PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

Title: 12.65 MW Biomass based Cogeneration Project at Ajbapur, Uttar Pradesh.

Version 1.0

Date: 1/08/2022

First CoU Issuance Period: 2 years, 4 months

Date: 10/02/2020 to 10/06/2022

Project Concept Note (PCN)
CARBON OFFSET UNIT (CoU) PROJECT

BASIC INFORMATION	
Title of the project activity	12.65 MW Biomass based Cogeneration Project at Ajbapur, Uttar Pradesh.
Scale of the project activity	Large Scale
Completion date of the PCN	01/08/2022
Project participants	First Climate (India) Private Limited (AGGREGATOR) DCM Shriram Ltd (Distillery Unit Ajbapur) (DEVELOPER)
Host Party	India
Applied methodologies and standardized baselines	**CDM UNFCCC Methodology** ACM0006: Electricity and heat generation from biomass (Ver. 16).
Sectoral scopes	01- Energy industries (renewable -/ non-renewable sources)
Estimated amount of total GHG emission reductions	To be estimated during verification [An ex-ante estimate is 2,42,164 CoUs per year]

SECTION A. Description of project activity

A.1. Purpose and general description of Carbon offset Unit (CoU) project activity >>

The **12.65 MW Biomass based Cogeneration Project at Ajbapur, Uttar Pradesh** developed by M/s DCM Shriram Ltd (Distillery Unit Ajbapur) is located at Ajbapur Village, PO Mullapur, Distt.-Lakhimpur Kheri, Uttar Pradesh, 261505, India.

The details of the project are as follows:

Purpose of the project activity:

The proposed project activity is promoted by M/s DCM Shriram Ltd (henceforth referred as DCM) in their distillery unit located at Ajbapur Village, PO Mullapur, Distt.-Lakhimpur Kheri, Uttar Pradesh, 261505, India. The purpose of the project activity is to install one 80 TPH biomass fired boiler and 12.65 MW turbine to cater the electricity and steam demand of distillery unit of DCM. Surplus power generated from the system would be exported to grid.

The plant is expected to supply 5,69,242 MT of process steam and generate 103.224 GWh of electricity per annum both for captive consumption and grid export. In absence of this project, equivalent amount of steam would have been sourced from a fossil fuel (i.e. Coal) fired boiler and electricity would have been sourced from grid which is mainly dominated by fossil fuel. The project activity thus reduces 2,42,164 t-CO2e/annum greenhouse gas emissions (GHG) collectively by avoiding fossil fuel combustion for steam, power usages from grid and surplus green power supplied to the grid.

This project will result in avoidance of GHG emissions associated with generation of equivalent amount of energy from a coal based captive co-generation plant. The proposed project activity will use the biomass which is carbon neutral and thus will prevent depletion of non-renewable natural resources like coal.

A.2 Do no harm or Impact test of the project activity

There are social, environmental, economic and technological benefits which contribute to sustainable development.

➢ **Social benefits:**

- The project activity would help to alleviate poverty in the area as it creates employment opportunities for the local people during the construction, operation and maintenance phases and also through handling of biomass material to the project plant.

➢ **Environmental benefits:**

- The project activity will help to bridge the gap of electricity demand and supply at local as well as national level
- Employment generation for the local population which results in economic well being
- The project activity will help in conservation of fast depleting natural resources like fossil fuels, thereby contributing to the economic well-being of country as a whole.

- **Economic benefits:**

- In this project activity, the electrical and thermal energy is generated by the biomass-based cogeneration plant which replaces carbon emission intensive fossil fuels. As renewable biomass is considered to be GHG neutral fuel, combustion of biomass in this project activity does not result in net increase of GHG emissions. Besides the GHG emission reduction, the project activity also reduces emission of SOx, NOx, etc. associated with the combustion of fossil fuels.

- **Technological well-being:**

- The technology facilitating use of biomass material for cogeneration is environmentally safe.
- The success of the project will help in diffusion of knowledge about renewable energy technology to other power producers and will also promote the generation of green power in the region.

Target Fulfillment of United Nations Sustainable Development Goals (SDG)

Sustainable Development Goals Targeted	Project-level SDGs	SDG Impact
		Contribution of Project-level Actions to SDG Targets
SDG 13. Climate Action	2,42,164 tCO2/annum Emission reductions achieved per year.	- Emission reductions achieved per year by reduction of emission of GHGs by stopping combustion of coal and replacing fuel with bagasse. - The company procure biomass from nearby areas which is a waste hence also utilises the waste as a fuel. - Distance of round trip transportation is less than 200 km, the carbon emission due to transportation of biomass get negligible. - Bagasse which is waste for sugar industry, if the waste was not properly managed and residue would have been dumped then it would generate bad odour, methane and other GHGs. - The company generates its own electricity for its process and not from the national grid which would have otherwise generated electricity from the emission of fossil fuel mostly.
SDG 8.	The project activity has created at least 2	The biomass power plant contributes directly to achieve the SDG target, because the project

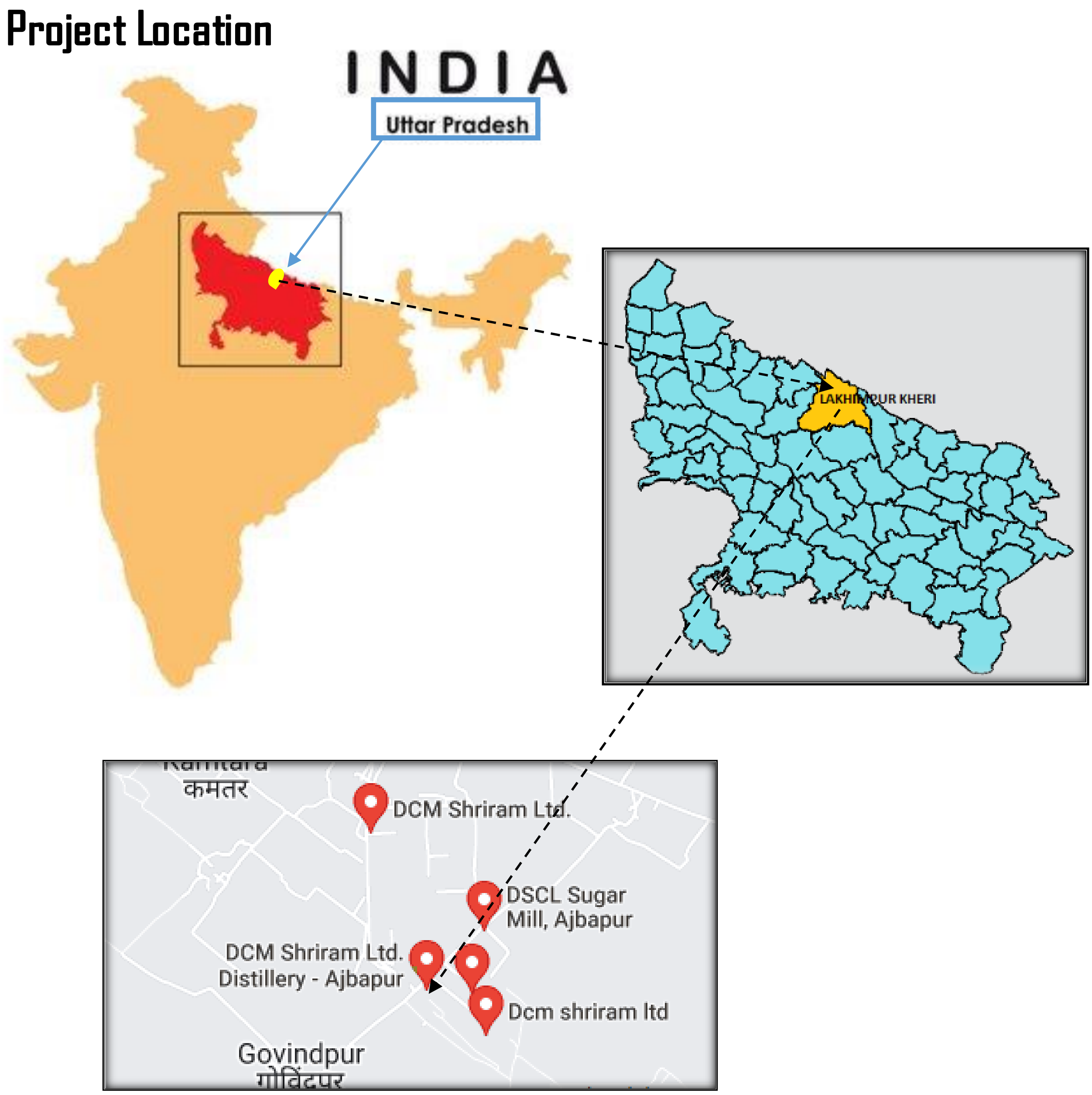
Decent Work and Economic Growth sustainable economic growth, employment and decent work for all	permanent jobs in the renewable power sector i.e., local employment generation.	activity creates jobs in the renewable energy sector, which diversify and upgrades the commonly used technology in the energy sector of India.
Goal 7. Affordable And Clean Energy	SDG target 7.2 "By 2030, Increase substantially the share of renewable energy in the global energy mix" Indicator 7.2.1 Renewable energy share in the total final energy consumption	The biomass project contributes directly to achieve the SDG target, because the project activity delivers renewable energy, which would otherwise generate by fossil fuel dominated grid connect power plants. Contribute renewable energy share in total grid energy consumption

A.3. Location of project activity >>

Country: INDIA
District: Lakhimpur Kheri
Village: Ajbapur Village
State: Uttar Pradesh
Code: 261505

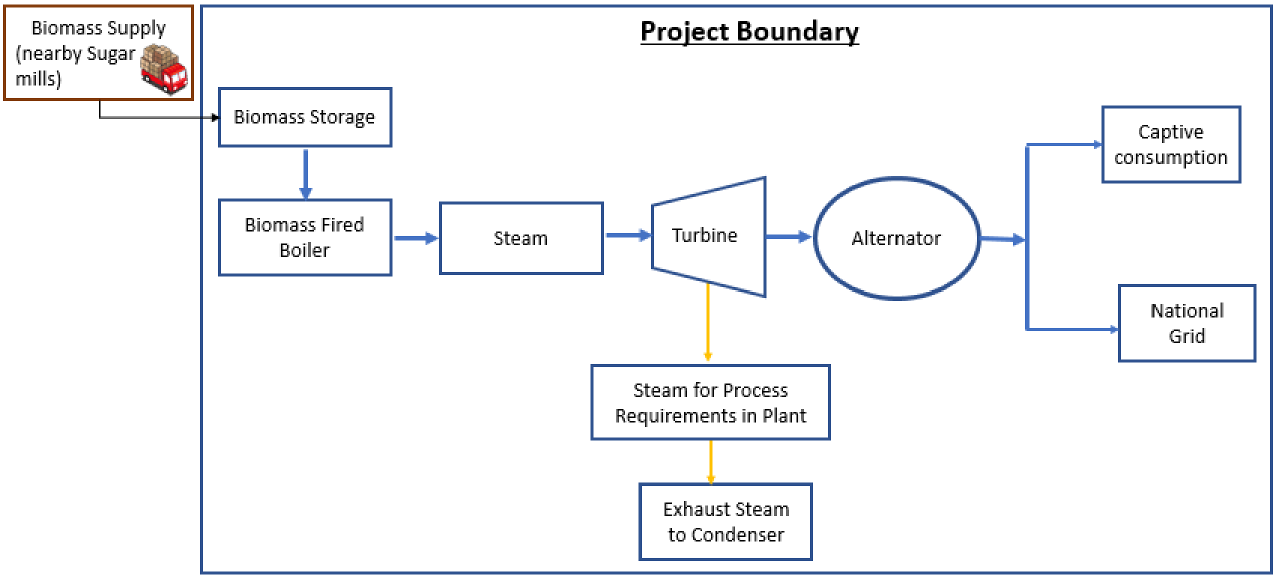
The project site is well connected by district and village roads to the nearest town. The geographic co-ordinates of the project location are:
Latitude: 27^{O}46'35.40" to 27^{O}46'51.84" N
Longitude: 80^{O}12'01.86" To 80^{O}12'16.13"E

The representative location map is included below:



A.4. Technologies/measures >>

Process flow chart:



The project activity involves generation of renewable energy from the combustion of renewable biomass residue, to generate process steam and electricity for captive consumption and grid supply. The technology employed is biomass-based cogeneration plant, generating steam and electricity, which would lead to avoidance of GHG emission associated with the direct coal combustion for steam generation and indirect emission due to fossil fuel dominated grid electricity. Thus, the technology to be used in this project is indigenous and is environmentally safe & sound. Emission reductions will be claimed for both thermal and electricity generation from biomass.

Details of the technical concept is as below:

The distillery unit demands both electrical and thermal energy to run the process. To meet the demand, plant has installed a biomass fired co-generation system at their facility. Plant has installed one 80 TPH biomass fired boiler which can generate superheated steam at a pressure of 45 kg/cm^2 pressure and 400 ^{O}C temperature. Superheated steam directly entered to a 12.65 MW turbine. After turbine, steam is being extracted for process use at a pressure of 5.75 kg/cm^2.

To operate the plant, proponent could have used coal as a fuel, which is very common across the industry sector. Bagasse is considered as renewable biomass and surplus in the region of Uttar Pradesh. Owing to some operational barriers, plant has decided to operate the co-gen system with bagasse and other biomass residues to reduce the carbon emission caused by fossil fuels.

As the project is a co-gen system, conventional Rankine cycle is considered. Equipment required for the project are as follows:

- Boiler
- Turbine
- Alternator
- Boiler and Turbine Auxiliaries
- Cooling water system
- Air pollution controlling system
- BOP

Technical details of boiler, turbine and alternator are tabulated below:

Boiler:

Parameter	Unit	Details
Type of boiler	-	Biomass TG Boiler
Boiler rated capacity	TPH	80
Steam Pressure	kg/cm2	45
Steam Temperature	Deg. C	400 +/- 5
Feed water Temperature	Deg. C	150
Fuel Type	-	Bagasse and other biomass residue

Turbine:

Parameter	Unit	Details
Type of turbine	-	STG Turbine
Inlet steam pressure	kg/cm2	42.03
Inlet steam temperature	Deg. C	395
Inlet steam quantity	TPH	80
Extraction pressure	kg/cm2	5.75
Extraction steam quantity	TPH	69.76

Alternator:

Parameter	Unit	Details
Type	-	4 pole synchronous generator
Rated Capacity	MW	12.65
Rated power factor	-	0.8
Generation voltage	V	11000
Frequency	Hz	50

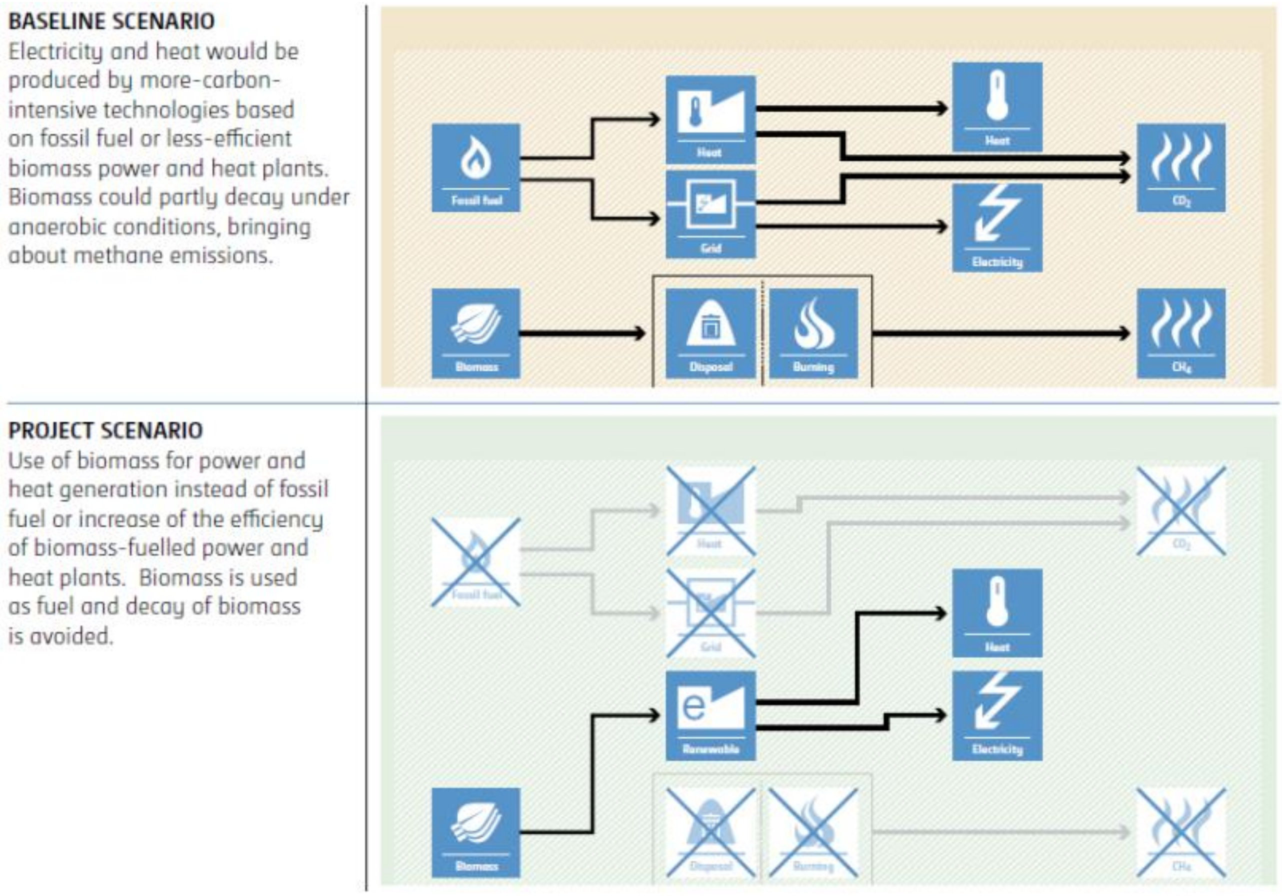
A.5. Parties and project participants >>

Party (Host)	Participants
India	**First Climate (India) Pvt. Limited (AGGREGATOR)** Contact person: Partha P Chaudhuri Mobile: +91 9831012824 Address: 903 ERGO Tower, Plot No. A1-4, Block EP & GP, Sector V, Salt Lake, Kolkata 700 091 **DCM Shriram Ltd (Distillery Unit Ajbapur) (DEVELOPER)** Address: Ajbapur Village, PO Mullapur, Distt.-Lakhimpur Kheri, Uttar Pradesh, 261505, India.

A.6. Baseline Emissions>>

In-house steam generation for running the process is an indispensable need of the Project owner, who intends to run a distillery.
Whatever the source of the electricity be, an in-house boiler is an absolute necessity. Also, having an in-house boiler and simultaneously purchasing electricity from outside is not an economically viable model. Therefore, in the absence of this project, the Project owner would have installed a coal-fired cogeneration boiler coupled with a turbine system.
The above statement representing the baseline scenario, it would have led to GHG emissions contributed by the burning of coal.

Flow showing baseline scenario:



A.7. Debundling>>

This 12.65 MW Biomass based Cogeneration Project is not a debundled component of a larger project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)

TYPE: I - Renewable Energy Projects

CATEGORY- ACM0006: Electricity and heat generation from biomass (Ver. 16)

B.2. Applicability of methodologies and standardized baselines >>

The project activity is a biomass based co-generation system set to cater the electricity and steam demand of the distillery unit of DCM. It replaced the baseline technology fossil fuel fired traditional co-generation system that used non-renewable fuel or more carbon intensive fuel sources i.e. Coal. This project will result in avoidance of GHG emissions associated with generation of equivalent amount of energy from a coal based captive co-generation plant. Moreover, the proposed project activity will also utilize the biomass which is a renewable source of energy and thus will prevent depletion of non-renewable natural resources like coal.
Here, the project activity is to install one 80 TPH biomass fired boiler and a turbo-alternator set to cater the electricity and steam demand of distillery unit of DCM.

Applicability Criteria	Project Condition
The methodology is applicable under the following conditions: (a) Biomass used by the project plant is limited to biomass residues, biogas, RDF2 and/or biomass from dedicated plantations; (b) Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 80% of the total fuel fired on energy basis. (c) For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of (the industrial facility generating the residues) raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process; (d) The biomass used by the project plant is not stored for more than one year; (e) The biomass used by the project plant is not processed chemically or biologically (e.g. through esterification,	The project activity would use renewable biomass without any chemical, physical and biological processing. Biomass would not stored in the project boundary more than one years. Project would not use any fossil fuel for co-firing. Hence the criteria points (a), (b), (d) and (e) are applicable.

fermentation, hydrolysis, pyrolysis, bio- or chemical-degradation, etc.) prior to combustion. Drying and mechanical processing, such as shredding and pelletisation, are allowed.	
In the case of fuel switch project activities, the use of biomass or the increase in the use of biomass as compared to the baseline scenario is technically not possible at the project site without a capital investment in: (a) The retrofit or replacement of existing heat generators/boilers; or (b) The installation of new heat generators/boilers; or (c) A new dedicated supply chain of biomass established for the purpose of the project (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes); or Equipment for preparation and feeding of biomass.	The project is a new greenfield project and hence this criteria is not applicable.
If biogas is used for power and heat generation, the biogas must be generated by anaerobic digestion of wastewater, and: (a) If the wastewater generation source is registered as a CDM project activity, the details of the wastewater project shall be included in the PDD, and emission reductions from biogas energy generation are claimed using this methodology; If the wastewater source is not a CDM project, the amount of biogas does not exceed 50% of the total fuel fired on energy basis.	There is no production of biogas and hence this criteria is not applicable.
In the case biomass from dedicated plantations is used, the “TOOL16: Project and leakage emissions from biomass” shall apply to determine the relevant project and leakage emissions from cultivation of biomass and from the utilization of biomass residues.	Dedicated plantation is not applicable for the project and hence the given clause is not applicable to the Project so concerned.

B.3. Applicability of double counting emission reductions >>

There is no double accounting of emission reductions in the project activity due to the following reasons:

- Project is uniquely identifiable based on its location coordinates,
- Project has dedicated commissioning certificate and connection point,

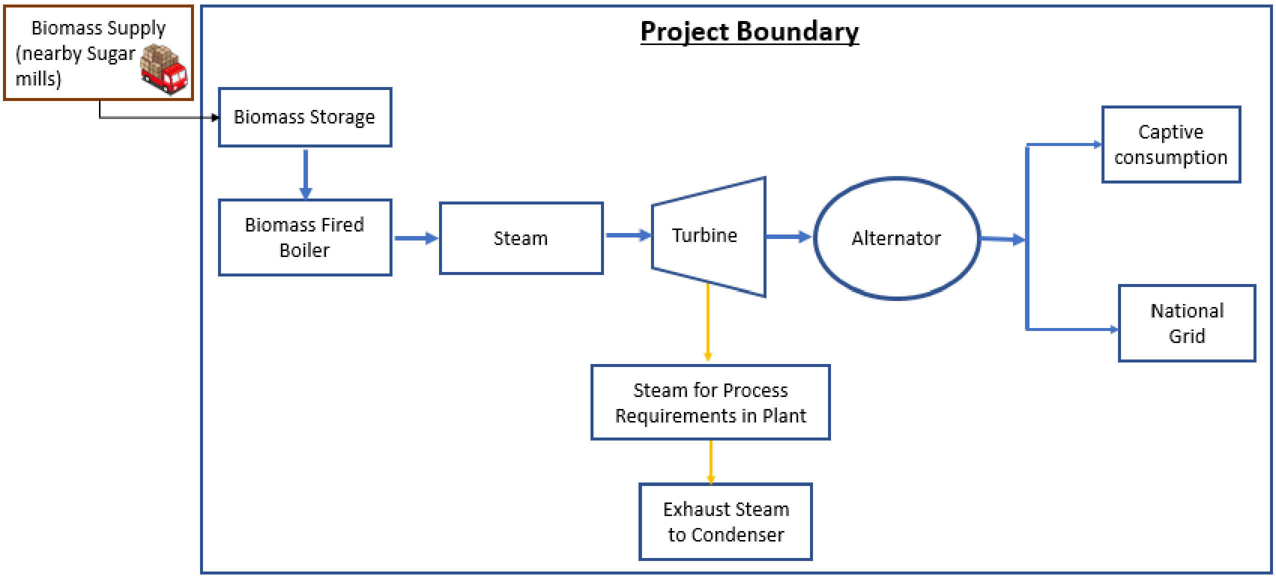
The Monitoring Report has the details of the end user's name and location i.e DCM Shriram Ltd (Distillery Unit Ajbapur) located at Ajbapur Village, PO Mullapur, Distt.-Lakhimpur Kheri, Uttar Pradesh, 261505, India.

B.4. Project boundary, sources and greenhouse gases (GHGs)>>

In line with the methodology, the project boundary encompasses the industrial facility of DCM, equipment installed for the operation of cogeneration plant, the biomass storage facility, the facility (distillery unit) consuming the energy (electrical and thermal) generated by the project activity plant and its supply to the grid;

Plant would use the bagasse and other biomass residue as a renewable fuel for the boiler. Quantity of the biomass supplied from nearby sugar mills would be used as fuel for project boiler.

Project boundary of this project is illustrated below:



The table below provides an overview of the emission sources included or excluded from the project boundary for determination of baseline and project emissions.

Source		Gas	Included	Justification/Explanation
Baseline	Electricity and heat generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	No	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector

Source		Gas	Included	Justification/Explanation
		CH4	No	Excluded for simplification. This emission source is assumed to be very small
		N2O	No	Excluded for simplification.
Project activity	On-site fossil fuel consumption	CO2	No	Project Activity does not use fossil fuel.
		CH4	No	Project Activity does not use fossil fuel.
		N2O	No	Project Activity does not use fossil fuel.
	Off-site transportation of biomass	CO2	No	Biomass is not transported to the outside of the plant premises.
		CH4	No	Biomass is not transported to the outside of the plant premises.
		N2O	No	Biomass is not transported to the outside of the plant premises.
	Combustion of biomass for electricity and heat	CO2	No	It is assumed that CO2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH4	No	Not applicable, as not considered in baseline scenario either.
		N2O	No	Excluded for simplification. This emission source is assumed to be small
	Wastewater from the treatment of biomass	CO2	No	Biomass does not undergo any treatment. So no wastewater is generated.
		CH4	No	Biomass does not undergo any treatment. So no wastewater is generated.
		N2O	No	Biomass does not undergo any treatment. So no wastewater is generated.
	Cultivation of land to produce biomass feedstock	CO2	No	Not applicable, as the biomass is not sourced from dedicated plantations.

Source		Gas	Included	Justification/Explanation
		CH4	No	Not applicable, as the biomass is not sourced from dedicated plantations.
		N2O	No	Not applicable, as the biomass is not sourced from dedicated plantations.

B.5. Establishment and description of baseline scenario >>

According to paragraph 23 under sub-section 5.3.1 (“Identification of alternative scenarios”) of the ACM0006 CDM Methodology, the alternative baseline scenarios shall specify the following:

“The alternative scenarios shall specify:
(a) How electric power would be generated in the absence of the CDM project activity (P scenarios);
(b) How heat would be generated in the absence of the CDM project activity (H scenarios);
(c) If the CDM project activity generates mechanical power through steam turbine(s): how the mechanical power would be generated in the absence of the CDM project activity (M scenarios);
(d) If the CDM project activity uses biomass residues, what would happen to the biomass residues in the absence of the CDM project activity (B scenarios);
(e) If the CDM project activity uses biomass cultivated in dedicated plantations, what the land use would be in the absence of the CDM project activity (L scenarios); and
(f) If the CDM project activity uses biogas from on-site wastewater, what would happen to the biogas in the absence of the CDM project activity (BG scenarios).”

Therefore for power generation, the realistic and credible alternatives may include:

Baseline scenario for power generation (ACM0006, V.16.0)	**Description (of P Scenarios)**	**Justification for choosing or not choosing the alternative, while comparing it with the Project activity**
P1	The proposed project activity not undertaken as a UCR project activity;	This is a possible power generation baseline alternative to the UCR Project activity.
P2	The continuation of power generation in existing power plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the starting date of the UCR project activity;	The Project being a greenfield one, such scopes do not exist hence this alternative is not applicable a baseline alternative.

P3	The continuation of power generation in existing power plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the starting date of the project UCR activity;	This is a greenfield Project and no other power generation facilities are present within the project site of the Project activity. Hence, this cannot be a possible alternative scenario.
P4	The retrofitting of existing power plants at the project site. The retrofitting may or may not include a change in fuel mix;	The Project being a greenfield one, such scopes do not exist hence this alternative is not applicable a baseline alternative.
P5	The installation of new power plants at the project site different from those installed under the UCR project activity;	This is a possible alternative scenario, with respect to power generation.
P6	The generation of power in specific off-site plants, excluding the power grid;	The cost of transportation of electricity from off-site generation point(s) shall be higher than on-site electric power generation system(s). Hence this alternative scenario is unattractive.
P7	The generation of power in the power grid.	This is a possible baseline alternative, with respect to electricity generation.

Similarly, from the UCR perspective, for power generation, the realistic and credible alternatives may include:

Baseline scenario for heat generation (ACM0006, V.16.0)	**Description (of H scenarios)**	**Justification for choosing or not choosing the alternative, with regards to the Project activity**
H1	The proposed project activity not undertaken as a UCR project activity;	This is a possible alternative scenario from the heat generation perspective.
H2	The continuation of heat generation in existing plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most	The project is a greenfield establishment hence such possibilities do not exist. So this scenario is not applicable.

	recent three years prior to the UCR project activity;	
H3	The continuation of heat generation in existing plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the UCR project activity;	The project is a greenfield establishment hence such possibilities do not exist. So this scenario is not applicable.
H4	The retrofitting of existing plants at the project site. The retrofitting may or may not include a change in fuel mix;	The project is a greenfield establishment hence such possibilities do not exist. So this scenario is not applicable.
H5	The installation of new plants at the project site different from those installed under the UCR project activity;	This is a possible alternative scenario, with respect to heat generation.
H6	The generation of heat in specific off-site plants;	Steam transportation from outside the plant premises to the process unit within the plant shall be more expensive than in-house steam generation and transportation. Hence, this alternative proposition is not attractive.
H7	The use of heat from district heating	Such facilities do not exist within the district of location of the Project.

Paragraph 26 of the same methodology document includes the M scenarios as in:

"*The alternative scenarios for mechanical power should include, but not be limited to, inter alia:*
(a) M1: The proposed project activity not undertaken as a CDM project activity;
(b) M2: If applicable, the continuation of mechanical power generation from the same steam turbines in existing plants at the project site;
(c) M3: The installation of new steam turbines at the project site
(d) M4: If applicable, the continuation of mechanical power generation from electrical motors in existing plants at the project site;
(e) M5: The installation of new electrical motors at the project site."

However, as the project activity does not employ the use of mechanical power from steam turbine(s), hence none of the M scenarios is applicable to our Project. Therefore, none of the M scenarios can be an alternative scenario.

Also, paragraph 29 of ACM0006 Version 16.0 states:

“ *When using biomass residues, the alternative scenarios of the biomass residues in absence of the project activity shall be determined following TOOL16.”*

As per CDM “Methodological TOOL 16: Project and leakage emissions from biomass”, the following points with regards to project emission can be stated with respect to our Project:

Sr. No.	Project Emission	Justification
1	*“Project emissions resulting from cultivation of biomass in a dedicated plantation in year y ($PE_{BC,y}$)”*	**Not Applicable** As dedicated plantations are not exploited by the Project activity hence this entire section does not apply to the Project. So, $PE_{BC,y} = 0$
2	*“Project emissions resulting from transportation of biomass in year y ($PE_{BT,y}$) and Project emissions resulting from transportation of biomass residues in year y ($PE_{BRT,y}$)”*	**Negligible** As biomass is sourced from nearby sugar mills, the emissions occurring due to transportation of bagasse from these very close locations to the site of Project is considered to be zero for all purposes of calculation. Hence, $PE_{BT,y} = 0$ and $PE_{BRT,y} = 0$
3	*“Project emissions resulting from processing of biomass in year y ($PE_{BP,y}$) and Project emissions resulting from processing of biomass residues in year y ($PE_{BRP,y}$)”*	**Not Applicable** As no biomass processing is required or carried out, hence this section is not applicable to the Project. So, $PE_{BP,y} = 0$ and $PE_{BRP,y} = 0$

Hence, for all practical and calculation purposes, project emission is considered to be zero.

Using the same tool, the leakage emissions can be accounted as:

Sr. No.	Leakage Emission	Justification
1	*“Leakage due to shift of pre-project activities resulting from cultivation of biomass in a dedicated plantation in year y ($LE_{BC,y}$)”*	**Not Applicable** The project does not involve the use of resources from dedicated plantations. Hence, this clause is not applicable. Therefore, $LE_{BC,y} = 0$
2	*“Leakage due to diversion of*	**Not possible**

	biomass residues from other applications in year y ($LE_{BR,Div,y}$)"	Uttar Pradesh being the largest sugar producing state of India has tremendous resources of bagasse. Hence, there is no dearth of bagasse within the state (on sugar seasons). More than enough bagasse is available for channelizing it into different purposes during the season. Also, as per the audit report of the Comptroller and Auditor General of India, Uttar Pradesh has a biomass power potential of 1477.9 MW (as assessed by MNRE) and 3757 MW (as assessed by SNAs); while the installed capacity scenario is of 776.5 MW as per MNRE and 1142 MW as per SNA. From the above data it is evident that even after commissioning the proposed plant, biomass would be surplus in that region. Hence, the surplus biomass availability is unquestionable and leakage due to diversion is neglected. So, $LE_{BR,Div,y}$ is considered as zero.
3	*"Leakage due to the transportation of biomass residues outside of the project boundary in year y ($LE_{BRT,y}$)"*	**Not applicable** $LE_{BRT,y}$ can be safely considered to be zero.
4	*"Leakage due to processing of biomass residues outside the project boundary in year y ($LE_{BRP,y}$)"*	**Not applicable** Biomass to be used within the project boundary shall not require any processing and hence no leakage can occur due to processing of biomass with respect to the Project activity. Therefore, $LE_{BRP,y} = 0$

Thus it is seen that using CDM Methodological TOOL 16, the leakage emissions due to the project activity in is zero.
And because the project emissions are also considered to be zero for all practical purposes using the same TOOL 16, **the total PE + LE from the project = 0.**

Paragraph 30 of the ACM0006 Version 16.0 Methodology document refers back to TOOL 16 as it mentions:

"*In addition to the alternative scenarios (B scenarios) included in TOOL16, the project participants shall include scenario B5: (a) The biomass residues are used for power or heat generation at the project site in new and/or existing plants."*

Therefore, with reference to the B scenarios of TOOL 16 and adding B5 to it, the most possible fate of the biomass in absence of the project activity shall be:

B Scenario	**Description**	**Justification**
B1	*"The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields;"*	This is the most probable fate of the biomass in absence of the project activity, where it would have been left unattended in the open- left to decay and rot at a natural pace under ambient environmental conditions. Therefore, this is the most likely alterative of the biomass so used in the project.
B2	*"The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than five meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;"*	This cannot be a possible alternative, as the biomass, in absence of the project activity, is dumped in ambient air in the open on level land. Hence, this alternative is not generally possible.
B3	*"The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes;"*	Bagasse is not generally burnt in an uncontrolled manner; therefore, this alternative is not applicable.
B4	*"The biomass residues are used for energy or non-energy applications, or the primary source of the biomass residues and/or their fate cannot be clearly identified."*	This could be a likely alternative for some part of the bagasse generated.
B5	*"The biomass residues are used for power or heat generation at the project site in new and/or existing plants"*	The Project is a greenfield project and all energy producing establishments within the Project site are new. Hence, this scenario is representative of the Project activity rather than the baseline alternative.

As this Project does not involve the use of biogas as a fuel source, hence none of the BG scenarios of ACM0006 methodology are applicable.

Hence to summarize the baseline scenario, the most probable alternatives are **P1, P5** and **P7** with respect to power generation and H1 and H5 with respect to heat generation. **B1** is the most suitable biomass baseline scenario, noting the surplus biomass availability.

In absence of financial support to the project from carbon credits so generated, the next best alternative for the Project owner is to install and commission a captive coal-fired cogeneration system of the same capacity and meet the energy requirements of the plant using GHG-emitting coal as the fuel source.

Therefore, an in-house coal-fired captive cogeneration system being the baseline of the project, the key parameters to calculate the baseline emissions are:
The key parameters for baseline emission calculation are presented below in a tabular format: -

Parameter	Unit	Value
Steam to turbine	Tph	80
Extraction steam	Tph	69.76
Electricity generation capacity of project	MW	12.65
Coal emission factor ($EF_{FF,CO2}$) (mixed power plant)	tCO_2/TJ	96.1
Operating days	Days	340
Operating hours	Hours	24
Efficiency of boiler using coal	%	80 %
Pressure of steam at Boiler outlet	kg/cm2	45
Temperature of steam at Boiler outlet	Deg. C	400
Pressure of steam at Turbine Extraction	kg/cm2	5.75
Temperature of feed water inlet to boiler	Deg. C	150

As per ACM0006 Version 16.0, the formula to calculate emission reductions from a project is given in paragraph 34 as:

"*Emission reductions are calculated as follows:*

$$ER_y = BE_y - PE_y - LE_y$$

Where:
ER_y = *Emissions reductions in year y (t CO_2)*
BE_y = *Baseline emissions in year y (t CO_2)*
PE_y = *Project emissions in year y (t CO_2)*
LE_y = *Leakage emissions in year y (t CO_2)"*

The PEy and LEy due to the project activity is zero each. So in this case,

$$ER_y = BE_y$$

Hence, for the given UCR project, the number of emission reduction units attained due to the commissioning and operation of the Project activity is exactly equal the units of GHG emission so avoided by not choosing to implement the baseline scenario.

The choice for CDM Methodology ACM0006 is simple- the project is a large-scale project where electricity is being co-generated with thermal energy (in the form of steam) from biomass. The guidance, the processes, the steps and the tools required to estimate carbon credits generated from "*Electricity and heat generation from biomass*" projects are mentioned in details within the given methodology.

The scope of the methodology so mentioned in Section B.2 of this PCN demonstrates as to why this Project qualifies to be claimed carbon credits against, in line with ACM0006 CDM Methodology.

As per paragraph 37 of methodology,

"*Baseline emissions are calculated as follows:*

$$BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y} + \sum FF_{BL,HG,y,f} \times EF_{FF,y,f} + EL_{BL,FF/GR,y} \times min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

Where:

BE_y = *Baseline emissions in year y (t* CO_2*)*
$EL_{BL,,}$ = *Baseline electricity sourced from the grid in year y (MWh)*
$FE_{G,,}$ = *Grid emission factor in year y (t* CO_2*/MWh)*
$FF_{BL,,,f}$ = *Baseline fossil fuel demand for process heat in year y (GJ)*
$EF_{FF,,}$ = CO_2 *emission factor for fossil fuel type f in year y (t* CO_2*/GJ)*
$EL_{BL,/GR,y}$ = *Baseline uncertain electricity generation in the grid or on-site or off-site power-only units in year y (MWh)*
$EF_{EG,,}$ = CO_2 *emission factor for electricity generation at the project site or off-site plants in the baseline in year y (t* CO_2*/MWh)*
$BE_{BR,}$ = *Baseline emissions due to disposal of biomass residues in year y (t* CO_2e*)*
f = *Fossil fuel type*"

In absence of the project activity, electricity would have been sourced from the grid. Hence, $EL_{BL,,}$ would be the sum of captive consumption of electricity and electricity supplied to the grid.

Baseline uncertain electricity generation in the grid or on-site or off-site power-only units in year y (MWh) is not applicable for the project activity and the project activity does not account the emission due to disposal of biomass residue. Hence, the baseline emissions for the project activity would be calculated as:

$$BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y} + \sum FF_{BL,,y,f} \times EF_{FF,y,f}$$

As per the Steps of calculation elucidated in ACM0006 Methodology:

"*Step 1: Determine the total baseline process heat generation (*$HC_{BL,y}$*), electricity generation and capacity constraints, and efficiencies*
Step 1.1: Determine the total baseline process heat generation
The amount of process heat that would be generated in the baseline in year y ($HC_{BL,y}$*) is determined based on continuously monitored data of process heat generated in the project scenario. The process heat should be calculated net of any parasitic heat used for drying of biomass.*
This methodology assumes for the sake of simplicity that the steam consumed in the baseline scenario would be the same quality as the steam used in the proposed CDM project activity and

transported through one steam header in both scenarios

Step 1.2: Determine the baseline capacity of electricity generation
The total capacity of electricity generation available in the baseline is calculated as follows:

$$CAP_{EG,total,y} = LOC_y \times \left[\sum_i \left(CAP_{EG,CG,i} \times LFC_{EG,CG,i} \right) + \sum_j \left(CAP_{EG,PO,j} \times LFC_{EG,PO,j} \right) \right]$$

Where:

$CAP_{EG,total,y}$	=	*Baseline electricity generation capacity in on-site and off-site plants in year y (MWh)*
$CAP_{EG,CG,i}$	=	*Baseline electricity generation capacity of cogeneration-type heat engine i (MW)*
$CAP_{EG,PO,j}$	=	*Baseline electricity generation capacity of power-only-type heat engine j (MW)*
$LFC_{EG,CG,i}$	=	*Baseline load factor of cogeneration-type heat engine i (ratio)*
$LFC_{EG,PO,j}$	=	*Baseline load factor of power-only-type heat engine j (ratio)*
LOC_y	=	*Operation of the industrial facility using the process heat in year y (hour)*
i	=	*Cogeneration-type heat engine in the baseline scenario*
j	=	*Power-only-type heat engine in the baseline scenario*

Step 1.3: Determine the efficiencies of heat generators, and efficiencies and heat-to-power ratio of heat engines"
As per para 42, efficiency of the heat engine would be calculated as per TOOL09.

"*Case 2: For heat engines without a minimum three-year operational history prior to the CDM project activity the heat-to-power ratio should be determined as per the design conditions of the plant, for the configuration identified as baseline scenario*"

As per para 38 of the methodology, Step 2 is "*Determine the baseline electricity generation in the grid and emission factors*". Emission factor is calculated as per the Tool 07.

and Step 3 is "*Determine the baseline biomass-based heat and power generation*". As base line does not involve the biomass based heat and power generation system, this step is not applicable.

Step 4 is *"Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation"*, and

"Step 4.1: Determine the baseline fossil fuel-based cogeneration of process heat and electricity and the remaining process heat demand" is seen mentioned in the methodology.

As per para 82, *"When the amount of biomass residues available is not sufficient to generate the heat required to meet the process heat demand, it is assumed that the balance of process heat is met using fossil fuels, resulting in related fossil fuel baseline emissions. Where fossil fuel based cogeneration, capacity is available it is assumed that the remaining process heat demand will first be supplied by cogeneration and then by direct use of heat supplied by heat generators."*

As baseline project activity does not involve biomass based cogeneration. Hence, this step is not applicable.

Step 4.2 states *"Determine the baseline heat generation to meet the fossil-based cogeneration of heat and power and the heat to meet the balance of process heat*", under which it is mentioned:

"*Estimate the total amount of fossil fuels required to generate the heat required for the cogeneration in Step 4.1 and the balance of process heat as follows:*

$$\sum_h HG_{BL,FF,y,h} = HG_{BL,FF,DHE,y} + HG_{BL,FF,CG,y}$$

$$FF_{BL,HG,y,f} = \sum_h \left(\frac{HG_{BL,FF,y,h}}{\eta_{BL,HG,FF,h}} \right)$$

Where:

$FF_{BL,HG,y,f}$	=	*Baseline fossil fuel demand for process heat in year y (GJ)*
$HG_{BL,FF,y,h}$	=	*Baseline fossil-based heat generation in heat generator h in year y (GJ)*
$\eta_{BL,HG,FF,h}$	=	*Baseline fossil-based heat generation efficiency of heat generator h (ratio)*[1]
$HG_{BL,FF,DHE,y}$	=	*Baseline fossil-based heat used to meet baseline process heat demand via direct heat extraction in year y (GJ)*
$HG_{BL,FF,CG,y}$	=	*Baseline fossil-based heat cogeneration in year y (GJ)*

The total heat generation required from fossil fuels ($HG_{BL,FF,y}$) shall be allocated to the different heat generators ($HG_{BL,FF,y,h}$), so as to maximize the heat generation efficiency, subject to the difference in heat content in the different heat carriers, up to the level required for meeting the balance of process heat demand."

As direct steam extraction not applicable for the project case, $HG_{BL,FF,DHE,y}$ would be zero. Hence, $HG_{BL,,,h}$ = $HG_{BL,FF,CG}$.

Step 5 states "*Determine the baseline emissions due to uncontrolled burning or decay of biomass residues*"
This step is not applicable for the project activity as the project activity would not account the

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[1] In case of connection to a district heating system or off-site heat supply from which the individual sources cannot be identified, the district heating system shall be considered the most efficient heat source. The capacity of the district heating system shall be considered unlimited unless it can be justified (based on historical consumption data or heat purchase contracts) that the amount of heat to be consumed from/ or delivered to the district heat system was limited. The emission factor of the district heating system shall be considered 0.

emission due to the decay of biomass.

Thus, Baseline emission of the project activity would be:

$$\boldsymbol{BE_y} = \boldsymbol{EL_{BL,GR,y}} \times \boldsymbol{EF_{EG,GR,y}} + \sum_f \boldsymbol{FF_{BL,HG,y,f}} \times \boldsymbol{EF_{FF,y,f}} + \boldsymbol{EL_{BL,FF/GR,y}} \times \boldsymbol{min(EF_{EG,GR,y}, EF_{EG,FF,y})} + \boldsymbol{BE_{BR,y}}$$

Where:

BE_y = Baseline emissions in year y (t CO_2)
$EL_{BL,,}$ = Baseline electricity sourced from the grid in year y (MWh)
$FE_{G,,}$ = Grid emission factor in year y (t CO_2/MWh)
$FF_{BL,,,f}$ = Baseline fossil fuel demand for process heat in year y (GJ)
$EF_{FF,,}$ = CO_2 emission factor for fossil fuel type f in year y (t CO_2/GJ)
$EL_{BL,/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site or off-site power-only units in year y (MWh)
$EF_{EG,,}$ = CO_2 emission factor for electricity generation at the project site or off-site plants in the baseline in year y (t CO_2/MWh)
$BE_{BR,}$ = Baseline emissions due to disposal of biomass residues in year y (t CO_2e)
f = Fossil fuel type"

Baseline uncertain electricity generation in the grid or on-site or off-site power-only units in year y (MWh) is not applicable for the project activity and the project activity does not account the emission due to disposal of biomass residue. Hence, the baseline emissions for the project activity would be calculated as:

$$\boldsymbol{BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y} + \sum FF_{BL,,y,f} \times EF_{FF,y,f}}$$

B.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits.
Hence project will not cause double accounting of carbon credits (i.e. COUs).

B.7. Changes to start date of crediting period >>

The crediting period under UCR has been considered from the date of commissioning of the project.

B.8. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

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

B.9. Monitoring period number and duration>>

First Issuance Period: 2 years, 4 months – 10/02/2020 to 10/06/2022

B.8. Monitoring plan>>

Following parameters being used in emission reductions determination (Fixed Ex-Ante)

Data / Parameter:	$EF_{BL,CO2,FF}$
Methodology reference	ACM0006
Data unit	t-CO_2/GJ
Description	CO_2 emission factor of the fossil fuel type that would be used for power generation at the project site in the baseline (t CO_2/GJ)
Measured/calculated/default	Default
Data source	IPCC database
Value(s) of monitored parameter	0.0961
Measurement/ Monitoring equipment (if applicable)	Not Applicable
Measuring/reading/ recording frequency (if applicable)	-
Calculation method (if applicable)	-
QA/QC procedures	Data taken from IPCC database. Hence, no QA/QC required.
Purpose of data	To calculate baseline emission
Additional comments	Value is fixed ex-ante

Data / Parameter:	$\eta_{BL,FF}$
Methodology reference	ACM0006
Data unit	%
Description	Efficiency of the fossil fuel boiler at the project site in the baseline
Measured/calculated/default	Default
Data source	CDM methodological Tool 09
Value(s) of monitored parameter	90
Measurement/ Monitoring equipment (if applicable)	Not Applicable
Measuring/reading/ recording frequency (if applicable)	-
Calculation method (if applicable)	-
QA/QC procedures	Data taken from CDM methodological Tool. Hence, no QA/QC required.
Purpose of data	To calculate baseline emission
Additional comments	Value is fixed ex-ante

Data / Parameter:	$NCV_{BR,n,x}$
Methodology reference	ACM0006
Data unit	KCal/kg
Description	Net calorific value of biomass
Measured/calculated/default	Measured
Data source	Test Report
Value(s) of monitored parameter	2131 (Bagasse) and 1719 (Slop)
Measurement/ Monitoring equipment (if applicable)	Not Applicable
Measuring/reading/ recording frequency (if applicable)	-
Calculation method (if applicable)	-
QA/QC procedures	Data taken from biomass suppliers. Hence, no QA/QC required.
Purpose of data	To calculate baseline emission
Additional comments	Value is fixed ex-ante

Data / Parameter:	$NCV_{FF,f,x}$
Methodology reference	ACM0006
Data unit	GJ/tonne
Description	Net calorific value of fossil fuel type f in year x
Measured/calculated/default	Measured
Data source	Supplier’s quotation
Value(s) of monitored parameter	23.03
Measurement/ Monitoring equipment (if applicable)	Not Applicable
Measuring/reading/ recording frequency (if applicable)	-
Calculation method (if applicable)	-
QA/QC procedures	Data taken from suppliers. Hence, no QA/QC required.
Purpose of data	To calculate baseline emission
Additional comments	Value is fixed ex-ante

Data/Parameter	$EF_{\text{Grid}y}$
Data unit	tCO2 /MWh
Description	Combined margin grid emission factor

Source of data	CEA database
Value applied	0.9088
Measurement methods and procedures	N/A
Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of Emission Factor of the grid
Additional Comment	-

Data and parameters that require to be monitored at the Project location from time to time is tabulated below:

Data / Parameter:	$HG_{BL,y}$
Methodology reference	CDM Large-scale Consolidated Methodology ACM0006
Data unit	TJ/Year
Description	Baseline process heat generation in year y (TJ)
Measured/calculated /default	Measured
Data source	Onsite measurement
Value(s) of monitored parameter	1389
Measurement/ Monitoring equipment	Steam Flow Meter, Pressure Gauge and Temperature Gauge.
Measuring/reading/ recording frequency	Monitoring procedure: Continuously with steam flow meter Data Type: measured Recording frequency: Daily Average Archiving method: Electronic
Calculation method (if applicable)	Calculation would be done by multiplying the generated steam quantity with its enthalpy.
QA/QC procedures	Steam flow meter shall be certified by third party as per national or international standards and recalibrated at appropriate intervals according to manufacturer specifications, or at least once in three years;
Purpose of data	To cross check emission reduction
Additional comments	Data would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	EL_{MWhy}
Data unit:	MWh/year
Description:	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y (MWh)
Source of data:	Monthly Joint Meter Readings (JMRs)
Measurement procedures (if any):	Data Type: Measured Monitoring equipment: ABT Energy Meters Frequency: Continuous

	monitoring and Monthly recording from Energy Meters, Archiving Policy: Paper & Electronic Calibration frequency: 5 years (as per CEA provision) Generally, the calculation is done by the Authority/Dis-com and the project proponent has no control over the authority for the calculation. Therefore, based on the joint meter reading certificates/credit notes, the project shall raise the invoice for monthly payments. EL = E(export)- E(import)
Monitoring frequency:	Monthly
Value applied:	To be applied as per actual data
QA/QC procedures:	Calibration of the Main meters will be carried out once in five (5) years as per National Standards (as per the provision of CEA, India) and faulty meters will be duly replaced immediately as per the provision of power purchase agreement. Cross Checking: Quantity of net electricity supplied to the grid will be cross checked from the invoices raised by the project participant to the grid.
Purpose of date:	The Data/Parameter is required to calculate the baseline emission.
Any comment:	All the data will be archived till a period of two years from the end of the crediting period.

Data / Parameter:	$EL_{PG,Gross,y}$
Methodology reference	CDM Large-scale Consolidated Methodology ACM0006
Data unit	MWh
Description	Gross quantity of electricity generated in all power plants in year y (MWh)
Measured/calculated /default	Measured
Data source	Plant Record
Value(s) of monitored parameter	103,224
Measurement/ Monitoring equipment	Three Phase Energy Meter
Measuring/reading/ recording frequency	Monitoring procedure: Continuously from Installed energy meter. Data Type: Measured Recording frequency: Daily cumulative Archiving method: Electronic

Calculation method (if applicable)	Calculated by subtracting previous reading from present reading of energy meter reading. Gross Generation = Present Reading – Previous Reading
QA/QC procedures	Energy meter shall be certified by third party as per national or international standards and recalibrated at appropriate intervals according to manufacturer specifications, or at least once in 5 years;
Purpose of data	To crosscheck emission reduction
Additional comments	Data would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	$EL_{PJ,aux,y}$
Methodology reference	CDM Large-scale Consolidated Methodology ACM0006
Data unit	MWh
Description	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh)
Measured/calculated /default	Measured
Data source	Onsite Measurement
Value(s) of monitored parameter	Would be provided during verification
Measurement/ Monitoring equipment	Three Phase Energy Meter
Measuring/reading/ recording frequency	Monitoring procedure: Daily from Installed Energy Meter. Data Type: Measured Recording frequency: Daily Archiving method: Electronic
Calculation method (if applicable)	Calculated by subtracting previous reading from present reading of energy meter reading. Net auxiliary consumption = Present Reading – Previous Reading
QA/QC procedures	Energy meter shall be certified by third party as per national or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, or at least once in three years;
Purpose of data	To evaluate net quantity of thermal energy delivered by the project.
Additional comments	Steam quantity data would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	$B_{biomass,y}$
Methodology reference	ACM0006
Data unit	Tonne/Year
Description	Quantity (dry basis) of biomass combusted in an year y
Measured/calculated /default	Measured

Data source	Onsite measurement
Value(s) of monitored parameter	Would be provided during verification
Measurement/ Monitoring equipment	Mechanical Weigh Bridge
Measuring/reading/ recording frequency	Monitoring procedure: Continuous. Data Type: Calculated Recording frequency: Daily / Monthly Average Archiving method: Electronic
Calculation method (if applicable)	Net biomass consumption can be calculated by subtracting closing stock of biomass from opening stock of biomass.
QA/QC procedures	Consumption of biomass can be cross checked by conducting energy balance.
Purpose of data	To cross check energy generation.
Additional comments	Data would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	Moisture Content
Methodology reference	ACM0006
Data unit	%
Description	Moisture content of the biomass (wet basis)
Measured/calculated /default	Measured
Data source	Test Report/ Plant Data
Value(s) of monitored parameter	Would be provided during verification
Measurement/ Monitoring equipment	Weight Balance Machine
Measuring/reading/ recording frequency	Monitoring procedure: Measurement would be carried out for each batch of purchased biomass. Data Type: Measured Archiving method: Electronic
Calculation method (if applicable)	Value can be obtained by testing the biomass sample in the in-house lab for each batch of biomass entered into the project boundary.
QA/QC procedures	N/A
Purpose of data	To cross check energy generation.
Additional comments	Data would be archiving electronically up to 2 years from the end of crediting period.