	16th annual report 2007 -

[20] http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/85254.pdf The PLR is sourced from the weekly statistical survey bulletin dated 27th June, 2008 issued by the Reserve Bank of India, which was available to the PP at the time of decision making (i.e., June 30, 2008).

				08 page no. 6
6	Furnace oil cost savings	INR/year	29560594	Calculated
7	Net savings	INR/year	14455718	Calculated
8	Salvage value	%	5 (at the end of 20 years.)	Letter given by Thermax Ltd. dated 02nd July, 2010
9	Efficiency of boiler	%	89	Instruction Manual for Shellmax Boiler, Make: Thermax, Technical Specifications, Page No. 5
10	CER Price	Euro	7	Assumed
11	Exchange Rate	INR/Euro	63	Assumed

Project cost envisaged by PP based on offer letters was 129.2 million whereas actual incurred cost is 126.6 million[21].

Proposed project involves treatment of wastewater i. e. Mother Liquor with high COD approx. 390,000 mg/lit. PP uses specially designed UASB reactor (Research and developed by Thermax Ltd.) to bring down this COD and to treat it further through aerobic as well as anaerobic treatment. Treated waste water is then ozonised so that, it can be reused inside the plant. This approach and PP's commitment for environment protection has lead to high project cost incurred for the project.

Based on the above data, the IRR for the project activity has been calculated without CDM benefits.

	Without CDM	**Benchmark**
IRR	8.60 %[22]	12.25%

It can be observed from the above table that the project is not a business-as-usual scenario and additional.

Sub-step 2c: Comparison of financial indicators

Conclusion of the Benchmark Analysis

As per above table, it is evident that the project is financially not viable. Hence the project is additional.

Sub-step 2d: Sensitivity Analysis

The above conclusion has been tested by subjecting the critical parameters to reasonable variations in order to access the robustness of the conclusion. The Sensitivity Analysis is to determine whether the

[21] CA certificate for the project cost incurred is submitted to DoE

[22] Period of assessment for IRR calculation is 20 years as per guidance 03 EB51 Annex58. PP has carried out residual life assessment for the boilers used in the project activity and as per the report remaining life time of the boiler is 15 years whereas, MLTP under the project activity has remaining life time of 20 years. Hence, PP has considered period of assessment as 20 years.

conclusion regarding the financial attractiveness is robust to reasonable variations in the critical parameters.

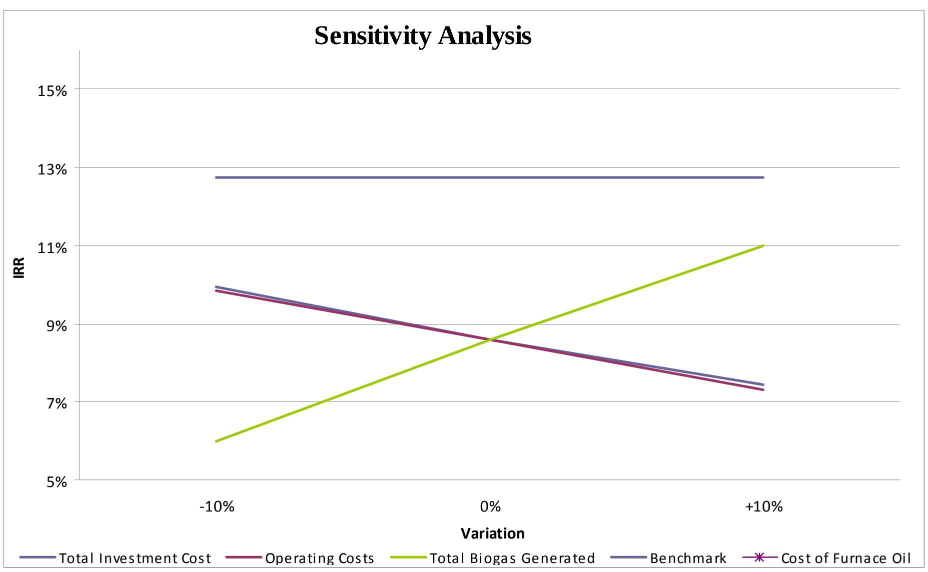
As per Guidance 20 of guidelines on the assessment of investment analysis (EB 62 annex 5, version 5), *Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets.*

The guidance requires the robustness of the conclusion to be proved through sensitivity analysis by varying the critical parameters to a reasonable variation (10%) as per paragraph 21 of applicable guideline (EB 62 annex 5, version 5).

For the proposed project activity five parameters i. e. capital cost, operation & maintenance cost, biogas generation, NCV of biogas and FO price are considered as the critical parameters.

The results of the sensitivity analysis are shown in the following table:

Sensitivities			
Factor	**-10%**	**0%**	**+10%**
Total Investment Cost	9.94%	8.60%	7.45%
Operating Costs	9.84%	8.60%	7.29%
Total Biogas Generated	5.98%	8.60%	10.98%
NCV of biogas	5.98%	8.60%	10.98%
FO price	5.98%	8.60%	10.98%
Benchmark	**12.25%**	**12.25%**	**12.25%**



The above sensitivity analysis clearly demonstrates that the project activity is not financially attractive even if the critical parameters are subjected to 10% variation.

If the project cost decreases by 26% then, the project activity will be financially attractive. This is not a practical situation. PP has done investment analysis on actual cost basis and the IRR of the project activity based on actual investment is 8.39%.

If operating costs of the project activity reduces by 33% then, the project activity will be financially attractive. PP has applied sensitivity analysis as per the applicable guidance with variation of 10% and the increase in the operating costs is beyond the variation of 10%.

If biogas generation increases by 18% then, the project activity will be financially attractive. PP has considered most plausible biogas generation from the project activity for investment analysis. This increase in biogas generation is beyond the variation of 10%, applicable as per the guidance.

If NCV of biogas increases by 16% then, the project activity will be financially attractive. This increase in NCV of biogas is beyond the variation of 10% considered as per the applicable guidance.

If FO price increases by 16% then, the project activity will be financially attractive. This increase in FO price is beyond variation of 10% as per the applicable guidance.

In the above background, if CDM benefits are considered then, the project IRR will be 11.89% which will alleviate the financially risk associated with the project. Hence the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As per methodology AMS III.H.

Baseline Emission: ($BE_{ww,y}$)

As per paragraph 18, baseline emissions for the systems affected by the project activity may consists of:

(i) Emissions on account of electricity or fossil fuel used ($BE_{power,y}$);

(ii) Methane emissions from baseline wastewater treatment systems ($BE_{ww,treatment,y}$);

(iii) Methane emissions from baseline sludge treatment systems ($BE_{s,treatment,y}$);

(iv) Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea ($BE_{ww,discharge,y}$);

(v) Methane emissions from the decay of the final sludge generated by the baseline treatment systems ($BE_{s,final,y}$).

$$BE_{ww,y} = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\}$$

Where,

$BE_{ww\ y}$	Baseline emissions in year *y* (tCO_2e)
$BE_{power,y}$	Baseline emissions from electricity or fuel consumption in year *y* (tCO_2e)
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems affected by the project activity in year *y* (tCO_2e)
$BE_{s,treatment,y}$	Baseline emissions of the sludge treatment systems affected by the project activity in year *y* (tCO_2e)
$BE_{ww,discharge,y}$	Baseline emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected

Baseline emissions from electricity or fuel consumption:
Baseline emission from electricity or fuel consumption has not been considered, since the electricity or fuel consumption in the baseline scenario is very negligible.

Baseline emissions of the wastewater treatment systems affected by the project ($BE_{ww,treatment,y}$):

Methane emissions from the baseline wastewater treatment systems affected by the project ($BE_{ww,treatment,y}$) are determined using the methane generation potential of the wastewater treatment systems:

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} * COD_{\inf low,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3). For *ex ante* estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used. However, the *ex post* emissions reduction calculation shall be based on the actual monitored volume of treated wastewater
$COD_{\inf low,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system *i* in year *y* (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i*, determined as per the paragraphs 26, 27 or 28 of AMS III.H version 16

$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i* (MCF values as per table III.H.1.)
i	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.25 kg CH_4/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.89)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

As per paragraph 20 of AMS III.H. Ver. 16, *If the baseline treatment system is different from the treatment system in the project scenario, the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions ex post.*

As per paragraph 26, *in determining baseline emissions, historical records of at least one year prior to the project implementation shall be used. This shall include for example the COD removal efficiency of the wastewater treatment systems, the amount of dry matter in sludge, power and electricity consumption per m^3 of wastewater treated the amount of final sludge generated per tonne of COD removed, and all other parameters required for determination of baseline emissions.*

In the project activity, baseline treatment system is different from the treatment system in the project scenario; hence the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions *ex post*.

Baseline emissions of the sludge treatment systems affected by the project activity:
As a conservative approach, baseline emissions from the sludge treatment systems have not been considered.

Baseline methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea:
Baseline emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater are not considered as a conservative approach.

Baseline methane emissions from anaerobic decay of the final sludge
As a conservative approach, Methane emissions from anaerobic decay of the final sludge have not been considered in the baseline calculations.

Project Emission :($PE_{ww,y}$)

As per paragraph 29 of AMS III.H. Version 16, project activity emissions from the systems affected by the project activity are:

(i) CO_2 emissions on account of power and fuel used by the project activity facilities ($PE_{power,y}$);

(ii) Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{ww,treatment,y}$);

(iii) Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{s,treatment,y}$);

(iv) Methane emissions on account of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater ($PE_{ww,discharge,y}$);

(v) Methane emissions from the decay of the final sludge generated by the project activity treatment systems ($PE_{s,final,y}$);

(vi) Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,y}$);

(vii) Methane emissions due to incomplete flaring ($PE_{flaring,y}$);

(viii) Methane emissions from biomass stored under anaerobic conditions which does not take place in the baseline situation ($PE_{biomass,y}$).

$$PE_{ww,y} = \begin{Bmatrix} PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + \\ PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \end{Bmatrix}$$

Where:

$PE_{ww,y}$	Project activity emissions in the year y (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y (tCO_2e). These emissions shall be calculated as per paragraph 19 of AMS III.H, for the situation of the project scenario, using energy consumption data of all equipment/devices used in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use. As per paragraph 19 of AMS III.H, Project emissions from electricity and fossil fuel consumption ($PE_{power,y}$) will determined as per the procedures described in the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", respectively. The energy consumption shall include all equipment/devices in the baseline wastewater and sludge treatment facility. If recovered biogas in the baseline is used to power auxiliary equipment it should be taken into account accordingly, using zero as its emission factor.
$PE_{ww\ treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity and not equipped with biogas recovery, in year y (tCO_2e). These emissions shall be calculated as per equation 2 in paragraph 20 of AMS III.H. Version 16, using an uncertainty factor of 1.12 and data applicable to the project situation ($MCF_{ww,treatment,PJ,k}$ and $\eta_{,PJ,k,y}$) and with the following changed definition of parameters

$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater

		treatment system k (MCF values as per Table III.H.1)
	$\eta_{,PJ,k,}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system k in year y (t/m^3), measured based on inflow COD and outflow COD in system k
$PE_{s,\ treatment,\ y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (tCO_2e). These emissions shall be calculated as per equations 3 and 4 in paragraph 22 of AMS III.H. Version 16, using an uncertainty factor of 1.12 and data applicable to the project situation ($S_{l,PJ,y}$, $MCF_{s,treatment,l}$) and with the following changed definition of parameters:	
	$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system l in the project scenario in year y (t)
	$MCF_{s,treatment,l}$	Methane correction factor for the project sludge treatment system l (MCF values as per Table III.H.1)
$PE_{,ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO_2e). These emissions shall be calculated as per equation 6 in paragraph 24 of AMS III. H. Version 16, using an uncertainty factor of 1.12 and data applicable to the project conditions ($COD_{ww,discharge,PJ,y}$, $MCF_{ww,PJ,discharge}$) and with the following changed definition of parameters:	
	$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into the sea, river or lake in the project scenario in year y (t/m^3)
	$MCF_{ww,PJ,discharge}$	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake) (MCF values as per Table III.H.1)
$PE_{s,final,y}$	Methane emissions from the decay of the final sludge generated by the project activity treatment systems (tCO_2e). These emissions shall be calculated as per equation 7 in paragraph 25, using an uncertainty factor of 1.12 and data applicable to the project conditions ($MCF_{s,PJ,final}$, $S_{final,PJ,y}$). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in aerobic conditions in the project activity, this term shall be neglected, and the sludge treatment and/or use and/or final disposal shall be monitored during the crediting period with the following revised definition of the parameters:	
	$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
	$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year y (t)
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year y, calculated	

	as per paragraph 30 (tCO_2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year *y* (tCO_2e). For *ex ante* estimation, baseline emission calculation for wastewater and/or sludge treatment (i.e. equation 2 and/or equation 3 of AMS III.H. Version 16) can be used but without the consideration of GWP for CH_4. However, the *ex post* emission reduction shall be calculated as per the "Tool to determine project emissions from flaring gases containing methane" by using actual monitored data
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. If storage of biomass under anaerobic conditions takes place in the project and does not occur in the baseline , methane emissions due to anaerobic decay of this biomass shall be considered and be determined as per the procedure in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (tCO_2e) .

CO_2 emissions on account of power used by the project activity facilities ([23]$PE_{power,y}$)

These emissions are calculated as per paragraph 19 of AMS III.H Version 16 and the latest version of "Tool to calculate baseline, project and / or leakage emissions from electricity consumption" (EB39 Annex07, Version 01).

$$PE_{power,y} = \sum_j EC_{PJ,j,y} * EF_{j,y} * (1 + TDL_{j,y}) \qquad (1)^{24}$$

In case of project activity, CO_2 emissions on account of power used by the project activity are from two different sources, regional electricity grid ($PE_{Grid,y}$) and off grid captive power plant i.e. diesel generator sets ($PE_{DG,y}$).

$$PE_{power,y} = PE_{Grid,y} + PE_{DG,y}$$

$$PE_{Grid,y} = EC_{PJ,Grid,y} * EF_{EL,Grid,y} * (1 + TDL_{Grid,y})$$

$$PE_{DG,y} = EC_{PJ,DG,y} * EF_{EL,DG,y} * (1 + TDL_{DG,y})$$

$PE_{power,y}$	CO_2 emissions on account of power used by the project activity facilities (tCO_2e)
$PE_{Grid,y}$	CO_2 emissions on account of power used from regional electricity grid by the project activity facilities (tCO_2e)
$PE_{DG,y}$	CO_2 emissions on account of power used from off grid captive power plant i.e.

[23] CO_2 emissions are considered using energy consumption data of all equipments/devices used in project activity wastewater treatment systems and systems for biogas recovery and gainful use.

[24] Equation 1 of the "tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01) , EB 39, Annex 7

	Diesel Generator (DG) by the project activity facilities (tCO_2e)
$EC_{PJ,Grid,y}$	Energy consumption data of all equipments/devices used in project activity wastewater treatment systems and systems for biogas recovery and gainful use from regional electricity grid for a year y (MWh)
$EC_{PJ,DG,y}$	Energy consumption data of all equipments/devices used in project activity wastewater treatment systems and systems for biogas recovery and gainful use from off grid captive power plant (diesel generator DG) for a year y (MWh)
$EF_{EL,Grid,y}$	CO_2 emission factor of the grid in year y (tCO_2/MWh) For project emissions due to electricity consumption by the project activity using local electricity grid, emission factor is calculated as per scenario A, option A1 of the tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (EB39 Annex07). As per option A1, the combined margin emission factor of the local electricity grid is calculated using the procedures in the latest approved version of the 'Tool to calculate the emission factor for an electricity system. (EB63 Annex19)'. The calculation of Combined Margin (CM) Emission Factor is given in appendix 5. The CM emissions factor ($EF_{grid,.CM,.y}$), calculated is 0.84 tCO_2/MWh and is fixed ex-ante during the entire crediting period and no monitoring of emission factor is required.
$EF_{EL,DG,y}$	CO_2 emission factor of off grid power captive power plant in year y (tCO_2/MWh) For project emissions due to electricity consumption by the project activity using off grid fossil fuel fired captive power plant, emission factor is calculated using Scenario B, option B2 of the tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (EB 39 Annex 07). Default value of emission factor i.e. 1.3 tCO_2/MWh will be used. Hence, the emission factor for captive power plant ($EF_{DG,y}$) will be 1.3 tCO_2/MWh and is fixed ex-ante during the entire crediting period and no monitoring of emission factor is required.
$TDL_{Grid,y}$	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
$TDL_{DG,y}$	Average technical transmission and distribution losses for providing electricity to source *j* in year *y* (here, $TDL_{DG,y}$ =0)

Methane emissions from wastewater treatment systems affected by the project activity and not equipped with biogas recovery in the project scenario ($PE_{ww,treatment,y}$),

Project activity will affect existing 2000 m^3/day and new 1000 m^3/day waste water treatment plant. These emissions shall be calculated as per equation 2 in paragraph 20 of AMS III.H. version 16, using an uncertainty factor of 1.12 and data applicable to the project situation ($MCF_{ww,treatment,PJ,k}$ and $\eta_{PJ,k,y}$):

$$PE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} * COD_{inlow,i,y} * \eta_{PJ,k} * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4}$$

$Q_{ww,i,y}$	Volume of wastewater treated in project wastewater treatment system *i* in year *y* (m^3)
$COD_{\inf ow,i,y}$	Chemical oxygen demand of the wastewater inflow to the project treatment system *i* in year *y* (t/m^3).
$\eta_{,PJ,k,}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* in year *y* (t/m^3), measured based on inflow COD and outflow COD in system *k*
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment system *k* (MCF values as per Table III.H.1)
i	Index for project wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{s,treatment}$***)***

These project emissions are not considered as sludge treatment systems are not affected by the project activity.

***Methane emissions* from degradable organic carbon in treated wastewater in year *y* (**$PE_{,ww,discharge,y}$**)**

These emissions shall be calculated as per equation 6 in paragraph 24 of AMS III.H using an uncertainty factor of 1.12 and data applicable to the project situation ($COD_{ww,discharge,PJ,y}$, $MCF_{ww,PJ,discharge}$)

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,discharge}$$

$Q_{ww,y}$	Volume of treated wastewater discharged in year y (m^3)
GWP_{CH4}	Global Warming Potential for methane (value of 21)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.21 kg CH_4/kg COD)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the project situation in year y (t/m^3)
$MCF_{ww,PJ,discharge}$	Methane correction factor based on discharge pathway in the project situation (e.g. sea, river or lake) of the wastewater (fraction) (MCF values as per table III.H.1)

***Methane emissions from the decay of the final sludge generated by the project activity treatment systems* ($PE_{s,final,y}$)**

As explained above, as per paragraph 29, *If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in aerobic conditions in the project activity, this term shall be neglected.* Since the sludge generated in the project activity would be used for soil application, methane emissions from the decay of the sludge are neglected.

Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,y}$)

As per paragraph 30 of AMS III. H. version 16, project activity emissions form methane release in capture systems are determined as follows,

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$$

Where,

$PE_{fugitive,y}$ = Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO_2e)

$PE_{fugitive,s,y}$ = Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y (tCO_2e)

For this case, $PE_{fugitive,s,y} = 0$

Hence,

$$PE_{fugitive,y} = PE_{fugitive,ww,y}$$

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$$

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$$

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)
$Q_{ww,y}$	Volume of treated wastewater discharged in year y (m^3)
GWP_{CH4}	Global Warming Potential for methane (value of 21)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.25 kg CH_4/kg COD)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)

$COD_{removed,PJ,k,y}$	Chemical oxygen demand removed[25] by the treatment system k of the project activity equipped with biogas recovery equipment in year y (t/m^3)
$MCF_{ww,treatment,PJ,y}$	Methane correction factor for the project wastewater treatment systems k equipped with biogas recovery equipment (MCF values as per table III.H.1)

Methane emissions due to incomplete flaring in year y (*$PE_{flaring,y}$*)

In the project activity, generated biogas will be consumed in the heat generating equipments (boilers). The project activity involves two heat generating equipments (2*13.2 TPH (F&A 100^{0}C)). When one boiler is forced shut down or is under maintenance, biogas can be supplied to another boiler. It is very unlikely that both the heat generating equipments are under maintenance or forced shut down.

However, if such condition occurs, the number of hours of operation of flare shall be monitored as H_{flare} and the quantity of biogas flared shall be obtained by multiplying the flare capacity and number of hours of operation of flare. The project activity involves open flaring system. This system is now not operational in and use of the same is very unlikely because the generated biogas will be used in the boilers. Hence, the default value to be adapted for flare efficiency is 0%.

Methane emissions shall be calculated as per the "Tool to determine project emissions from flaring gases containing methane" (EB 28 Annex 13, version 01)

The tool involves seven steps, out of which, step 3 and step 4 are not applicable since, in project activity enclosed flares are not used.

Step1: Determination of the mass flow rate of the residual gas that is flared

This step calculates the residual gas mass flow rate in each hour *h,* based on the volumetric flow rate and the density of the residual gas. The density o the residual gas is determined based on the volumetric fraction of all components in the gas.

$$FM_{RG,h} = \rho_{RG,n,h} \text{ x } FV_{RG,h}$$

Where,

Variable	**Description**
$FM_{RG,h}$	Mass flow rate of the residual gas in hour *h*
$\rho_{RG,n,h}$	Density of the residual gas at normal conditions in hour *h*
$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*

$$\rho_{RG,n,h} = \frac{P}{\frac{R_u}{MM_{RG,h}} x T_n}$$

[25] Difference between inflow COD and the outflow COD

Where,

Variable	Description
$\rho_{RG,n,h}$	Density of the residual gas at normal conditions in hour *h*
P_n	Atmospheric pressure at normal conditions (101325)
R_u	Universal ideal gas constant (8314)
$MM_{RG,h}$	Molecular mass of the residual gas in hour *h*
T_n	Temperature at normal conditions (273.15)

$$MM_{RG,h} = \sum fv_{i,h} * MM_i$$

Where,

Variable	Description
$MM_{RG,h}$	Molecular mass of the residual gas in hour *h*
$fv_{i,h}$	Volumetric fraction of component *i* in the residual gas in the hour *h*
MM_i	Molecular mass of residual gas component *i*
i	The components CH_4, CO, CO_2, O_2, H_2, N_2

As a conservative approach, project proponent will only measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N_2)

Step 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

Determine the mass fractions of carbon, hydrogen, oxygen and nitrogen in the residual gas, calculated from the volumetric fraction of each component *i* in the residual gas, as follows,

$$FM_{j,h} = \frac{\sum_i fv_{i,h..} AM_j . NA_{j,t}}{MM_{RG,h}}$$

Where,

Variable	Description
$Fm_{j,h}$	Mass fraction of element *j* in the residual gas in hour *h*
$Fv_{i,h}$	Volumetric fraction of component *i* in the residual gas in the hour *h*
AM_j	Atomic mass of element *j*
$NA_{j,i}$	Number of atoms of element *j* in component *i*
$MM_{RG,h}$	Molecular mass of the residual gas in hour *h*
j	The elements carbon, hydrogen, oxygen and nitrogen
i	The components CH_4, CO, CO_2, O_2H_2, N_2

Step 5: Determination of methane mass flow rate of the residual gas on a dry basis

The quantity of methane in the residual gas flowing into flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density if methane ($\rho_{CH4,n,h}$) in the same reference conditions (normal conditions and dry basis).

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

Where,

Variable	Description
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in hour *h*
$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour *h* (NB: this corresponds to $fv_{i,RG,h}$ where *i* refers to methane)
$\rho_{CH4,n}$	Density of methane at normal conditions (0.716)

Step 6: Determination of the hourly flare efficiency

The determination of the hourly flare efficiency depends on the operation of flare (e.g. temperature, the type of flare used (open or enclosed). The project activity involves open flaring. Hence, the flare efficiency in the hour *h* ($\square_{flare,h}$) will be any of the following,

1. 0% if the flame is not detected for more than 20 minutes during the hour *h*
2. 50% in the flare is detected for more than 20 minutes during the hour *h*

Step 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Project emissions from flaring are calculated as the sum of emissions from each hour h, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour h ($\eta_{flaure,h}$), as follows:

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

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year *y*
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour *h*
$\eta_{flaure,h}$	Flare efficiency in hour *h*
GWP_{CH4}	Global Warming Potential of methane valid for commitment period

***Methane emissions from biomass stored under anaerobic conditions which does not take place in the baseline situation* ($PE_{biomass,y}$)**

Since, generated biogas shall not be stored under anaerobic conditions, methane emissions shall be neglected.

Leakage $(LE_{ww,y})$ **:**

There is no transfer of equipment from another activity nor the existing equipment is transferred to another activity, hence there is no leakage has been considered for this project activity.

Emission Reduction :($ER_{ww\,y}$)

As per paragraph 32 of AMS III.H. version 16, f*or all scenarios in paragraph 1, i.e. 1 (a) to 1 (f) of the methodology, emission reductions shall be estimated ex ante in the PDD using the equations provided in the baseline, project and leakage emissions sections above. The project activity falls under scenario 1 (f). Emission reductions shall be estimated ex ante as follows:*

$$ER_{wwy,ex\ ante} = BE_{ww,y,ex\ ante} - \left(PE_{,ww,y,ex\ ante} + LE_{ww,y,ex\ ante}\right)$$

Where:

$ER_{ww,y,ex\ ante}$	*Ex ante* emission reduction in year *y* (tCO_2e)
$LE_{ww,y,ex\ ante}$	*Ex ante* leakage emissions in year *y* (tCO_2e)
$PE_{ww,y,ex\ ante}$	*Ex ante* project emissions in year *y* calculated as paragraph 29 of AMS III.H. ver.16 (tCO_2e)
$BE_{ww,y,ex\ ante}$	*Ex ante* baseline emissions in year *y* calculated as per paragraph 18 of AMS III.H. ver.16 (tCO_2e)

As per paragraph 34 of AMS III. H. version 16, f*or cases 1 (b), 1 (c), 1 (d) and 1 (f): it is possible that the project activity involves wastewater and sludge treatment systems with higher methane conversion factors (MCF) or with higher efficiency than the 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:*

$$ER_{y,ex\ post} = \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}),$$
$$(MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post}))$$

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 as per paragraph 18 of AMS III.H. ver.16 using *ex post* monitored values
$PE_{y,ex\ post}$	Project emissions calculated as per paragraph 29 of AMS III.H. ver.16 using *ex post* monitored values
MD_y	Methane captured and destroyed/gainfully used by the project activity in the year *y*

(tCO_2e)

As per paragraph 35 of AMS III. H. version 16, *in the case of flaring/combustion MD_y will be measured using the conditions of the flaring process:*

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \quad \textbf{(1)}$$

Where:

$BG_{burnt,y}$	Biogas flared/combusted in year *y* (m^3)
$w_{CH4,y}$	Methane content of the biogas in the year *y* (volume fraction)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year *y* (t/m^3)
FE	Flare efficiency in year *y* (fraction). If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% may be applied

$BG_{burnt,y}$ will be calculated based on measured values of biogas generated from two nos. of anaerobic digesters of Mother Liquor Treatment Plant. Biogas generated from existing 2000 m^3/day and new 1000 m^3/day WWTP will not be considered.

In the Project activity, biogas is combusted for gainful purpose hence, flare efficiency of 100% will be considered for the calculation purpose.

As per methodology AMS I. C.:

Calculation of baseline emissions:

Baseline of the project activity is identified as per paragraph 42, "*For project activities that seek to retrofit or modify an existing facility for the purpose of fuel switch from fossil fuels to biomass residues in heat generation equipment, the baseline emissions shall be calculated as per equation 2*." As per paragraph 22 of AMS I. C. Version 19, the baseline emissions for steam produced using fossil fuels are calculated as follows:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

Where:

$BE_{thermal,CO_2,y}$	The baseline emissions from steam/heat displaced by the project activity during the year *y* (tCO_2e)
$EG_{thermal,y}$	The net quantity of thermal energy supplied by the project activity during the year *y* (TJ)
EF_{FF,CO_2}	The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant; tCO_2/TJ, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used
$\eta_{BL,thermal}$	The efficiency of the plant using fossil fuel that would have been used in the

absence of the project activity

$$EG_{thermal,y} = \left((H_{steam} - H_{feedwater}) \times Q_{steam} \times 4.186 \times 10^{-9} \right)$$

Where,

H_{steam}	= Enthalpy of steam, kcal/kg
$H_{feed\ water}$	= Enthalpy of feed water, kcal/kg
Q_{steam}	= Quantity of steam produced, t
4.186	= Conversion factor from kcal to KJ

Efficiency of the baseline boiler will be determined as per para 30 (b) of AMS I.C. version 19.

As per paragraph 17 of AMS I.C, "*Existing facilities are those that have been in operation for at least three years immediately prior to the start date of the project activity. For project activities implemented in existing facilities, baseline calculations shall be based on historical data on energy use (e.g. electricity, fossil fuel) and plant output (e.g. steam/electricity) in the baseline plant for at least three years prior to project implementation. For existing facilities with less than three years of operational data, all historical data shall be available (a minimum of one year data would be required). For existing facilities having no historical data/information on baseline parameters such as efficiency, energy consumption and output (e.g. the available data is not reliable due to various factors such as the use of imprecise or non-calibrated measuring equipment), the baseline parameters can be determined using a performance test/measurement campaign to be carried out prior to the implementation of the project activity. The project proponent may follow the relevant provisions from the "Tool to determine baseline efficiency of thermal and electricity systems". In the case of project activities that export to other facilities within the project boundary, historical data from the recipient plants is also required*". PP will use historical data for use of energy source and plant output as described in the methodology.

As per paragraph 35 of the same, "*baseline emissions shall be determined based on three years average historical data on the relative share of fossil fuel and biomass in the baseline fuel mix. The relative share is determined based on the energy content of each fuel".* In this project activity, in baseline condition, only fossil fuel i. e. Furnace Oil was used and biomass fuel was not used. Hence, baseline emissions shall be calculated as per equation 2 in paragraph 22 of AMS I.C. version 19.

<u>Calculation of project emissions</u>

As per AMS I.C. version 19 paragraph 45, the project emissions include,

- CO_2 emission from onsite consumption of fossil fuels due to the project activity will be calculated using the latest version of " Tool to calculate project or leakage CO_2 emissions from fossil fuel consumption"
    - $PE_{FC,boiler,y} = (\sum_{FO} FC_{FO,bolier,y} \times COEF_{FO,y})$

  Where,

$PE_{FC,boiler,y}$ CO_2 emission from the process (boiler) during the year y, tCO_2e/year

$FC_{FO,boiler,y}$	Quantity of fuel type (FO) combusted in the process (boiler) during the year y, kg/year
$COEF_{FO,y}$	CO_2 emission coefficient of the fuel (FO) during the year y, tCO_2e/kg
FO	The fuel type combusted in process j during the year y

The CO_2 emission coefficient $COEF_{FO,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type (FO), as follows using option B in the tool:

$$COEF_{FO,y} = NCV_{FO,y} * EF_{CO2,FO,y}$$

Where:

$COEF_{FO,y}$	The CO_2 emission coefficient of fuel type (FO) in year y (tCO_2e/kg)
$NCV_{FO,y}$	The weighted average net calorific value of the fuel type (FO) in year y (GJ/kg)
$EF_{CO2,FO,y}$	The weighted average CO_2 emission factor of fuel type (FO) in year y (tCO_2/GJ)
FO	The fuel type combusted in process (boiler) during the year y

- CO_2 emission from electricity consumption by the project activity using the latest version of "Tool to calculate baseline, project and / or leakage emissions from electricity consumption".

'CO_2 emissions from electricity consumption by the project activity' will be considered and calculated as per paragraph 29 (i) of AMS III.H. version 16 and are described above under $PE_{ww,y}$.

Total project emissions:

Therefore, Project emissions due to thermal energy generation will be,

$$PE_{thermal,y} = PE_{FC,boiler,y}$$

Leakage $(LE_{thermal,y})$ **:**

Leakage emissions are not considered since there is no transfer of equipment from another activity.

Emission Reductions due to thermal energy generation ($ER_{thermal,y}$ **):**

$$\mathbf{ER_{thermal,y} = BE_{thermal,y} - PE_{thermal,y} - LE_{thermal,y}}$$

Where:

$ER_{thermal,y}$	Emission reductions in year *y* (tCO_2e)
$BE_{thermal,y}$	Baseline emissions in year *y* (tCO_2e)

$PE_{thermal,y}$	Project emissions in year y (tCO_2e)
$LE_{tehrmal,y}$	Leakage emissions in year y (tCO_2e)

Therefore, total emission reduction because of this project activity is,

$$\mathbf{ER_y = ER_{ww,y} + ER_{thermal,y}}$$

Where,

$ER_{ww,y} = ER_{y,ex\ post}$

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

Data / Parameter:	UF_{BL}
Data unit:	
Description:	Model correction factor to account for model uncertainties
Source of data used:	FCCC/SBSTA/2003/10/Add.2,page25[26]
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is taken from the methodology AMS III.H version 16
Any comment:	NA

Data / Parameter:	$B_{o,ww}$
Data unit:	$kgCH_4$ / kg COD
Description:	Methane producing capacity of the wastewater
Source of data used:	IPCC report
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value is used as per paragraph 20 of AMS III.H version 16
Any comment:	NA

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2/tCH_4
Description:	Global Warming Potential for methane
Source of data used:	Para 20 of AMS III.H version 16

[26] Footnote 8 page 6 of AMS III.H Ve. 16

Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value is used as per paragraph 20 of AMS III.H version 16
Any comment:	NA

Data / Parameter:	$MCF_{ww,treatment,BL,j}$
Data unit:	
Description:	Methane correction factor for baseline wastewater treatment system i (anaerobic lagoon)
Source of data used:	As per table III.H 1, paragraph 21 AMS III.H version 16 for anaerobic deep lagoon (depth more than 2 meters)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value is used from table III.H 1, as per chapter 6 of volume 5, waste in 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	NA

Data / Parameter:	$MCF_{ww,treatment,PJ,aerobic,k}$
Data unit:	
Description:	Methane correction factor for project wastewater treatment system *k (aerobic system)* affected by the project activity, and not equipped with biogas recovery,
Source of data used:	As per table III.H 1, paragraph 21 AMS III.H version 16 for aerobic treatment well managed
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value is used from table III.H 1, as per chapter 6 of volume 5, waste in 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	For para 20 equation 2 of AMS III.H Version 16, $MCF_{ww,treatment,PJ,aerobic,k} = MCF_{ww,treatment,PJ,k}$

Data / Parameter:	$MCF_{ww,treatment,PJ,anaerobic,k}$
Data unit:	
Description:	Methane correction factor for the project wastewater treatment system *k (anaerobic system)* equipped with biogas recovery equipment
Source of data used:	As per table III.H 1, paragraph 21 AMS III.H version 16 for anaerobic reactor
Value applied:	0.8

Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value is used from table III.H 1, as per chapter 6 of volume 5, waste in 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	For calculcation as per para 30 of AMS III.H version 16, $MCF_{ww,treatment,PJ,anaerobic,k} = MCF_{ww,treatment,PJ,k}$

Data / Parameter:	$MCF_{ww,PJ,discharge}$
Data unit:	
Description:	Methane correction factor based on discharge pathway in the project situation of the wastewater fraction
Source of data used:	As per table III.H 1, paragraph 21 AMS III.H version 16 for discharge on wastewater to sea, river or lake
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value is used from table III.H 1 as per chapter 6 of volume 5, waste in 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	NA

Data / Parameter:	$Q_{ww,i,y}$
Data unit:	m^3/day
Description:	Flow of wastewater (mother liquor) to the baseline treatment system *i* (anaerobic lagoon) in year *y*
Source of data used:	Historical data for last 1 year
Value applied:	38
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is used based on historical data of one year for the baseline treatment system i. e. anaerobic lagoon prior to project implementation.
Any comment:	NA

Data / Parameter:	$COD_{inflow,i,y}$
Data unit:	t/m^3
Description:	Chemical oxygen demand of the wastewater (mother liquor) inflow to the baseline treatment system *i* (anaerobic lagoon) in year *y*
Source of data used:	The value is determined as per the paragraph 26 of AMS III.H version 16
Value applied:	0.388
Justification of the choice of data or description of measurement methods	This value is used based on historical data of one year for the baseline treatment system i. e. anaerobic lagoon prior to project implementation.

and procedures actually applied :	
Any comment:	NA

Data / Parameter:	$\eta_{COD,BL,i}$
Data unit:	%
Description:	COD removal efficiency of the baseline treatment system *i* - (i. e. anaerobic lagoon)
Source of data used:	The value is determined as per the paragraph 26 of AMS III.H version 16
Value applied:	80
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is used based on historical data of one year for the baseline treatment system i. e. anaerobic lagoon prior to project implementation.
Any comment:	NA

Data / Parameter:	UF_{PJ}
Data unit:	
Description:	Model correction factor to account for model uncertainties
Source of data used:	Equation 8 paragraph 29 of AMS III.H version 16, page 11
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is taken from the methodology AMS III.H version 16
Any comment:	NA

Data / Parameter:	$EF_{CO2,FO,y}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor for fossil fuel (Furnace Oil)
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2; Chapter 2.3.2; Page 16; Table 2.2
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The above value has been taken from IPCC guidelines for National Greenhouse Gas Inventories as suggested in the applicable methodology. The local or national data for emission coefficient for FO is not available hence IPCC default emission factors are chosen for estimating the emissions reductions.
Any comment:	$EF_{CO2,FO,y} = EF_{FF,CO2}$

Data / Parameter:	NCV_{FO}
Data unit:	kcal/kg

Description:	Heating value of unit quantity of Furnace Oil
Source of data used:	PCRA website
Value applied:	9650
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value has been taken from PCRA website - http://www.pcra.org/English/latest/book/02-Chapter%20-%202.pdf. This data is publicly available for reference.
Any comment:	This value is in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 1

Data / Parameter:	$\eta_{BL,thermal}$
Data unit:	-
Description:	Efficiency of baseline boiler
Source of data used:	As per paragraph 30 (b) of AMS I.C. version 19, highest efficiency provided by two manufacturers.
Value applied:	89%
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology, highest of the efficiency values provided by two manufacturers for unit with similar specifications, using the baseline fuel.
Any comment:	$\eta_{BL,thermal} = \eta_{BL}$

Data / Parameter:	$EF_{ELGrid,y}$
Data unit:	tCO_2/MWh
Description:	Grid Emission factor of NEWNE Grid
Source of data used:	Central Electricity Authority (CEA's) CO_2 baseline database for the Indian Power sector User Guide. Version 5.0
Value applied:	0.84
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is taken from CO_2 baseline database for the Indian Power sector User Guide, Version 5.0.
Any comment:	Grid Emission factor is officially published by CEA

Data / Parameter:	$EF_{EL,DG,y}$
Data unit:	tCO_2/MWh
Description:	Emission factor of Captive Power Plant (Diesel Generator)

Source of data used:	Option B2 of scenario B of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (EB 39 Annex 07)
Value applied:	1.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is taken from option B2 as given in scenario B of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (EB 39 Annex 07)
Any comment:	

Data / Parameter:	$TDL_{Grid,y}$
Data unit:	--
Description:	Average technical transmission and distribution losses for providing electricity to source in year y
Source of data used:	Use recent, accurate and reliable data available within the host country; Use as a default value of 20 % , a) For leakage electricity consumption. 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 <u>larger </u>than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies
Value applied:	20 % (if host country data is not available)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per EB 39 Annex 07, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption".
Any comment:	This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later.

Data / Parameter:	$TDL_{DG,y}$
Data unit:	--
Description:	Average technical transmission and distribution losses for providing electricity to source in year y
Source of data used:	For scenario B, value is assumed 0 as a simplification.
Value applied:	0 % (if host country data is not available)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption".

Any comment:	This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later.

Data / Parameter:	CFE_{ww}
Data unit:	-
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment system
Source of data:	Paragraph 30 of AMS III.H version 16
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value of the parameter is applied as per paragraph 30 of AMS III. H version 16
Any comment:	-

Data / Parameter:	FE
Data unit:	%
Description:	Flare efficiency in year y
Source of data:	Paragraph 35 of AMS III.H version 16
Value applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value of the parameter is applied as per paragraph 35 of AMS III. H version 16
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

In the absence of project activity the Mother Liquor would be treated in anaerobic deep lagoon without any capture of methane and the thermal energy would be produced using FO. As per AMS III.H. version 16, paragraph 18, baseline emissions for the systems affected by the project activity are considered a per paragraph 18 equation 1 of the methodology and subsequently as per paragraph 20 equation 2. And, baseline of the project activity is identified as per paragraph 42 of AMS I.C. Version 19 as, *For project activities that seek to retrofit or modify an existing facility for the purpose of fuel switch from fossil fuels to biomass residues in heat generation equipment, the baseline emissions shall be calculated as per equation 2"* Thus, paragraph 22 is identified as baseline scenario. Other paragraphs 17, 30 and 44 of the methodology are also applicable.

<u>As per AMS III.H. methodology,</u>

Baseline Emissions (BE):

The baseline emissions are calculated by using the formula given in AMS III.H. Version 16 which are given below:

$$BE_{ww,y} = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\}$$

In the project case, the baseline would be due to methane emissions from the wastewater (Mother Liquor) treatment system and it has been calculated as per the formula mentioned above.

Baseline emissions of the wastewater treatment systems affected by the project ($BE_{ww,treatment,y}$):

Methane emissions from the baseline wastewater treatment systems affected by the project ($BE_{ww,treatment,y}$) are determined using the methane generation potential of the wastewater treatment systems:

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} * COD_{inflow,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

Where:

$Q_{ww,i,y}$	Volume of wastewater (Mother Liquor) treated in baseline wastewater treatment system *i* in year *y* (13870 m^3[27]). For *ex ante* estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used. However, the *ex post* emissions reduction calculation shall be based on the actual monitored volume of treated wastewater
$COD_{inflow,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system *i* in year *y* (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10 (0.388 t/m^3)
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i*, determined as per the paragraphs 26 of AMS III.H version 16 (0.80)
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i* (MCF values as per table III.H.1.) (0.8)
I	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value for domestic wastewater of 0.25 kg CH_4/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.89)
GWP_{CH4}	Global Warming Potential for methane (value of 21 tCO_2/tCH_4)

Calculation of baseline emission due to treatment of mother liquor:

[27] The volume is calculated based on historical data of wastewater generation per day for baseline wastewater treatment system (38 m^3/day)

$BE_{ww,treatment,y} = 13870 * 0.388 * 0.80 * 0.80 * 0.25 * 0.89 * 21$

= 16086 tCO_2e/year

Baseline emission will be

$$BE_{ww,y} = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\}$$

= 0 + 16086 + 0 + 0 + 0

= 16086 tCO_2e/year

$BE_{WW,y}$ = 16086.00 tCO_2e/year

As per paragraph 35 of AMS III. H. version 16, MD_y is calculated as follows,

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$$

Where,

$BG_{burnt,y}$	Biogas combusted in year y (2083236.68[28] m^3)
$w_{CH4,y}$	Methane content of the biogas in the year y (0.67)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year y (0.001089 t/m^3)
FE	Flare efficiency in year y (100%).
GWP_{CH4}	Global Warming Potential for methane (21 tCO_2/tCH_4)

Calculation for methane captured and gainfully used by the project activity in the year *y* *(MD_y):*

MD_y = 2083236.68*0.67*0.001089*100%*21

= 31919.83 tCO_2e/year

= 31919 tCO_2e/year (round down value)

Project Emissions ($PE_{WW,y}$):

Project activity emissions from the systems affected by the project activity are:

$$PE_{ww,y} = \begin{Bmatrix} PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + \\ PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \end{Bmatrix}$$

CO_2 emissions on account of power used by the project activity facilities ([29]$PE_{power,y}$)

[28] Calculated based on expected biogas generation from new two nos. of anaerobic digesters of Mother Liquor Treatment Plant

[29] CO_2 emissions are considered using energy consumption data of all equipments/devices used in project activity wastewater treatment systems and systems for biogas recovery and gainful use.

$PE_{power,y} = PE_{Grid,y} + PE_{DG,y}$

$PE_{Grid,y} = EC_{PJ,Grid,y} * EF_{EL,Grid,y} * (1 + TDL_{Grid,y})$

$PE_{DG,y} = EC_{PJ,DG,y} * EF_{EL,DG,y} * (1 + TDL_{DG,y})$

Parameter	**Symbol**	**Unit**	**Value**
Electricity consumption per year from grid		kWh/year	3663186.18
Total electricity consumption per year	$EC_{PJ,Grid,y}$	MWh/year	3663.18618
Grid emission factor	$EF_{EL,Grid,y}$	tCO_2/MWh	0.84
Average technical transmission and distribution losses for providing electricity to source *j* in year y	$TDL_{Grid,y}$	%	20
Project emissions through electricity consumption from regional electricity grid	$PE_{Grid,y}$	tCO_2e/year	3707.144
Electricity consumption per year from diesel generator sets		kWh/year	7472.82
Electricity consumption per year	$EC_{PJ,DG,y}$	MWh/year	7.47
Emission factor for Diesel	$EF_{EL,DG,y}$	tCO_2/MWh	1.30
Average technical transmission and distribution losses for providing electricity to source *j* in year y	$TDL_{DG,y}$	%	0
Project emissions through electricity consumption from Captive Power Plant (Diesel Generator)	$PE_{DG,y}$	tCO_2e/year	9.715
	$PE_{power,y}$	**tCO_2e/year**	**3716.859**

$PE_{Grid,y}$ = (3663.18618 * 0.84 * (1+20%))
= 3707.144 tCO_2e/year

$PE_{DG,y}$ = (7.47 * 1.30)
= 9.715 tCO_2e/year

$PE_{power,y}$ = 3707.144 + 9.715
= 3716.859 tCO_2e/year
= 3717.00 tCO_2e/year (rounded up value)

Methane emissions from wastewater treatment systems affected by the project activity and not equipped with biogas recovery, in year y ($PE_{ww,treatment,y}$ ***),***

$$PE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} * COD_{inlow,i,y} * \eta_{PJ,k} * MCF_{ww,treatmet,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4}$$

Parameter	**Symbol**	**Unit**	**Value**
Volume of the waste water treated in the year (2000 m^3/day and 1000 m^3/day WWTPs)	$Q_{ww,y}$	m^3/year	1095000.00
Chemical oxygen demand of the wastewater inflow to the project treatment system *i* (2000 m^3/day and 1000 m^3/day WWTPs) in year *y* (t/m^3).	$COD_{\inf ow,i,y}$	t/m^3	4.438608
Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* in year *y* (t/m^3), measured based on inflow COD and outflow COD in system *k*	$\eta_{PJ,k}$	%	59
Methane correction factor for project wastewater treatment system k	$MCF_{ww,treatment,PJ,k}$		0
Methane producing capacity of the wastewater	$B_{o,ww}$	kg CH_4/kg COD	0.25
Model correction factor to account for model uncertainties	UF_{PJ}		1.12
Global Warming Potential for methane	GWP_{CH_4}	tCO_2/tCH_4	21
	$PE_{ww,treatment,y}$	**tCO_2e/year**	**0.00**

Therefore,

$PE_{ww,treatment,y}$ = 1095000*4.438608*0.59*0.0*0.25*1.12*21
= 0.00 tCO_2e/year

Methane emissions from degradable organic carbon in treated wastewater in year *y* ($PE_{ww,discharge,y}$);

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,dischrge}$$

Parameter	**Symbol**	**Unit**	**Value**
Volume of waste water treated in the year (2000 m^3/day and 1000 m^3/day WWTPs)	$Q_{y,ww}$	m^3/year	1095000
Chemical oxygen demand of the treated wastewater in the year	$COD_{,ww,discharge,y}$	t/m^3	0.00015
Methane generation capacity of the wastewater	$B_{o,ww}$	kg CH_4/kg COD	0.25
Methane correction factor based on type of treatment and discharge pathway of the wastewater,	$MCF_{ww,PJ,discharge}$		0.10
Model Correction factor to account for model uncertainties	UF_{PJ}		1.12
Global warming potential of methane	GWP_{CH_4}		21
	$PE_{ww,discharge,y}$	**tCO_2e/year**	**96.58**

Therefore,

$PE_{ww,\ discharge,y}$ = 1095000*0.00015*0.10*(0.25/1000)*1.12*21
= 96.58 tCO_2e/year
= 97 tCO_2e/year (rounded up value)

Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,\ y}$)

Project activity emissions from methane release in capture systems are determined as follows,

$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$

Where,

$PE_{fugitive,ww,,y}$ = Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO_2e)

$PE_{fugitive,s,y}$ = Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y (tCO_2e)

For this case, $PE_{fugitive,s,y} = 0$

$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{0,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$$

For the project activity, $PE_{fugitive,ww,y}$ are calculated separately for anaerobic digesters in Mother Liquor Treatment Plant (MLTP) and Waste Water Treatment Plant (WWTP) as follows,

Parameter	**Symbol**	**Unit**	**Value**
For Mother Liquor Treatment Plant (MLTP)			
Capture efficiency of the biogas recovery equipment in the wastewater treatment systems	CFE_{ww}		0.90
Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y	$MEP_{ww,treatment,y}$	t	1148.40
Volume of the waste water treated in the year	$Q_{ww,y}$	m^3/year	43800.00
methane generation capacity of the wastewater	$B_{o,ww}$	kg CH_4/kg COD	0.25
Model Correction factor to account for model uncertainities	UF_{PJ}		1.12
Global Warming Potential for methane	GWP_{CH4}	tCO_2/tCH_4	21.00
Chemical oxygen demand removed by the treatment system k (45 m^3 Mother Liquor Treatment Plant) of the project activity equipped with biogas recovery equipment in year y	$COD_{removed,PJ,k,y}$	t/m^3	0.12

Methane correction factor for the project wastewater treatment systems k equipped with biogas recovery equipment	$MCF_{ww,treatment,PJ,y}$		0.80
Methane fugitive emissions on account of inefficiencies in capture systems in MLTP	$\mathbf{PE_{fugitive,ww,y}}$	**tCO_2e/year**	**2412.00**
For Waste Water Treatment Plant (WWTP)			
Capture efficiency of the biogas recovery equipment in the wastewater treatment systems	CFE_{ww}		0.90
Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y	$MEP_{ww,treatment,y}$	t	156.72
Volume of the waste water treated in the year	$Q_{ww,y}$	m^3/year	1095000.00
Methane generation capacity of the wastewater	$B_{o,ww}$	kg CH_4/kg COD	0.25
Model Correction factor to account for model uncertainities	UF_{PJ}		1.12
Global Warming Potential for methane	GWP_{CH4}	tCO_2/tCH_4	21.00
Chemical oxygen demand removed by the treatment system k (120 m3 Mother Liquor Treatment Plant) of the project activity equipped with biogas recovery equipment in year y	$COD_{removed,PJ,k,y}$	t/m^3	0.0006
Methane correction factor for the project wastewater treatment systems k equipped with biogas recovery equipment	$MCF_{ww,treatment,PJ,y}$		0.80
Methane fugitive emissions on account of inefficiencies in capture systems in WWTP	$\mathbf{PE_{fugitive,ww,y}}$	**tCO_2e/year**	**330.00**
Methane fugitive emissions on account of inefficiencies in capture systems	$\mathbf{PE_{fugitive,y}}$	**tCO_2e/year**	**2742.00**

$\mathbf{PE_{fugitive,ww,y}}$ for Mother Liquor Treatment Plant:

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,MLTP,y} * MCF_{ww,treatment,PJ,MLTP}$$

= ((45+75)*365)*0.25*1.12*(((146.31[30]-29.26[31])/1000)*0.80)
= 43800 *0.25*1.12* (0.12*0.80)
= 1148.40 MT

$PE_{fugitive,ww,y}$ = (1-0.9) * 1148.40 *21
= 2411.64 tCO_2e/year
= 2412 tCO_2e/year (rounded up value)

[30] The COD inlet is arrived as follows, ((Flow of Mother Liquor*Inlet COD of Mother liquor)+(Flow of cow water*Inlet COD of cow water))/total flow of mother liquor + cow water i.e. ((45m^3/day*390 kg/m^3)+(75 m^3/day *0.100 kg/m^3))/120 m^3/day=146.31 kg/m^3

[31] The value is derived based on inlet COD of MLTP and designed efficiency of MLTP i. e. 80% = 146.31 kg/m^3 * 20/100 = 29.26 kg/m^3

$PE_{fugitive,ww,y}$ for Waste Water Treatment Plant:

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,WWTP,y} * MCF_{ww,treatment,PJ,WWTP}$$

= 1095000*0.25*1.12* (((1.818-1.179)/1000)[32]*0.80)
= 1095000*0.25*1.12* (0.006*0.80)
= 156.72 MT

$PE_{fugitive,ww,y}$ = (1-0.9) * 156.72 *21
= 329.12 tCO_2e/year
= 330 tCO_2e/year (rounded up value)

Therefore,
$PE_{fugitive,y}$ = 2412 + 330
= 2742 tCO_2e/year

***Methane emissions due to incomplete flaring in year y (*$PE_{flaring,y}$)**

Step 1: Determination of the mass flow rate of the residual gas that is flared

PP has decided to use the biogas as a fuel in the boiler on continuous basis. In project scenario, residual gas will be flared if it is not used in any of the boiler. Hence,

$FM_{RG,h}$ = 0 (as $FV_{RG,h}$ is zero)

Step 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas.

Mass fraction of carbon, hydrogen, oxygen and nitrogen will be derived if and when residual gas will be flared.

Step 5: Determination of methane mass flow rate of the residual gas on a dry basis

$TM_{RG,h}$ = 0 (as $FV_{RG,h}$ is zero)

Step 6: Determination of the hourly flare efficiency

Hourly flare efficiency will be decided on the basis of flame detected per hour and accordingly the value 0.0 or 0.5 will be considered.

Step 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.
Project emissions due to gas flaring will be calculated based on the actual data available.

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[32] The COD removed is calculated as (COD of Wastewater inlet to anaerobic digesters – (COD of Wastewater inlet to anaerobic digesters* COD reduction from anaerobic Digesters))/1000 = ((1.818 kg/m^3– (1.818*64.86%))/1000 = 0.0006 t/m^3

Project activity emissions from the systems affected by the project activity are:

$$PE_{ww,y} = \begin{Bmatrix} PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + \\ PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \end{Bmatrix}$$

= 3717+ 0+ 0+ 97 + 0 + 2742+ 0+ 0

= 6556.500 tCO_2e/year

$PE_{ww,y}$ = 6556.00 tCO_2e/year (rounded up value)

Leakage:
The used technology equipment is not transferred from another activity hence leakage is not considered for this project activity.

Emission Reductions due to Mother Liquor Treatment ($ER_{ww,y}$)

$ER_{ww,y}$ = Baseline Emissions ($BE_{ww,y}$) – Project Emissions ($PE_{WW,y}$) – Leakage ($LE_{ww,y}$)

= 16086.00 – 6556.00 – 0

= 9530.00 t CO_2e/year

As per paragraph 34 of AMS III. H. version 16, f*or cases 1 (b), 1 (c), 1 (d) and 1 (f), $ER_{y,ex\ post}$* will be as follows,

$$ER_{y,ex\ post} = \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}),$$
$$(MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post}))$$

In following calculations for $ER_{y,ex\ post}$, the ex-ante values are considered only as a reference. $BE_{y,ex\ post}$ is calculated based on historical data of anaerobic lagoons and MD_y is calculated based on designed data for Mother Liquor Treatment Plant. During monitoring period actual values will be used for emisison redction calculations.

For Project activty,

$BE_{y,ex\ post} = BE_{ww,y} = BE_{ww,treatment,y}$

Hence,

$BE_{y,ex\ post}$ = 16086.00 tCO_2e/year

$PE_{y,ex\ post} = PE_{ww,y} = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{fugitive,y} + PE_{flaring,y}$

Hence,

$PE_{y,ex\ post}$ = 3717 + 0 + 97 + 2742 + 0

= 6556.00 tCO_2e/year

$LE_{y,ex\ post}$ = 0.00 tCO_2e/year

MD_y = 31919.00 tCO_2e/year

$PE_{power,y}$ = 3717.00 tCO_2e/year

$PE_{biomass,y}$ = 0.00 tCO_2e/year

$LE_{y,ex\ post}$ = 0.00 tCO_2e/year

Hence,

$$ER_{y,ex\ post} = \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}),$$
$$(MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post}))$$

= min ((16086.00 - 6556.00 – 0.00), (31919.00 – 3717.00 – 0.00 – 0.00))

= min (9530.00, 28202.00)

= 9530.00 tCO_2e/year

Hence, Emission Reductions due to Mother Liquor Treatment

$ER_{ww,y}$ = = $ER_{y,ex\ post}$
= 9530.00 tCO_2e/year

For AMS I.C.

<u>Calculation of baseline emissions</u>

As per paragraph 22 equation 2, the baseline emissions for steam produced using fossil fuels are calculated as follows:

$BE_{thermal,CO2,y}$ = ($EG_{thermal,y}$ / $\eta_{BL,Thermal}$) * $EF_{FF,CO2}$

Calculation for $EG_{thermal,y}$:

As per paragraph 17, $EG_{thermal,y}$ has been calculated based on historical data.

Steam flow	: 100717803.00 kg/year (calculated as per historical data)
Steam pressure	: 16.00 kg/cm^2 (g) (Historical data)
Steam temperature	: 230^0C (Historical data)
Feed water temperature	: 105^0C (Historical data)

Specific enthalpy of the steam at pressure of 16 kg/cm^2 (g) and 230°C temperature = 684.25 kcal/kg

Net quantity of thermal energy supplied by the project activity during the year *y*
= 100717803.0 kg/year *(684.25 – 109.89) kcal/kg

= 57848277331.08 kcal/year
= 57848277331.08 kcal/year*4.186*10^{-9}
= 242.15 TJ/year

Net quantity of thermal energy supplied by the project activity during the year *y* = 242.15 TJ/year

As per para 30 (b) of AMS I.C. version 19, the efficiency of the baseline boiler has been determined based on the highest efficiency provided by both Thermax (89%) and Energy Pack (89%).

Therefore,

$\eta_{BL,thermal}$ = 89%

$EF_{FF,CO2}$ = 77.4 tCO_2/TJ

$BE_{thermal,y}$ = (242.15/89%) * 77.4

= **21059.14 tCO_2e/year**

$BE_{thermal,y}$ = 21059.00 tCO_2e/year (rounded down value)

Calculation of project emissions due to FO consumption:

$$PE_{FC,boiler,y} = \sum_{FO} FC_{FO,boiler,y} \times COEF_{FO,y}$$

Where,

$PE_{FC,boiler,y}$ = CO_2 emissions from the process (boiler) during the year y, tCO_2e/year
$FC_{FO,boiler,y}$ = Quantity of fuel (FO) combusted in the process (boiler) during the year y, kg/year
$COEF_{FO,y}$ = CO_2 emission coefficient of the fuel (FO) during the year y, tCO_2/kg

Where,

$FC_{FO,boiler,y}$ = ((Thermal energy generated form boiler*24*365)/($NCV_{FO,y}$*η_{BL})) – ((total gas generated * NCV_{biogas})/($NCV_{FO,y}$*η_{BL}))
= ((6603684.63 kcal/hr*24*365) / (9650 kcal/kg * 89%)) - ((2607986 m^3/year * 5050 kcal/m^3) / (9650 kcal/kg * 89%))
= 5202066.69 kg/year

$COEF_{FO,y}$ = $NCV_{FO,y}$ * $EFCO_{2\ FO,y}$
= 0.000040TJ/kg * 77.4 tCO_2/TJ
= 0.0031 tCO_2/kg

$PE_{FC,boiler,y}$ = 5202066.69 kg/year * 0.0031 tCO_2e/kg
= 16264.60 tCO_2e/year

Total project emissions ($PE_{thermal,y}$) = 16265.00 tCO_2e/year (rounded up value)

Leakage $(LE_{thermal,y})$ **:**

Energy generating equipment is not transferred from another activity, hence leakage is not considered.

Biogas is generated, collected and transported within the project boundary, hence leakage is not considered.

$ER_{thermal,y}$ $= BE_{thermal,y} - (PE_{thermal,y} + LE_{thermal,y})$
$= 21059.00 - (16265.00 + 0)$
= 4794.00 tCO_2e/year

Total Emission Reduction:

The total Emission reductions by displacing the emissions from waste water treatment and FO for thermal energy generation are,

ER_y = $ER_{ww,y} + ER_{thermal,y}$
= 9530.00 + 4794.00
= 14324.00 tCO_2e/year

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

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions(tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
01/07/2012 – 30/06/2013	22821	37145	0	14324
01/07/2013 – 30/06/2014	22821	37145	0	14324
01/07/2014 – 30/06/2015	22821	37145	0	14324
01/07/2015 – 30/06/2016	22821	37145	0	14324
01/07/2016 – 30/06/2017	22821	37145	0	14324
01/07/2017 – 30/06/2018	22821	37145	0	14324
01/07/2018 – 30/06/2019	22821	37145	0	14324
01/07/2019 – 30/06/2020	22821	37145	0	14324
01/07/2020 – 30/06/2021	22821	37145	0	14324
01/07/2021 –	22821	37145	0	14324

30/06/2022				
	228210	**371450**	**0**	**143240**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{ww,j,y}$
Data unit:	m^3/month
Description:	Volume of wastewater entering anaerobic digesters in Mother Liquor Treatment Plant
Source of data to be used:	Volume is measured using the volume flow meter and recorded in the plant log books.
Value of data	3650
Description of measurement methods and procedures to be applied:	Monitoring: Data is calculated based on cow water and mother liquor flows which are continuously measured with the help of volume flow meter along with the totaliser and the measured value is recorded in the log book hourly which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$Q_{cw,j,y}$
Data unit:	m^3/month
Description:	Volume of cow water entering anaerobic digesters in Mother Liquor Treatment Plant
Source of data to be used:	Volume is measured using the volume flow meter and recorded in the plant log books.
Value of data:	2281.25
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of volume flow meter along with the totaliser and the measured value is recorded in the log book hourly which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$Q_{ML,j,y}$
Data unit:	m^3/month
Description:	Volume of mother liquor entering anaerobic digesters in Mother Liquor Treatment Plant
Source of data to be used:	Volume is measured using the volume flow meter and recorded in the plant log books.
Value of data:	1368.75

Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of volume flow meter along with the totaliser and the measured value is recorded in the log book hourly which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$COD_{ML,y}$
Data unit:	$tCOD/m^3$
Description:	The Chemical oxygen demand of the mother liquor entering anaerobic digesters in Mother Liquor Treatment Plant
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	0.390
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10 confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure,
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	

Data / Parameter:	$COD_{cw,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand of Cow water entering anaerobic digesters in Mother Liquor Treatment Plant
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	0.001
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10 confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	-

Data / Parameter:	$COD_{ww,\inf low,MLTP,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand of wastewater (Mother liquor + cow water) entering Mother Liquor Treatment Plant
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	0.146
Brief description of measurement methods	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10

and procedures to be applied:	confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure,
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	-

Data / Parameter:	$COD_{ww,outflow,MLTP,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand of wastewater outflow at Mother Liquor Treatment Plant
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	0.0293
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10 confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	-

Data / Parameter:	$COD_{ww,removed,PJ,MLTP,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand removed by the treatment system k (anaerobic digesters in mother liquor treatment plant) in project activity in year y
Source of data to be used:	COD value is calculated and recorded in the plant log books.
Value of data:	0.117
Brief description of measurement methods and procedures to be applied:	<u>Monitoring</u>: Data is calculated as follows, $COD_{ww,\inf low MLTP,y}$ - $COD_{ww,outflow,MLTP,y}$ Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	NA

Data / Parameter:	$COD_{ww,\inf low,WWTP,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand of wastewater inflow at anaerobic digesters of 2000 m^3/day and 1000 m^3/day Waste Water Treatment Plant in year y
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	1.8183
Brief description of measurement methods	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10

and procedures to be applied:	confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	$COD_{ww,\inf low,WWTP,y}$ = $COD_{inflow,i,y}$ in project scenario

Data / Parameter:	$COD_{ww,outoflw,WWTP,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand of wastewater outflow at anaerobic digesters of 2000 m^3/day and 1000 m^3/day Waste Water Treatment Plant in year y
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	0.639
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10 confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	-

Data / Parameter:	$COD_{ww,removed,PJ,WWTP,y}$
Data unit:	$tCOD/m^3$
Description:	The chemical oxygen demand removed by the treatment system k (anaerobic digesters in 2000 m^3/day and 1000 m^3/day waste water treatment system) in project activity in year y
Source of data to be used:	COD value is calculated and recorded in the plant log books. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure,
Value of data:	0.1179
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is calculated as follows, $COD_{ww,\inf low,WWTP,y}$ - $COD_{ww,toutflow,WWTP,y}$
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	NA

Data / Parameter:	$COD_{ww.disch\arg e,PJ,y}$
Data unit:	$tCOD/m^3$
Description:	The Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the project situation in year y
Source of data to be used:	This data is determined by analytical titration method and recorded in the plant log books.
Value of data:	0.00015

Brief description of measurement methods and procedures to be applied:	Monitoring: Data is determined by analytical titration method through representative sampling. The samples and measurements shall ensure a 90/10 confidence/precision level. Weighted average value will be used for emission reduction calculations. Please refer Annex 4 for detailed procedure,
QA/QC procedures to be applied:	As per procedures based on national / international standards. Further values can be cross-checked from the third party laboratory reports.
Any comment:	-

Data / Parameter:	$\eta_{PJ,k}$
Data unit:	%
Description:	The Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* i. e. 2000 m^3/day and 1000 m^3/day waste water treatment plants in year *y*
Source of data to be used:	This is determined on based of inflow COD and outflow COD in system k i.e. 2000 m^3/day and 1000 m^3/day waste water treatment plants
Value of data:	64.86
Brief description of measurement methods and procedures to be applied:	Monitoring: calculated
QA/QC procedures to be applied:	-
Any comment:	$\eta_{PJ,k} = COD_{ww,\inf low,i,y} - COD_{ww,\inf low,WWTP,y}$ Calculated value based on inflow and outflow COD of wastewater entering 2000 m^3/day and 1000 m^3/day waste water treatment plants

Data / Parameter:	$Q_{FF,FO1}$
Data unit:	Tonnes/year
Description:	Annual Furnace Oil consumption in the boiler 1
Source of data to be used:	This data is measured using the mass flow meter and recorded in the plant log books.
Value of data:	3828.25
Brief description of measurement methods and procedures to be applied:	Monitoring: Continuously. Data is measured by means of using mass flow meter and the measured value is totalized and recorded in the log book daily which is available for verification. Please refer Annex 4 for detailed procedure
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. If invoices are available, the metered fuel consumption quantities should be cross-checked with available purchase invoices from the financial records.
Any comment:	Flow meter will be calibrated as per manufacturer's specification. $Q_{FF,FO1} = FC_{Fo,boiler,y}$

Data / Parameter:	$Q_{FF,FO2}$
Data unit:	Tonnes/year
Description:	Annual Furnace Oil consumption in the boiler 2

Source of data to be used:	This data is measured using the mass flow meter and recorded in the plant log books.
Value of data:	3371.51
Brief description of measurement methods and procedures to be applied:	Monitoring: Continuously. Data is measured by means of using mass flow meter and the measured value is totalized and recorded in the log book daily which is available for verification. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. If invoices are available, the metered fuel consumption quantities should be cross-checked with available purchase invoices from the financial records.
Any comment:	Flow meter will be calibrated as per manufacturer's specification. $Q_{FF,FO2} = FC_{Fo,boiler,y}$

Data / Parameter:	$Q_{biogas,WWTP1}$
Data unit:	m^3/year
Description:	Quantity of biogas generated from 2000 m^3/day Waste Water Treatment Plant in year y
Source of data to be used:	Biogas quantity is measured using the Volume flow meter with totaliser and recorded in the plant log books.
Value of data:	349832.65
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of volume flow meter with totaliser and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$Q_{biogas,WWTP2}$
Data unit:	m^3/year
Description:	Quantity of biogas generated from 1000 m^3/day Waste Water Treatment Plant in year y
Source of data to be used:	Biogas quantity is measured using the Volume flow meter with totaliser and recorded in the plant log books.
Value of data:	174916.32
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of volume flow meter with totaliser and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$Q_{biogas,MLTP1}$
Data unit:	m^3/year

Description:	Quantity of biogas generated by Mother liquor digester 1 in year y
Source of data to be used:	Biogas quantity is measured using the volume flow meter with totaliser and recorded in the plant log books.
Value of data:	1041618.34
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of volume flow meter with totaliser and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	NA
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$Q_{biogas,MLTP2}$
Data unit:	m^3 /year
Description:	Quantity of biogas generated by Mother liquor digester 2 in year y
Source of data to be used:	Biogas quantity is measured using the volume flow meter with totaliser and recorded in the plant log books.
Value of data:	1041618.34
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of volume flow meter with totaliser and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	NA
Any comment:	Flow meter will be calibrated as per manufacturer's specification

Data / Parameter:	$Q_{biogas,boiler1}$
Data unit:	m^3/year
Description:	Quantity of biogas fired in the boiler 1 in year y
Source of data to be used:	Biogas quantity is measured using the Volume flow meter with totaliser and recorded in the plant log books.
Value of data:	2607985.66
Brief description of measurement methods and procedures to be applied:	Monitoring: At least hourly measurements will be undertaken, if less, confidence/precision level of 90/10 would be attained. Data will be measured with the help of volume flow meter with totaliser and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification $Q_{biogas,boiler} = B_{Biomass,y} = FC_{biogas,k,y}$ Cross check – The emission reductions are calculated based on energy output hence, the consistency of measurements ex post will be checked with annual data on energy generation, fossil fuels and biomass used and the efficiency of energy generation as determined ex ante.

Data / Parameter:	$Q_{biogas,boiler2}$
Data unit:	m^3/year

Description:	Quantity of biogas fired in the boiler 2 in year y
Source of data to be used:	Biogas quantity is measured using the Volume flow meter with totaliser and recorded in the plant log books.
Value of data:	2607985.66
Brief description of measurement methods and procedures to be applied:	Monitoring: At least hourly measurements will be undertaken, if less, confidence/precision level of 90/10 would be attained. Data will be measured with the help of volume flow meter with totaliser and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure. At least hourly measurements will be undertaken, if less, confidence/precision level of 90/10 would be attained.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Flow meter will be calibrated as per manufacturer's specification $Q_{biogas,boiler} = B_{Biomass,y} = FC_{biogas,k,y}$ Cross check – The emission reductions are calculated based on energy output hence, the consistency of measurements ex post will be checked with annual data on energy generation, fossil fuels and biomass used and the efficiency of energy generation as determined ex ante.

Data / Parameter:	$BG_{burnt,y}$
Data unit:	m^3
Description:	Biogas combusted in year y
Source of data to be used:	Biogas quantity is calculated based on measured values using the Volume flow meter with totaliser and recorded in the plant log books.
Value of data:	2083236.68
Brief description of measurement methods and procedures to be applied:	Monitoring: Calculated daily at least on hourly basis, based on measured quantity of biogas generated from anaerobic digesters of Mother Liquor Treatment Plant. i. e. $Q_{biogas,MLTP1}$ and $Q_{biogas,MLTP2}$.
QA/QC procedures to be applied:	---
Any comment:	$BG_{burnt,y} = Q_{biogas,MLTP1} + Q_{biogas,MLTP2}$. Hence, combusted biogas will be calculated based on measured values at anaerobic digesters of MLTP. The methane content measurement shall be carried out on a dry basis at the same point (i. e. gas outlets at anaerobic digesters of MLTP) where the biogas flow measurement is carried out on a dry basis.

Data / Parameter:	$W_{CH4,y}$
Unit:	%
Description:	Methane content in biogas in the year *y*
Source of data:	Measurement using a continuous gas analyzer and the data is recorded in the plant log books.
Value of data:	0 (Not available)
Brief description of measurement methods and procedures to be applied:	Monitoring: The fraction of methane in the gas will be measured with a continuous analyser. It will be measured using equipment that can directly measure methane content in the biogas. The measurement will be carried out at gas outlets at anaerobic digesters of Mother Liquor Treatment Plant where a

	biogas flow measurement will take place.
QA/QC procedures to be applied (if any):	Analysers will be periodically calibrated according to the manufacturer's recommendation.
Any comment:	NA

Data / Parameter:	T_{Biogas}
Unit:	°C
Description:	Temperature of the biogas
Source of data:	Biogas temperature is measured using temperature transmitter and the data is recorded in the plant log books.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of temperature transmitter and the measured value is recorded in the log book which is available for verification. It shall be measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied (if any):	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	Pr_{Biogas}
Data unit:	kg/cm^2
Description:	Pressure of the biogas
Source of data to be used:	Pressure of the generated biogas is measured using pressure transmitter and the data is recorded in the plant log books.
Value of data:	
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured with the help of pressure transmitter in mmWC and then will be recorded in the log book which is available for verification. The measured value will be then converted into kg/cm^2 for emission reduction calculation. It shall be measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	D_{CH4}
Data unit:	t/m^3
Description:	Density of methane at the temperature and pressure of the biogas in year *y*
Source of data to be used:	Calculated based on plant records of pressure and temperature of biogas
Value of data:	0.0001089
Brief description of measurement methods and procedures to be applied:	Monitoring: Density of biogas is calculated based on pressure and temperature of biogas. Please refer annex 4 for detailed procedure.

QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	NCV_{Biogas}
Data unit:	GJ/m^3
Description:	Heating value of unit quantity of biogas
Source of data to be used:	Laboratory reports
Value of data:	5050
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is analyzed by a NABL accredited laboratory. The NCV shall be measured on dry basis. Analysis will be done quarterly, taking at least three samples for each measurement. The average value can be used for the rest of the crediting period. The result of measurement will be compared with measurements from previous years, relevant data sources (e. g. values in literature, national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements shall be conducted.
QA/QC procedures to be applied:	---
Any comment:	---

Data / Parameter:	Moisture
Data unit:	% water
Description:	Moisture content of the biogas
Source of data to be used:	Laboratory reports
Value of data:	1.20
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is measured and recorded monthly. This data will be archived by Paper mode. The weighted average value shall be calculated for each monitoring period and used in the calculations. Please refer annex 4 for detailed procedure
QA/QC procedures to be applied:	---
Any comment:	The data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later.

Data / Parameter:	$FV_{RG,h}$
Data unit:	m^3/hour
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h
Source of data to be used:	Biogas quantity is measured using the Volume flow meter with totalizer and recorded in the plant log books.
Value of data:	0 (Not available)
Brief description of measurement methods and procedures to be	Monitoring: It will be ensured that the same basis (dry) is considered for this measurement and the measurement of volumetric fraction of all components in

applied:	the residual gas ($fv_{i,h}$) when the residual gas temperature exceeds 60 ºC. Frequency: Continuously. Values to be averaged hourly or at a shorter time interval Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented.
Any comment:	In the event of an emergency all the biogas generated will be sent to the flare for combustion. $FV_{RG,h} = Q_{biogas\ flaring}$

Data / Parameter:	T_{flare}
Unit:	^0C
Description:	Temperature in the exhaust gas of the flare
Source of data:	Measurements by project participants recorded in Plant records
Value of data:	0 (Not available)
Brief description of measurement methods and procedures to be applied:	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 ºC indicates that a significant amount of gases are still being burnt and that the flare is operating. Frequency: Continuously Please refer Annex 4 for detailed procedure
QA/QC procedures to be applied (if any):	Thermocouples should be replaced or calibrated every year
Any comment:	The flare will only be operated during emergencies and therefore this parameter will only be monitored during such times. An excessively high temperature at the sampling point (above 700 ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.

Data / Parameter:	$fv_{CH4,RG,h}$
Data unit:	mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
Source of data to be used:	Measurements using a continuous gas analyzer
Value of data:	0 (Not available)
Brief description of measurement methods and procedures to be applied:	It will be ensured that the same basis (dry) is considered for this measurement. Frequency: Continuously. Values to be averaged hourly or at a shorter time interval. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard certified gas.
Any comment:	As a simplified approach, PP will only measure methane content of the residual gas and consider the remaining part as N_2. Hence, $FV_{CH4,RG,h} = FV_{i,h}$

Data / Parameter:	Hrs_{flare}
Data unit:	Hours
Description:	Flare operating hours

Source of data to be used:	Plant records
Value of data:	0 (Not available as no flaring has taken place)
Brief description of measurement methods and procedures to be applied:	The flare will be operated only during emergencies. During such times, the operating hours of the flare will be monitored through the hour meter installed at the flaring stack. Please refer annex 4 for detailed procedure
QA/QC procedures to be applied:	---
Any comment:	The flare will only be operated during emergencies and therefore this parameter will only be monitored during such times.

Data / Parameter:	η_{flare}
Data unit:	%
Description:	Efficiency of flare
Source of data to be used:	As per the 'Tool to determine project emissions from flaring gases containing methane'
Value of data:	0 or 50%
Brief description of measurement methods and procedures to be applied:	Default value for open flare will be used. The efficiency is 0% if the flame is not detected for more than 20 minutes during the hour h; and 50%, if the flare is detected for more than 20 minutes during the hour h.
QA/QC procedures to be applied:	---
Any comment:	The flare will only be operated during emergencies and therefore this parameter will only be monitored during such times.

Data / Parameter:	Q_{Steam1}
Data unit:	tonnes/hour
Description:	Quantity of steam generated in the boiler 1
Source of data to be used:	Plant records
Value of data:	13.2 (F&A 100^0C)
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is Continuous monitored, integrated hourly and daily totalized recording with the help of calibrated meter which is available for verification. Please refer annex 4 for detailed procedure. The meter shall be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated once in a year.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	This will be totalized flow of both the boilers

Data / Parameter:	Q_{Steam2}
Data unit:	Tonnes/hour
Description:	Quantity of steam generated in the boiler 2

Source of data to be used:	Plant records
Value of data:	13.2 (F&A 100^{0}C)
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is Continuous monitored, integrated hourly and daily totalized recording with the help of calibrated meter which is available for verification. Please refer annex 4 for detailed procedure. The meter shall be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated once in a year.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	This will be totalized flow of both the boilers

Data / Parameter:	Pr_{steam1}
Data unit:	kg/cm^2 (g)
Description:	Steam pressure of boiler 1
Source of data to be used:	Plant records
Value of data:	23.5
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured, integrated hourly and daily totalized with the help of Pressure Transmitter and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	Pr_{steam2}
Data unit:	kg/cm^2 (g)
Description:	Steam pressure of boiler 2
Source of data to be used:	Plant records
Value of data:	23.5
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured, integrated hourly and daily totalized with the help of Pressure Transmitter and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	T_{steam1}
Data unit:	^oC
Description:	Steam temperature of boiler 1
Source of data to be	Plant records

used:	
Value of data:	230
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured, integrated hourly and daily totalized recording with the help of temperature Transmitter and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	T_{steam2}
Data unit:	^{o}C
Description:	Steam temperature of boiler 2
Source of data to be used:	Plant records
Value of data:	230
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured, integrated hourly and daily totalized recording with the help of temperature Transmitter and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	$T_{feed\ water1}$
Data unit:	^{o}C
Description:	Feed water temperature of boiler 1
Source of data to be used:	Plant records
Value of data:	105
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured, integrated hourly and daily totalized recording with the help of temperature Transmitter and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	$T_{feed\ water2}$
Data unit:	^{o}C
Description:	Feed water temperature of boiler 2
Source of data to be used:	Plant records
Value of data:	105

Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured, integrated hourly and daily totalized recording with the help of temperature Transmitter and the measured value is recorded in the log book daily which is available for verification. Please refer annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	$EG_{thermal,y}$
Data unit:	TJ
Description:	Net quantity of thermal energy supplied by the project activity during the year y
Source of data to be used:	Plant records
Value of data:	242.15
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is continuously measured and aggregated annually. Heat generation shall be determined as the difference of the enthalpy of the steam generated by the heat generation equipment and the sum pf the enthalpies of the feed and blow downs and condensate recovery. The respective enthalpies shall be determined based on the mass flow, temperature and pressure. Steam table shall be used to calculate the enthalpy as a function of temperature and pressure. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	$EC_{PJ,Grid,y}$
Data unit:	MWh/year
Description:	Project activity electricity consumption from regional electricity system
Source of data to be used:	Plant records
Value of data:	3663.19
Brief description of measurement methods and procedures to be applied:	Monitoring: Energy meter reading at the boiler end, MLTP/WWTP end will be used to calculate the total project electricity consumption from regional electricity system Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	$EC_{PJ,DG,y}$
Data unit:	MWh/year
Description:	Project activity electricity consumption from off grid fossil fuel fired captive power plant
Source of data to be used:	Plant records
Value of data:	7.47

Brief description of measurement methods and procedures to be applied:	Monitoring: Energy meter reading at the boiler end, MLTP/WWTP end will be used to calculate the total project electricity consumption from regional electricity grid. Electricity consumption from off grid captive power plant will take place in case of failure of regional electricity system and will be monitored. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	NA

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/TJ
Description:	Weighted average CO_2 emission factor of fuel type i in year y
Source of data to be used:	The following data sources may be used if the relevant conditions apply: **Data source** — **Conditions for using** a) Value 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 of 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 Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If, a) is not available
Value of data:	For a) and b): Measurements should be undertaken in line with national or international fuel standards For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines should be taken into account
Brief description of measurement methods and procedures to be applied:	--
QA/QC procedures to be applied:	Applicable where Option B is used. For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, Options b), c) or d) should be used.
Any comment:	

Data / Parameter:	Hrs_{DG}
Data unit:	Hours
Description:	Annual running hours of the DG sets for power supply during grid failure to MLTP and WWTP
Source of data to be used:	Plant records
Value of data:	17.71
Brief description of measurement methods and procedures to be applied:	Monitoring: Data will be recorded in hrs. manually Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	---
Any comment:	This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later.

Data / Parameter:	$Q_{FF,Diesel}$
Data unit:	M^3
Description:	Annual Diesel consumption in the DG sets for power supply during grid failure
Source of data to be used:	This data is measured using volume flow meter and recorded in the plant log books.
Value of data:	2.85
Brief description of measurement methods and procedures to be applied:	Monitoring: Data is measured by means of using volume flow meter in m^3/hr. Please refer Annex 4 for detailed procedure.
QA/QC procedures to be applied:	NA
Any comment:	Flow meter will be calibrated as per manufacturers specification

Data / Parameter:	Q_{sludge}
Data unit:	tonnes/year
Description:	Quantity of sludge generation in year y
Source of data to be used:	Plant records
Value of data:	0
Brief description of measurement methods and procedures to be applied:	Monitoring: Weighing through weigh bridge.
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	$Q_{sludge} = S_{i,PJ,y}$

Data / Parameter:	$Q_{sludge\ disposal}$
Data unit:	tonnes/year
Description:	Quantity of sludge disposed in year y

Source of data to be used:	Plant records
Value of data:	0
Brief description of measurement methods and procedures to be applied:	The final sludge will be used for land application for bio-composting by local farmers. It will be provided free of cost to them. Gate pass will be issued at each delivery and same will be recorded. Gate pass can be cross checked with the log book entry for delivery. This activity will be monitored throughout the crediting period plus 2 years. Monitoring: Through plant records
QA/QC procedures to be applied:	QA/QC procedures as per ISO 22000:2005 to be implemented
Any comment:	Land application activity is carried out by farmers located in the vicinity of the project site. Sludge will be given free of cost to them. This activity will be monitored throughout the crediting period plus 2 years.

Data / Parameter:	$BE_{y,ex\ post}$
Data unit:	tCO_2e/year
Description:	Baseline emissions calculated using ex post values in year y
Source of data to be used:	Plant records
Value of data:	0
Brief description of measurement methods and procedures to be applied:	Baseline emissions shall be calculated annually based on ex post values of other parameters and recorded in plant log books.
QA/QC procedures to be applied:	---
Any comment:	Baseline emissions shall be calculated as per paragraph 18 of AMS III.H version 16 using ex post monitored values

Data / Parameter:	$PE_{y,ex\ post}$
Data unit:	tCO_2e/year
Description:	Project emissions calculated using ex post values in year y
Source of data to be used:	Plant records
Value of data:	0
Brief description of measurement methods and procedures to be applied:	Project emissions shall be calculated annually based on ex post values of other parameters and recorded in plant log books.
QA/QC procedures to be applied:	---
Any comment:	Project emissions shall be calculated as per paragraph 29 of AMS III.H version 16 using ex post monitored values

Data / Parameter:	MD_y
Data unit:	tCO_2e/year
Description:	Methane captured and gainfully used by the project activity in the year *y*

Source of data to be used:	Plant records
Value of data:	31919.00
Brief description of measurement methods and procedures to be applied:	Date type: Calculated
QA/QC procedures to be applied:	---
Any comment:	The parameter shall be calculated as per paragraph 35, equation 16 of AMS III.H version 16

B.7.2 Description of the monitoring plan:

The project activity will be operated and managed by the SDDL. The plant will have a data recording system. In order to monitor and control the project performance, the PP will place a project management team. It will be coordinated by the Plant Manager, SDDL. He is also responsible for checking the information consistency. The PP will have well diversified procedure for collection of data and analysis of data at different levels and for subsequent corrective actions as when required in line with the internal quality systems.

The plant operation team will be entrusted with the responsibility of storing, recording the data related to the project activity. This team will be responsible for calculation of actual emission reduction in the most transparent and relevant manner and submit to the Plant Manager.

Data acquisition for the gas and wastewater flow meters will be executed through the process control unit of the biogas plant. Lab data will be recorded manually by the plant operation team.

Inspection and record of daily checklist of critical parameters of project activity will be maintained by Boiler shift operators / Chemist cum plant operators. The operators will access the condition of all the equipment and measuring equipment and appropriate corrective action will be taken. The meters which will be used in the project activity will be of reputed make with the best accuracy available. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time. The calibration frequency for each instrument will be determined and documented and will also be a part of the monitoring and verification parameters. All the equipments and meters will be calibrated as per the local/national standards or as per manufacturer's specifications. The equipments and meters will be calibrated at appropriate intervals as per manufacturer's specifications or at least once in three years. The measured data without adequate calibration will be compared with local/national data and commercial data to ensure consistency. Calibration plan and process will be regularly audited during internal and external QMS audits.

All the monitoring data will be stored /will be recorded and scrutinized by Plant Manager and final monitored data kept under safe by Senior Manager – Utilities / Manager – Environment/WWTP for a period of crediting period (10 years fixed crediting period) + 2 years or the last issuance of CERs + 2 years whichever occurs later. The data will be stored in soft format as well as hard copies. This will ensure that no data loss occurs at any point of time during the crediting period.

Parameters such as generated biogas, biogas fed to the boiler, steam generation from boiler etc. will be monitored continuously through meters. Electricity consumption from local grid as well as captive power plant will be measured and monitored through electronic meters.

The Instrumentation and control system for the project activity will be designed with adequate instruments to control and monitoring the various operating parameters for safe and efficient operations. All the instruments are of reputed make.

Emergency Preparedness Plan in case of partial or total failure of meters:

1. Failure of volume flow meter used for wastewater: The failure period of the volume flow meter shall be recorded. The time lost in the meter correction / replacement will be recorded in log book. The flow of wastewater during meter failure period will be calculated and recorded manually based on the average flow recorded during that particular day/month.

2. Failure of volume flow meter used for generated biogas/biogas fed to boiler: The failure period of the volume flow meter shall be recorded. The time lost in the meter correction / replacement will be recorded in log book. The flow of biogas during meter failure period will be calculated and recorded manually based on the average flow recorded during that particular day/month.

3. Failure of steam flow meter: The thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

4. Failure of temperature transmitter: The operational staff at boiler house will manually record the reading on hourly basis in the log book from the temperature gauge installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years.

5. Failure of pressure transmitter: The pressure shall be manually recorded through the installed pressure gauges which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years.

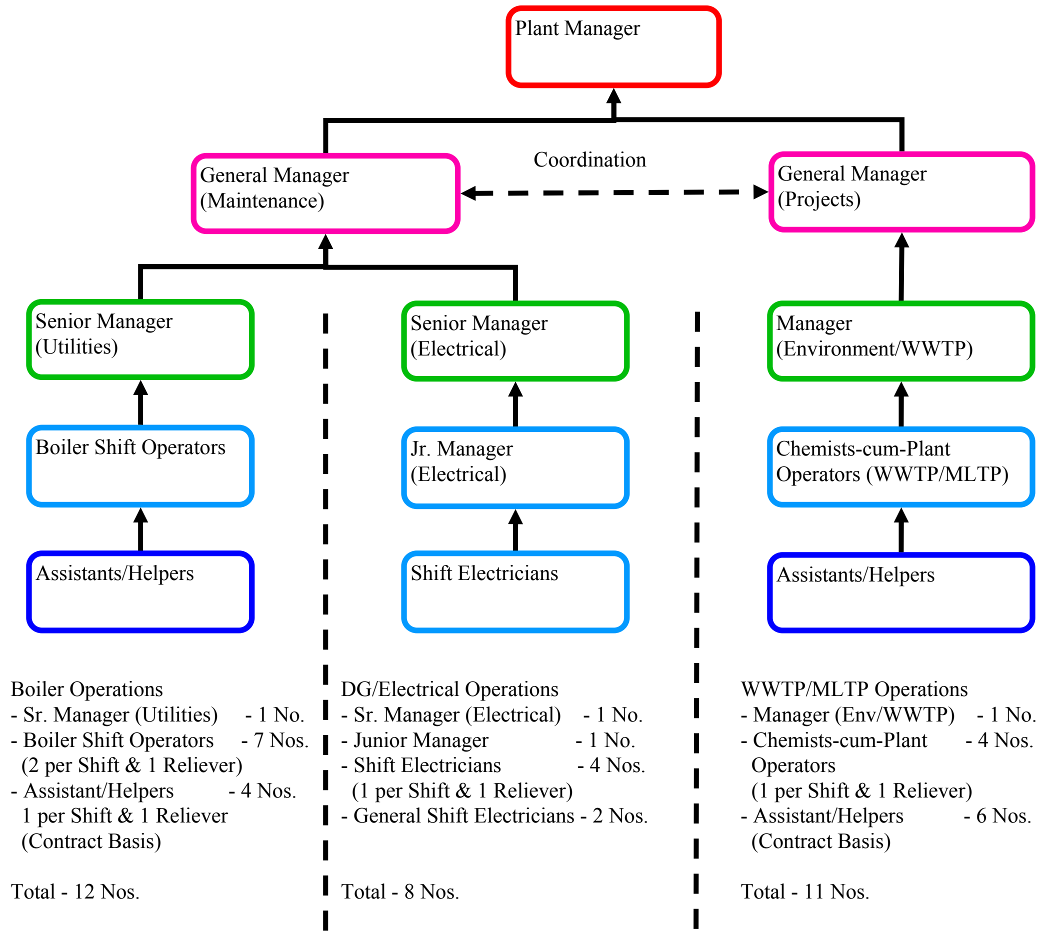
6. Failure of energy meter: The failure period of the energy meter shall be recorded. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i. e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation

Also any change within the project boundary, such as change in equipments will be recorded and any change in the emission reduction due to such alteration will also be studied and recorded.

The plant operation team will be trained in operation, maintenance, trouble shooting, and analysis of operating parameters and other safety procedures of the UASB technology and biogas boiler.

The team will also deal with emergency situations. The emergencies like leakage of biogas from the gas holders, other gas handling, and trouble shooting in flaring system or boiler, trouble shooting in UASB will be dealt by this team.

Organisaitonal chart:



Monitoring roles and responsibilities

Sr.	Title	Activity	Recording Frequency	Reporting Frequency	Data Approval Frequency
1	Plant Manager	Review of CDM data and approval	NA	NA	Monthly
2	General Manager – Projects	Validation and data approval for WWTP and MLTP	NA	Monthly	Monthly Report to Plant Manager

3	General Manager – Maintenance	Validation of data for Boiler and Electricity	NA	Monthly	Monthly Report to General Manager – Projects and Plant Manager
4	Senior Manager – Utilities	Data Checking and archiving - Boiler	Daily	Weekly	Weekly report to General Manager – Maintenance
5	Senior Manager – Electrical	Data Checking and archiving - DG House	Daily	Monthly	Monthly report to General Manager – Maintenance
6	Manager – Environment/WWTP	Data Checking and archiving - MLTP/WWTP	Daily	Weekly	Weekly report to General Manager – Projects
7	Boiler Shift Operators	Data Recording and reporting - Boiler House	Hourly	Daily	Daily report to Senior Manager – Utilities
8	Chemist-cum-Plant Operators – WWTP	Data Recording and reporting - MLTP and WWTP	Hourly	Daily	Daily report to Manager – Environment/ WWTP
9	Shift Electrician	Data Recording and reporting - DG House	Daily	Daily	Daily report to Senior Manager – Electrical

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 completion: 25/02/2009

Organization:	Thermax Sustainable Energy Solutions Ltd.
Street/P.O.Box:	4 Mumbai Pune Road, Wakadewadi
Building	Thermax House annex
City:	Pune
State/Region:	Maharashtra
Postfix/ZIP:	411 005
Country:	India
Telephone:	+91-20- 66476200, 25542155
FAX:	+91-20-66476266
E-Mail:	rmadiwale@thermaxindia.com
URL:	www.thermaxindia.com

The above entity is not a project participant.

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:

22/08/2008 (Date of Purchase Order for major equipments)

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

25 years 0 months

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

C.2.1. Renewable crediting period

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:

The start date of the crediting period is 01/07/2012 or date of registration of the small scale project activity whichever is later.

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:

The Ministry of Environment and Forests (MoEF), Government of India notification, dated September 14, 2006[33], regarding the requirement of Environment Impact Assessment (EIA) studies states that any project developer in India needs to file an application to the Ministry of Environment and Forests (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Thirty-eight categories of activity with a certain investment criteria are required to undertake an Environment Impact Assessment (EIA). However, the proposed project doesn't fall under the list of activities requiring EIA. Thus, no EIA study is required for this proposed project activity.

[33] http://envfor.nic.in/legis/eia/so1533.pdf

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:

There are no environmental impacts due to the implementation of the project activity. With reference to Maharashtra Pollution Control Board consent dated 06/03/2010 and Boiler inspectorate certificates for Boiler SM140 B/2 dated 16/07/2009 and Boiler SM140 B/1 dated 14/08/2009, the project activity complies with the below mentioned statutory requirements,

- Section 25 of the Water (Prevention & Control of pollution) act 1974
- Section 21 of the Air (Prevention & Control) act 1981
- Rule 5 of the Hazardous wastes (Management, Handling & transboundary movement)
- Boiler act, 1923

SECTION E. Stakeholders' comments

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

A local stakeholder consultation meeting for the proposed project activity was organised on 12th December, 2008 between 15.00 to 17.00 hrs at SDDL, Baramati, the invitation for the same has been distributed on 4th December 2008 requesting stakeholder's presence in meeting. The open invitation is given to all stakeholders through invitation notice pasted on notice board at the main gate of the factory of Project Proponent as well as personal distribution of invitation.

The stakeholders from the following categories have been identified and called for the meeting

- Biotechnology Scientist
- Neighbouring industry representative
- Regulatory body
- Contractors
- Equipment suppliers
- Employees from Dynamix Dairy / Local people

The agenda of the meeting is to brief stakeholders on the environmental and socio-economic benefits accrued due implementation of the proposed project activity, background of global warming and climate change, Introduction of project activity with CDM registration and its benefit to the society and industry.

The representatives of the SDDL, explained about their proposed project activity and its CDM benefits on implementation. It was informed that reduction in emissions by treating the mother liquor and using biogas improves the ambient air quality in the local area. They also explained about Global warming and how these projects can reduce emissions as well as contribute towards sustainable development.

After briefing the stakeholders they were asked to raise their concerns / issues (if any) or comments regarding the project activity.

The summary of the stakeholder's consultation is made available to DOE for verification along with the media used to invite the stakeholder's consultation process.

E.2. Summary of the comments received:

The participants showed tremendous interest about the concept of CDM and the advantages that the project implementation brings to the society. They were enthusiastic about the new technology, the cleaner environment and the socio-economic developments due to the proposed project implementation. A separate questionnaire was circulated to the stakeholders during the meeting and sufficient time was given to the participants to complete the questionnaire and the comments received from the participants. The summary of local stakeholder's comments included in the Appendix 2, it clearly indicates that all the stakeholders agree that no negative impact identified due to the project activity.

No serious comment / issues were raised by the stakeholders during the meeting.

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

No actions were necessary in order to take due account of comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Schreiber Dynamix Dairies Ltd.
Street/P.O.Box:	Bhigwan Road
Building:	E-94, M.I.D.C
City:	Baramati, Pune
State/Region:	Maharashtra
Postfix/ZIP:	413133
Country:	India
Telephone:	+91 2112 243825
FAX:	+91 2112 243710
E-Mail:	jitendra.jadhav@schreiberfoods.com
URL:	www.schreiberfoods.com
Represented by:	
Title:	General Manager
Salutation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project activity

Annex 3

BASELINE INFORMATION

The identification and description of baseline scenario has been explained detail in the section B.4

Sr.	Parameter	Unit	Value	Source
1	Mother Liquor Generation	m^3/day	38	Calculated based on historical data for last 1 historical year
2	Mother Liquor COD	mg/litre	387855	Calculated based on historical data for last 1 historical year
3	COD reduction efficiency of baseline mother liquor treatment system (anaerobic lagoon)	%	80%	Calculated based on historical data for last 1 historical year
4	Methane content of Biogas	%	67%	Biogas Analysis report carried out by MITCON dt. 19-Aug-08
5	Density of Biogas	kg/m^3	1.089	Density of biogas: Page 11 & 22 of Thermax Technical Offer: Wws:Tmn:DDIL: Biogas: TCOff-05 dt. 06-Mar-08
6	Waste water generation quantity from existing WWTP	m^3/day	2000	Project Commissioning Certificate dated 16/08/2006
7	Waste water generation quantity from proposed WWTP	m^3/day	1000	Thermax Technical Offer: Wws:Tmn:DDIL: Biogas:TCOff-05 dated 06/03/2008
8	Net calorific value of Biogas	kcal/ m^3	5050	Biogas Analysis report carried out by MITCON dated 19/08/2008
9	Net calorific value of FO	kcal/ kg	9650	Instruction Manual for Shellmax Boiler, Make: Thermax, Technical Specifications, Page No. 5 Thermax Technical Offer:Wws:Tmn:DDIL: Biogas: TCOff-05 dated 06/03/2008 (Refer: Thermax Offer, Page No. 12)
10	Electrical operating load of Mother Liquor Treatment Plant (MLTP) (Continuous operation)	kW	30.02	Thermax Technical Offer:Wws:Tmn:DDIL: Biogas: TCOff-05 dated 06/03/2008 (Refer: Thermax Offer, Page No.7 - Operating load for MLTP & Page.17 - Operating load of Booster pump (11.25 kW = 15 HP * 0.75)
11	Electrical operating load of Digester recirculation pump	kW	30	Thermax Technical Offer:Wws:Tmn:DDIL: Biogas: TCOff-05 dated 06/03/2008 (Refer: Thermax Offer, Page No.6 - Operating load for Digester recirculation pump
12	Operating hours of	Hours	22	Letter by Thermax Ltd. (Technology Supplier)

	Digester recirculation pump			dated 02/07/2010
13	Electrical operating load of sludge disposal pump	kW	3.7	Thermax Technical Offer:Wws:Tmn:DDIL: Biogas: TCOff-05 dated 06/03/2008 (Refer: Thermax Offer, Page No.6 - Operating load for Sludge disposal pump
14	Operating hours	Hours	22	Letter by Thermax Ltd. (Technology Supplier) dated 02/07/2010
15	Electrical operating load of caustic tank mixer	kW	0.37	Thermax Technical Offer:Wws:Tmn:DDIL: Biogas: TCOff-05 dated 06/03/2008 (Refer: Thermax Offer, Page No.6 - Operating load for caustic tank mixer
16	Operating hours	Hours	20	Letter by Thermax Ltd. (Technology Supplier) dt. 02/07/2010
17	Electrical operating load of 1000 m³ WWTP	kW	153.49	Thermax Offer:Wws:DDIL:ETP:2000:TCOff-03 dt.07/02/2005, Page no: 25
18	Operating load of existing 2000 m³ WWTP	kW	174.32	Thermax Offer:Wws:DDIL:ETP:2000:TCOff-03 dated 07/02/2005, Page no: 12
19	Connected load of boiler (Blowers)	kW	30	Thermax Technical Offer:Wws:Tmn:DDIL: Biogas: TCOff-05 dated 06/03/2008 (Refer: Thermax Offer, Page No. 14)
20	Operating days	days	365	Calendar days
21	Thermal Efficiency of Boiler	%	89%	Instruction Manual for Shellmax Boiler, Make: Thermax, Technical Specifications, Page No. 5
22	Emission factor of Grid	tCO_2/MWh	0.84	NEWNE (North East West North East) Grid Emission factor

Calculation for justification of the project activity's installed thermal energy generation is less than 45 MW thermal:

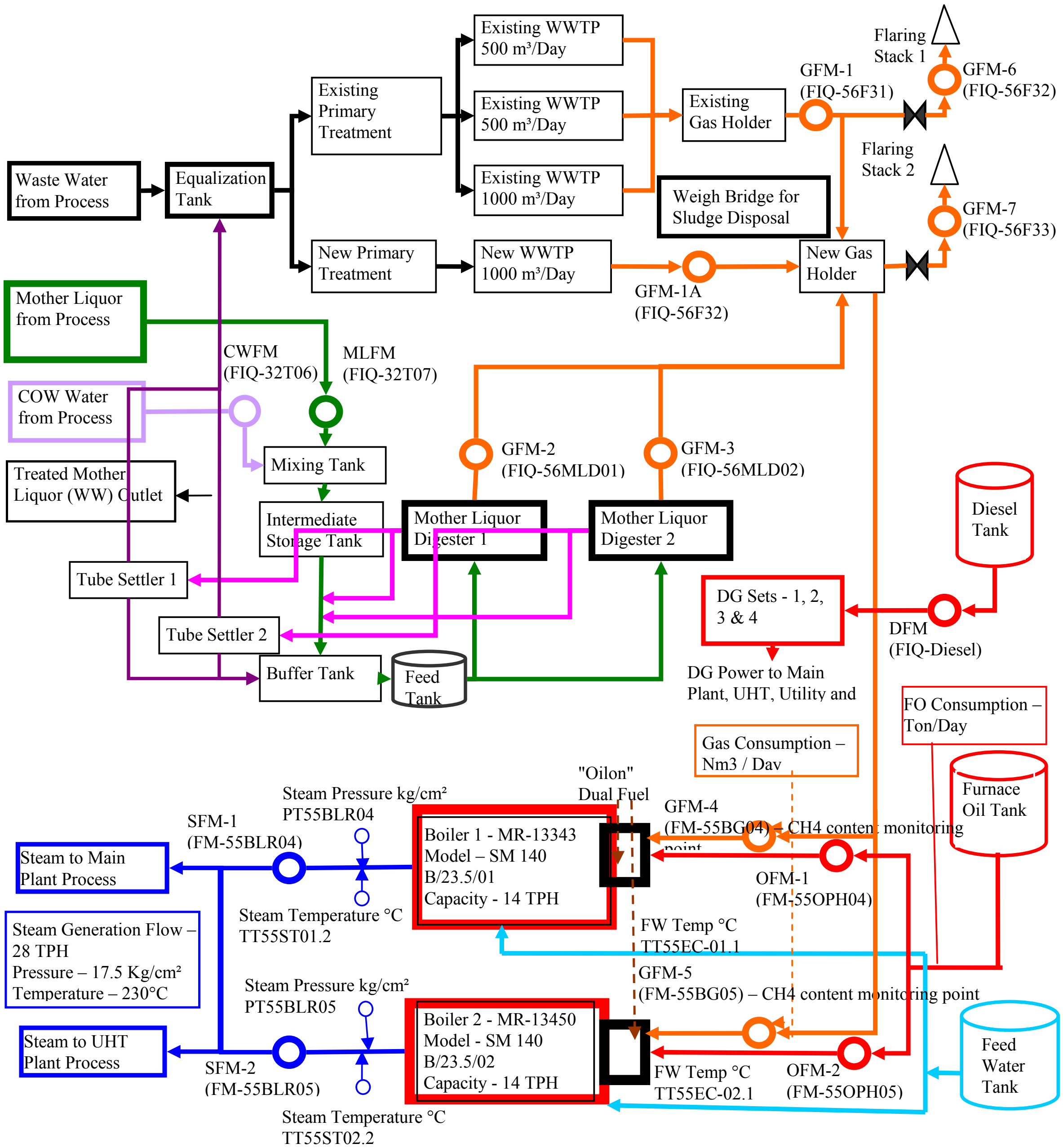
Steam flow : 26.4 TPH (2 Nos. of 13.2 TPH (F&A 100^0C))

As per technical specifications[34], steam output F&A 100^0C is 13200 kg/hr and heat output is 7.12 $*10^6$ kCal/hr i. e. 7120000 kCal/hr. Thus for two boilers, total heat output will be (7120000*2) 14240000 kCal/hr. Assuming 1 kCal//hr = 4.186 kJ/hr; the heat output will be 59608640 kJ/hr i. e. 16557.96 kJ/s. Assuming 1 kJ/s = 1 kW, the heat output will be 16557.96 kW i. e. 16.56 MW thermal.

[34] Technical specifications of boiler (SM-140B/23.5)

Annex 4

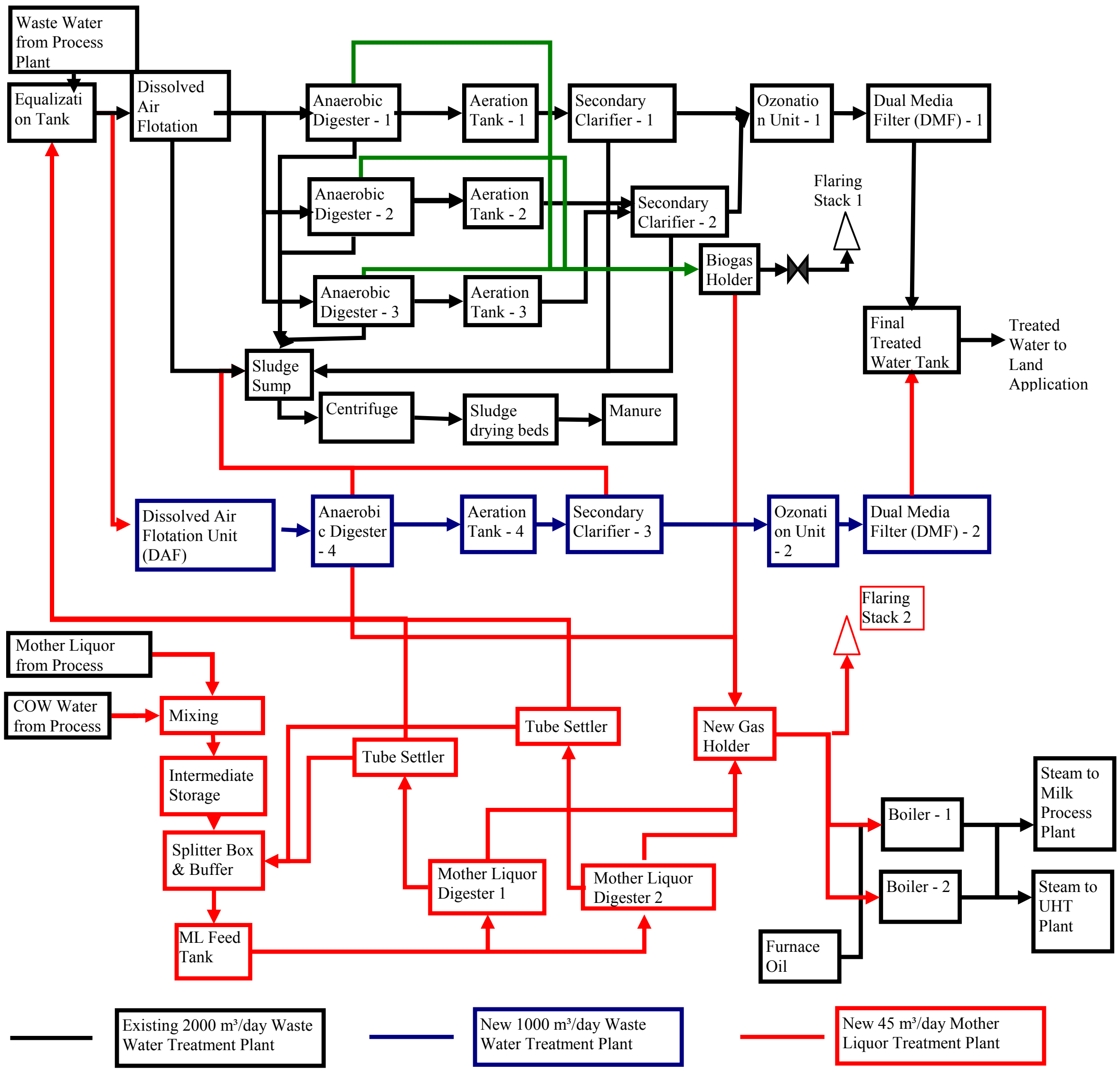
MONITORING INFORMATION



WWTP = Waste Water Treatment Plant;	MLFM = Mother Liquor Flow Meter,	SFM = Steam Flow Meter;
MLTP = Mother Liquor Treatment Plant	CWFM = Cow Water Flow Meter,	GFM = Gas Flow Meter;
DG Sets = Diesel Generator Sets	OFM = Oil Flow Meter,	DFM = Diesel Flow Meter
FW = Feed Water		

Legends for Monitoring Information

Sr. No.	Line colour	Legend
1	**Black**	Existing Waste Water flow
2	**Orange**	Biogas generation from Mother Liquor Treatment Plant and Waste Water Treatment Plant and utilization in boilers
3	**Green**	Mother Liquor Flow
4	**Rose**	Cow water Flow
5	**Violet**	Mother liquor from Mother Liquor Treatment Plant to Waste Water Treatment Plant through tube settler
6	**Pink**	Treated Mother Liquor from Mother Liquor Treatment Plant digesters to tube settlers
7	**Red**	Furnace Oil and Diesel Line
8	**Blue**	Generated Steam
9	**Light Blue**	Feed water flow


Waste Water from Process Plant
Equalization Tank
Dissolved Air Flotation
Anaerobic Digester - 1
Aeration Tank - 1
Secondary Clarifier - 1
Ozonation Unit - 1
Dual Media Filter (DMF) - 1
Anaerobic Digester - 2
Aeration Tank - 2
Secondary Clarifier - 2
Flaring Stack 1
Biogas Holder
Anaerobic Digester - 3
Aeration Tank - 3
Final Treated Water Tank
Treated Water to Land Application
Sludge Sump
Centrifuge
Sludge drying beds
Manure
Dissolved Air Flotation Unit (DAF)
Anaerobic Digester - 4
Aeration Tank - 4
Secondary Clarifier - 3
Ozonation Unit - 2
Dual Media Filter (DMF) - 2
Flaring Stack 2
Mother Liquor from Process
COW Water from Process
Mixing
Tube Settler
Tube Settler
New Gas Holder
Intermediate Storage
Steam to Milk Process Plant
Boiler - 1
Splitter Box & Buffer
Mother Liquor Digester 1
Mother Liquor Digester 2
Boiler - 2
Steam to UHT Plant
ML Feed Tank
Furnace Oil
Existing 2000 m³/day Waste Water Treatment Plant
New 1000 m³/day Waste Water Treatment Plant
New 45 m³/day Mother Liquor Treatment Plant

As per methodology AMS III.H. and AMS I.C. the following parameters with the corresponding procedures to be adopted:

Sr. No.	Parameters	Tag No.	Acronym	Unit	Measured (M) / Calculated (C) / Estimated (E)	Recording Frequency	Archiving Mode	Instrument	Accuracy Level	Calibration Procedure	Calibration Frequency	Responsibility for Data Recording
1	Volume of wastewater entering anaerobic digesters in Mother Liquor Treatment Plant		$Q_{ww,j,y}$	m³/month	C	hourly	Manual in logbook	-	-	-	-	Chemist-cum-Plant Operator
2	Volume of mother liquor entering anaerobic digesters in Mother Liquor Treatment Plant	FIQ-32T07	$Q_{ML,j,y}$	m³/month	M	Continuous and recorded hourly	Manual in logbook / Electronic in PLC	MLFM	<1.5%	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator
3	Volume of cow water entering anaerobic digesters in Mother Liquor Treatment Plan	FIQ-32T06	$Q_{cw,j,y}$	m³ /month	M	Continuous and recorded hourly	Manual in logbook / Electronic in PLC	CFM	<1.5%	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator
4	Quantity of biogas generated from 2000 m³/day Waste Water Treatment Plant in year y	FIQ-56F31	$Q_{biogas,WWTP1}$	m³	M	Continuous and recorded hourly	Manual in logbook / Electronic in PLC	GFM 1	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator
5	Quantity of biogas generated from 1000 m³/day Waste Water Treatment Plant in year y	FIQ-56F32	$Q_{biogas,WWTP2}$	m³	M	Continuous and recorded hourly	Manual in logbook / Electronic in PLC	GFM 1A	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator
6	Quantity of biogas generated by Mother liquor digester 1 in year	FIQ-56MLD01	$Q_{biogas,MLTP1}$	m³	M	Continuous and recorded hourly	Manual in logbook / Electronic in PLC	GFM 2	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator

	y											
7	Quantity of biogas generated by Mother liquor digester 2 in year y	FIQ-56MLD02	$Q_{biogas,MLTP2}$	m³	M	Continuous and recorded hourly	Manual in logbook / Electronic in PLC	GFM 3	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator
8	The Chemical oxygen demand of the mother liquor entering anaerobic digesters in Mother Liquor Treatment Plant	-	$COD_{ML,y}$	tCOD/m^3	C	Daily through representative sampling. The samples and measurements shall ensure a 90/10 confidence/ precision level.	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator
9	The Chemical oxygen demand of cow water entering anaerobic digesters in Mother Liquor Treatment Plant	-	$COD_{CW,y}$	tCOD/m^3	C	Daily through representative sampling, The samples and measurements shall ensure a 90/10 confidence/ precision level	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator
10	The chemical oxygen demand of wastewater (Mother liquor + cow water) entering Mother Liquor Treatment	-	$COD_{ww,inflow,MLTP,y}$	tCOD/m^3	C	Daily through representative sampling, The samples and	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator

	Plant					measurements shall ensure a 90/10 confidence/ precision level						
11	The chemical oxygen demand of wastewater outflow at Mother Liquor Treatment Plant	-	$COD_{ww,outflow,MLTP,y}$	$tCOD/m^3$	C	Daily through representative sampling, The samples and measurements shall ensure a 90/10 confidence/ precision level	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator
12	The Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the project situation in year y		$COD_{ww,discharge,PJ,y}$	$tCOD/m^3$	C	Daily through representative sampling, The samples and measurements shall ensure a 90/10 confidence/ precision level	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator
13	The chemical oxygen demand removed by the treatment system k (anaerobic digesters in mother liquor treatment plant)	-	$COD_{ww,removed,PJ,MLTP,y}$	$tCOD/m^3$	C	Daily	Manual in Logbook	-	N/A	Calculated from measured value.	6 months	Chemist-cum-Plant Operator

	in project activity in year y											
14	The chemical oxygen demand of wastewater inflow at anaerobic digesters of 2000 m^3/day and 1000 m^3/day Waste Water Treatment Plant in year y	-	$COD_{ww,inflow,WWTP,y}$	$tCOD/m^3$	C	Daily through representative sampling, The samples and measurements shall ensure a 90/10 confidence/ precision level	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator
15	The chemical oxygen demand of wastewater outflow at anaerobic digesters of 2000 m^3/day and 1000 m^3/day Waste Water Treatment Plant in year y	-	$COD_{ww,outflow,WWTP,y}$	$tCOD/m^3$	C	Daily through representative sampling, The samples and measurements shall ensure a 90/10 confidence/ precision level	Manual in Logbook / PLC	-	N/A	Calculated from measured value. Verification of results from accredited external laboratory after every 6 months.	6 months	Chemist-cum-Plant Operator
16	The chemical oxygen demand removed by the treatment system k (anaerobic digesters in 2000 m^3/day and 1000 m^3/day waste water treatment	-	$COD_{ww,removed,PJ,WWTP,y}$	$tCOD/m^3$	C	Daily	Manual in Logbook	-	N/A	Calculated from measured value.	6 months	Chemist-cum-Plant Operator

	system) in project activity in year y											
17	The Chemical oxygen demand removal efficiency of the project wastewater treatment system k i. e. 2000 m^3/day and 1000 m^3/day waste water treatment plants in year y	-	$\square_{PJ,k}$	%	C	Daily	Manual in Logbook	-	N/A	Calculated from measured value.	6 months	Chemist-cum-Plant Operator
18	Quantity of Biogas fed to Boiler 1	FM-55BG04	$Q_{biogas,boiler1}$	m^3	M	At least hourly measurements, if less, confidence/ precision level of 90/10 would be attained and data recorded daily	Manual in logbook / Electronic in PLC	GFM 4	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
19	Quantity of Biogas fed to Boiler 2	FM-55BG05	$Q_{biogas,boiler2}$	m^3	M	At least hourly measurements, if less, confidence/ precision level of 90/10 would be attained and data	Manual in logbook / Electronic in PLC	GFM 5	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator

						recorded daily						
20	Biogas combusted in year y		$BG_{burnt,y}$	m^3	C	Daily at least on hourly basis	Manual in Logbook	-	-	-	-	Boiler Shift Operator
21	Annual Furnace Oil consumption in the boiler 1	FM-55OPH04	$Q_{FF,FO1}$	tonnes/year	M	Continuously and daily totalized recording	Manual in logbook / Electronic in PLC	OFM 1	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
22	Annual Furnace Oil consumption in the boiler 2	FM-55OPH05	$Q_{FF,FO2}$	tonnes/year	M	Continuously and daily totalized recording	Manual in logbook / Electronic in PLC	OFM 2	< 1.7 %	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
23	Methane content in biogas in the year y	-	$W_{CH4,y}$	%	M	Continuous	Manual in logbook / Electronic in PLC	Gas analyzer	-	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
24	Pressure of the biogas		Pr_{biogas}	kg/cm^2	M	Continuous, shall be measured at the same time when methane content in biogas measured	Manual in logbook / Electronic in PLC	Pressure transmitter		As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
25	Temperature of the biogas		T_{biogas}	^0C	M	continuous, shall be measured at the same time when methane content in biogas measured	Manual in logbook / Electronic in PLC	Temperature transmitter		As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
26	Density of methane at the temperature and pressure of the biogas in year y		D_{CH4}	t/m^3	C	Calculated based on plant records of pressure and	Manual in logbook / Electronic in PLC		N/A	-	-	Manager - Env./WWTP

						temperature of biogas						
27	Quantity of steam generated in the Boiler 1	FM-55BLR04	Q_{steam1}	Tonnes/year	M	Continuous monitoring integrated hourly. Daily totalized recording	Manual in logbook / Electronic in PLC	SFM 1	< 1.7 %	Calibration will be according to the national standards and reference points or IEC standards and recalibrated once in a year. As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
28	Quantity of steam generated in the Boiler 2	FM-55BLR05	Q_{steam2}	Tonnes/year	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	SFM 2	< 1.7 %	Calibration will be according to the national standards and reference points or IEC standards and recalibrated once in a year As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
29	Steam temperature of Boiler 1	TT55ST01.2	T_{steam1}	ºC	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	Temperature transmitter	1%	Calibration SOP ISO doc. (Ref: I&C/P/002)	6 months	Boiler Shift Operator
30	Steam temperature of Boiler 2	TT55ST02.2	T_{steam2}	ºC	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	Temperature transmitter	1%	Calibration SOP ISO doc. (Ref: I&C/P/002)	6 months	Boiler Shift Operator
31	Steam pressure of Boiler 1	PT55BLR04	Pr_{steam1}	kg/cm²(g)	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	Pressure transmitter	<1.5%	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator

32	Steam pressure of Boiler 2	PT55BLR05	Pr_{steam2}	Kg/cm²(g)	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	Pressure transmitter	<1.5%	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
33	Feed Water temperature of Boiler 1	TT55EC-01.1	$T_{feed\ water1}$	ºC	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	Temperatur e transmitter	1%	Calibration SOP ISO doc. (Ref: I&C/P/0x02)	6 months	Boiler Shift Operator
34	Feed Water temperature of Boiler 2	TT55EC-02.1	$T_{feed\ water2}$	ºC	M	Continuous monitoring integrated hourly and daily totalized recording	Manual in logbook / Electronic in PLC	Temperatur e transmitter	1%	Calibration SOP ISO doc. (Ref: I&C/P/002)	6 months	Boiler Shift Operator
35	Heating value of unit quantity of biogas	-	NCV_{biogas}	GJ/m^3	C	Quarterly	Manual in Logbook / PLC	-	N/A	Sample test results from accredited external laboratory after every 3 months.	3 months	Manager - Env./WWTP
36	Moisture content of the biogas	-	Moisture	% water	M	Monthly, the weighted average value shall be calculated for each monitoring period and used in the calculations	Manual in Logbook / PLC	--	N/A	Sample test results from accredited external laboratory every month.	Monthly	Senior Manager Utilities
37	Temperature in the exhaust gas of the flare		T_{flare}	^0C	M	Continuously	Manual in Logbook / PLC	Thermocouple	N/A	Thermocouples should be replaced or calibrated every year	1 year	Senior Manager Utilities

38	Efficiency of flare	- -	η_{flare}	%	M		Manual in Logbook / PLC	-	N/A			Manager - Env./WWTP
39	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h	-	$FV_{RG,h}$	m^3/hour	M	Continuously. Values to be averaged hourly or at a shorter time interval.	Manual in Logbook / PLC	GFM 6 and GFM 7	< 2 %	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator
40	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h	-	$fv_{CH4,RG,h}$	mg/m^3	M	Continuously. Values to be averaged hourly or at a shorter timeinterval. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place	Manual in Logbook / PLC	Gas analyzer	N/A	Sample test results from accredited from accredited external laboratory after every 3 months. Zero check and a typical value check should be performed by comparison with a standard gas.	3 months	Manager - Env./WWTP
41	Flare operating hours	-	Hrs_{flare}	hours	M	Daily totalized	Manual in Logbook / PLC	Hour meter	N/A	As per manual and calibration procedure of manufacturer	1 year	Chemist-cum-Plant Operator

42	Project activity electricity consumption from regional electricity grid	--	$EC_{PJ,Grid,y}$	MWh/year	M	Daily	Manual in Logbook / PLC	Energy meter	Class 1.0 as per IEC 62052-11 & 62053-21	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
43	Project activity electricity consumption from off grid fossil fuel fired captive power plant	-	$EC_{PJ,DG,y}$	MWh/year	M	Daily	Manual in Logbook / PLC	Energy meter	Class 1.0 as per IEC 62052-11 & 62053-21	As per manual and calibration procedure of manufacturer	1 year	Boiler Shift Operator
44	Weighted average CO_2 emission factor of fuel type i in year y	-	$EF_{CO2,i,y}$	tCO_2/TJ	M/C	Monthly	Manual in Logbook / PLC	-			1 year	Manager Env/WWTP
45	Annual running hours of the DG sets for power supply during grid failure to MLTP and WWTP	-	Hrs_{DG}	hours	M/C	Monthly	Manual in Logbook / PLC	-		Manual record	1 year	Shift Electrician
46	Annual Diesel consumption in the DG sets for power supply during grid failure	FIQ-Diesel	$Q_{FF,Diesel}$	m^3	M/C	Monthly	Manual in Logbook / PLC	DFM	< 2 %	As per manual and calibration procedure of manufacturer	1 year	Shift Electrician
47	Quantity of sludge generated in year y	-	Q_{sludge}	t/year	M	As per sludge generation	Manual in Logbook / PLC	-	< 20 kg	As per manual and calibration procedure of manufacturer and Department of Metrology (Weights and Measures), Government of Maharashtra	1 year	Chemist-cum-Plant Operator

48	Quantity of sludge disposed in year y	-	$Q_{sludge\ disposal}$	t/year	M	As per sludge generation	Manual in Logbook / PLC	-	< 20 kg	As per manual and calibration procedure of manufacturer and Department of Metrology (Weights and Measures), Government of Maharashtra	1 year	Chemist-cum-Plant Operator
49	Net quantity of thermal energy supplied by the project activity during the year y	-	$EG_{thermal,y}$	TJ	C	Continuous monitoring, aggregated annually	Manual in Logbook	-	-	-	-	Manager - Env./WWTP
50	Baseline emissions calculated using ex post values in year y	-	$BE_{y,ex\ post}$	tCO_2e/year	C	-	Manual in Logbook	-	-	-	1 year	Manager - Env./WWTP
51	Project emissions calculated using ex post values in year y	-	$PE_{y,ex\ post}$	tCO_2e/year	C	-	Manual in Logbook	-	-	-	1 year	Manager - Env./WWTP
52	Methane captured and gainfully used by the project activity in year y	-	MD_y	m^3	C	-	Manual in Logbook	-	-	-	1 year	Chemist-cum-Plant Operator

Appendix 1

Abbreviations

1. SDDL - Schreiber Dynamix Dairies Ltd.
2. FO - Furnace oil
3. ML - Mother liquor
4. BOD - Biological oxygen demand
5. COD - Chemical oxygen demand
6. TPH – Tonnes per hour
7. MLTP – Mother liquor treatment plant
8. WWTP – Waste water treatment plant
9. MWh – Megawatt hour
10. NEWNE – North East West North East
11. UASB – Up flow anaerobic sludge blanket
12. MNC – Multi national company
13. CER – Certified emission reductions
14. t – Tonnes
15. NABL - National Accreditation Board for Testing and Calibration Laboratories

Appendix 2

Summary of Stakeholder's Comments

Sr. No.	Participants name	Category	Employment opportunities increased?	Whether Infrastructural facilities will develop due to the project activity	Whether you have learnt or exposed to new technology?	Whether you face any type of pollution problems due to the project?	Whether the electricity facility will be improved?	Whether your local area will improve due to the project?
1.	Sudipta Pathak	Sr. Manager	YCVM	YVMM	Y	N	Y	VV
2.	K. B. Ghosh	GM, Production	N	YVNM	Y	N	Y	VVMN
3.	Raskar Manisha D	Employee	YCVM	YVVV	Y	N	Y	VVVM
4.	Ashok K Soni	Employee	YAMM	N	Y	N	Y	V
5.	Shivaji Tukaram Dhumal	Manager, Projects	YCM	YMMM	Y	N	E	-
6.	Vijay Jailkhani	GM, QA	YCMN	N		N	Y	M
7.	Gandhi V A	Employee	YCMM	N	Y	N	Y	NMVN
8.	Vijay Gaur	Sr. Manager, QA	YAV	YM	Y	N	Y	M
9.	V N K Nair	Sr. Manager, Purchase	Y	Y	Y	N	Y	V
10.	R B Mantri	Employee	YCMN	N	Y	N	Y	MMMN
11.	Ganpat Shinde	Manager, Safety	YCVV	YV	Y	N	-	-
12.	Ajit V Joshi	Engineer	YAMM	YNNM	Y	N	Y	NMMN
13.	Bhutkar Manoj Vijay	Employee	YCMM	N	Y	N	Y	V
14.	R R Bhomle	Manager	YCMM	YMMM	Y	N	E	MM
15.	H D Jagtap	Sr Manager, Production	YCMM	YMMM	Y	N	Y	MMMN
16.	M. V. Ukarande	Manager	Y	YVV	Y	N	Y	V
17.	Vinod Kumar Gupta	Employee	YCVM	YVMM	Y	N	Y	VVMM
18.	Asabe Priyadarshani Vitthal	Trainee	Y	Y	Y	N	Y	VVVM
19.	J S Waghmare	Sr Manager, Production	YCV	YV	Y	N	Y	V
20.	Rubesh Krishnan	Employee	YCVV	YMVV	Y	N	Y	VVVV
21.	Ashok Shivaram Patil	Employee	YM	N	Y	N	Y	MMNV
22.	J. L. Jadhav	Employee	YCVV	YV	Y	N	Y	MVVM
23.	Mrs. S S Deshpande	Jr Manager	YCMM	YMMM	Y	N	Y	NMMM
24.	Dr. Sushama R Chaphalkar	Scientist	YCMN	YMMV	Y	N	Y	MMMM
25.	Shirke Kailas S.	Asst. Manager, QC	YCMM	YMMM	Y	N	Y	NMMN
26.	R K Mishra	Employee	Y	YVV	Y	N	Y	V
27.	Kale S T	Employee	YCMM	YMMM	Y	N	Y	VM
28.	Vinit H Shah	Employee	YCMM	YMMM	Y	N	Y	VM

29.	P. S. Negi	Employee	YCMM	YNMV	Y	N	Y	M
30.	Darekar Ankush	Sr. Manager Elect	YA	YM	Y	N	Y	M
31.	Narute U. B.	Employee	YCMM	YMNM	Y	N	Y	YVM
32.	Dange Vishant	HR	YCMV	MVV	Y	N	Y	MMVN
33.	A. Ghosh Roy	GM	YCVV	YNNN	N	N	Y	MMMM
34.	Madhav Kokare	Balaji Engineers Employee	YCVV	YNVV	Y	N	Y	VV
35.	C. P. Nimbalkar	Piaggio Vehicles Employee	YBM	YMM	Y	N	Y	MM
36.	S. V. Adnaik	Piaggio Vehicles Employee	YCVV	YVMV	Y	N	Y	VV
37.	P. J. Shetake	MIDC Employee	YCMM	YMMM	Y	N	Y	VM
38.	V. P. Ruikar	MIDC Employee	YCMM	YMMM	Y	N	Y	VM
39.	P. B. Kakade	Baramati Chamber of Cmmerce	YAMN	YV	Y	N	Y	VM

Y = Yes, N = No, A = Skilled Labourers, B= Unskilled Labours, C = Both skilled and unskilled labourers, V = Visible, M = Marginal

Appendix 3

Comments by Member Secretary, State Pollution Control Board on Wastewater (Effluent) Treatment Plant

Date : 02/11/06

ETP of Dynamix Dairy Industries is like what it should be , " More than good. " The units exceeds the compliance and is indicator of corporate responsiblity for environmental protection.

ETP is model for others to follow, particularly the success of primary treatment is critical and this has been well achieved - results : BOD : < 10 mg/l !!

Keep it up , All the best wishes.

D.B.Boralkar
2.11.06

Dr D.B. BORALKAR
Member Secy. M.P.C.B.

Appendix 4:
Calculation of Combined Margin Emission Factor for Regional Electricity Grid:

For project emissions due to electricity consumption by the project activity using local electricity grid, emission factor is calculated using Scenario A, option A1 of the tool. In option A1, Calculation of the combined margin emission factor of the applicable electricity system is carried out using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system (EB 63, Annex 19 version 02.2.1)"

($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$).

The project activity will withdraw power from the national grid, during emergency situation like grid failure DG sets will be operated to run the critical equipments in the MLTP/WWTP section. The emission from the DG sets will be calculated by monitoring the quantity of diesel consumption for the entire process plant including critical equipments of MLTP/WWTP and by applying the latest version of "Tool to calculate project or leakage CO2 emissions from fossil fuel consumption". The Emission factor for the grid has been calculated in a transparent and conservative manner as per point number 11 of the methodology AMS I.D version 15 which uses one of the two approaches given below:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' (EB 63, Annex 19 version 02.2.1)

OR

(b) The weighted average emissions (in tCO_2e/MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations must be based on data from an official source (where available) and made publicly available.

Approach (a) has been selected as the most conservative method for calculating the emission factor as per the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' (EB 63, Annex 19 version 02.2.1)

This methodological tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the combined margin emission factor (CM) of the electricity system. The CM is the result of a weighted average of two emission factors pertaining to the electricity system: the operating margin (OM) and the build margin (BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.

Baseline Methodology Procedure

Step-1 - Identify the relevant electricity system.
Step-2 - Choose whether to include off-grid power plants in the project electricity system (OPTIONAL)
Step-3 - Select a method to determine the operating margin (OM).
Step-4 - Calculate the operating margin emission factor according to the selected method.
Step-5 - Identify the group of power units to be included in the build margin (BM).
Step-6 - Calculate the build margin emission factor.
Step-7 - Calculate the combined margin (CM) emissions factor.

STEP 1 - Identify the relevant electricity system:

The tool defines the electric power system as the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. Keeping this into consideration, the Central Electricity

Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids (see table below).

Northern	Western	Southern	Eastern	North-Eastern
Chandigarh	Chhattisgarh	Andhra Pradesh	Bihar	Arunachal Pradesh
Delhi	Gujarat	Karnataka	Jharkhand	Assam
Haryana	Daman & Diu	Kerala	Orissa	Manipur
Himachal Pradesh	Dadar & Nagar Haveli	Tamil Nadu	West Bengal	Meghalaya
Jammu & Kashmir	Madhya Pradesh	Pondicherry	Sikkim	Mizoram
Punjab	Maharashtra	Lakshadweep	Andaman-Nicobar	Nagaland
Rajasthan	Goa			Tripura
Uttar Pradesh				
Uttaranchal				

However since 2007- 08 as the four regional grids except the southern grid have been synchronized and they are now being considered as one and named as NEWNE grid. Since the project withdraw electricity from the

NEWNE grid, emissions generated due to the electricity generated by the NEWNE regional grid by using simple operating margin and build margin for the same grid, for estimation of combined emission factor will serve as the baseline for this project.

STEP 2 - Choose whether to include off-grid power plants in the project electricity system.
This is an optional step and has not been considered in the emission factor calculations.

STEP 3 - Select a method to determine the operating margin (OM).
The calculation of the operating margin emission factor ($EF_{OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Any of the four methods can be used, however, the PP has chosen to use simple OM method (option a) which uses one of the two options given below

1) Average of the five most recent years, or
2) Based on long term averages for hydroelectricity production.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages.

• *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3 year generation –weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the most 5 recent calendar years prior to the time of submission of the CDM –PDD for validation,

OR

• *Ex post* option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity withdraws grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

In the project activity, *ex-ante* option is selected for the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission has been considered. The value for simple operating margin has been taken from CEA website from CO_2 baseline data base version 5. It is confirmed that ex-ante vintage is considered in the project activity and is kept constant throughout the crediting period.

STEP 4 - Calculate the operating margin emission factor according to the selected method.
The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants /units.

The simple OM may be calculated from either of the two options:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit, or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:
(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2)

In our case option B has been selected which meets above criteria of option B.

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_y}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year *y*

y = The relevant year as per the data vintage chosen in Step 3

The above formula is used by the Central Electricity Authority of India on a conservative basis for calculating the emission factor [35]

Simple operating margin			
	2006-07	2007-08	2008-09
NEWNE	1.01	1.00	1.01

Source: Baseline CO_2 emission database, version 5.0[36]

Thus the final $EF_{OM, Y}$ based on three years average is estimated to be **1.00 tCO_2/MWh.**

STEP 5 - Identify the group of power units to be included in the build margin (BM).
The sample group of power unit m used to calculate the build margin consists of either:
(a) The set of five power units that have been built most recently , or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The BM calculation is based on the 20% net generation that has been build most recently. Power plant registered as CDM project activities has been excluded from the sample group *m*. In terms of vintage of data, project participant has been selected **option 1** from the following two options:

Option 1
For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of request for renewal of crediting period to the DOE. For the third crediting period the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2
For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM, y}$ should be calculated ex-ante, as described in option 1 above. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

STEP 6 - Calculate the build margin emission factor ($EF_{grid,BM,y}$)
Option 1 as described above is chosen in the project activity. BM is calculated ex-ante based on the latest CEA database version 5 and is fixed for the entire crediting period.

The $EF_{BM, y}$ is estimated as **0.68 tCO_2/MWh** (With sample group constituting most recent capacity additions to the grid comprising 20% of the system generation)

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[35] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf

[36] http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm

STEP 7 - Calculate the combined margin (CM) emissions factor ($EF_{grid,CM,y}$)

The CM can be calculated as per the following:

$CM = EF_{grid, OM, y} \times W_{OM} + EF_{grid, BM, y} \times W_{BM}$

Where,

$EF_{grid, OM, y}$ = Build Margin CO_2 emission factor in the year *y* (tCO_2/MWh)

$EF_{grid, BM, y}$ = Operating Margin CO_2 emission factor in the year *y* (tCO_2/MWh)

W_{OM} = Weighting of operating margin emission factor (%)

W_{BM} = Weighting of build margin emission factor (%)

Owing to their intermittent and non-dispatchable nature, the default weights for the projects are as follows: W_{OM} = 50% and W_{BM} = 50% for the first crediting period. In the project activity, **combined margin has been chosen as the baseline emission factor** for grid emission factor. The value chosen is taken from relevant official sources and is publicly available[3].

Parameter Value (tCO_2/ MWh)

OM, Operating Margin = **1.00**

BM, Build Margin = **0.68**

CM, Combined Margin = $EF_{grid, OM, y} \times W_{OM} + EF_{grid, BM, y} \times W_{BM}$

$= 1.00 \times 0.5 + 0.68 \times 0.5$

$= 0.50 + 0.34$

= 0.84

Hence, the CM emissions factor ($EF_{grid,.CM,.y}$) is the project emission factor, calculated to be **0.84 tCO_2/MWh** and is fixed ex-ante during the entire crediting period and no monitoring of emission factor is required.