PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

Title: Biomass based Cogeneration Project at Kashipur, Uttarakhand

Version 1.0

Date 07/01/2023

First CoU Issuance Period: 9 years, 11 months

Date: 21/01/2013 to 21/12/2022

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

BASIC INFORMATION	
Title of the project activity	Biomass based Cogeneration Project at Kashipur, Uttarakhand
Scale of the project activity	Small Scale
Completion date of the PCN	07/01/2023
Project participants	First Climate (India) Private Limited (AGGREGATOR) Ms. Bahl Paper Mills Ltd. (Kashipur) (DEVELOPER)
Host Party	India
Applied methodologies and standardized baselines	**CDM UNFCCC Methodology** AMS-I.C: Thermal energy production with or without electricity version 22 Standardized baseline: N/A
Sectoral scopes	01 Energy industries (Renewable/NonRenewable Sources)
Estimated amount of total GHG emission reductions	69,260 t-CO_2/Yr.

SECTION A. Description of project activity

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

The project **Biomass based Cogeneration Project at Kashipur, Uttarakhand** is located in Mahuakhera Ganj, Kashipur, Udham Singh Nagar, Uttarakhand, India.

The project results in reductions of CO2 emissions that are real, measureable and give long-term benefits to the mitigation of climate change. Emission reductions attributable to the project are included in the *UCR Positive List of Project Types* deemed to be additional and also meet the "*Do No Net Harm to Society and Environment*" criteria under the ***UCR CoU Standard***.
The details of the registered project are as follows:

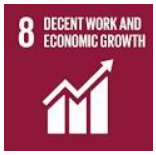
Purpose of the project activity:

The purpose of the project activity, promoted by Bahl Paper Mills Ltd, is to install 27 TPH biomass fired boiler with back pressure turbine to cater the electricity and steam demand of the company. The captive co-generation plant of 4MW capacity is utilized for running the existing and operational Duplex Board Plant more efficiently. The plant is expected to supply about 404.34 TJ of process heat in terms of steam and 31.68 GWh of electricity per annum.

The Project owner is one of the largest integrated paper manufacturers in India, and across Uttarakhand. The project activity was commissioned in 20/01/2013. The paper manufacturing demand both steam and electricity. In absence of this project activity, equivalent amount of energy and steam would have been sourced from more carbon intensive sources i.e. Coal. The project activity thus reduces 69,260 tCO2e/annum greenhouse gas emissions (GHG) by avoiding fossil fuel combination for steam and power generation.

The electricity produced by the project activity is directly contributing to climate change mitigation by reducing the anthropogenic emissions of GHGs into the atmosphere by displacing an equivalent amount of fossil power at grid.

Sustainable		SDG Impact

Development Goals Targeted	Project-level SDGs	Contribution of Project-level Actions to SDG Targets
SDG 13.  Climate Action	69,260 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 renewable biomass. - The company purchase biomass from nearby areas which is a waste hence also utilizes the waste as a fuel. In case, if the waste was not properly managed and residue would have been dumped then it would generate bad odour, methane and other GHGs. - The plant purchase biomass from nearby areas and distance of round trip transportation is less than 200 km, the carbon emission due to transportation of bio-mass get negligible. - 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.  Decent Work and Economic Growth sustainable economic growth, employment and decent work for all	The project activity has created at least 2 permanent jobs in the renewable power sector i.e., local employment generation.	The biomass power plant contributes directly to achieve the SDG target, because the project activity The project activity creates jobs in the renewable energy sector, which diversify and upgrades the commonly used technology in the energy sector of India

SDG 5.  Achieve gender equality and empower all women and girls	Equal pay for work of equal value" for both men and women and shall hire at least 1 women employee at the site.	Contribute to achieve equal rights for men & women. Number of women employed directly due to the project activity. As per company policy of Project implementer men & women have equal rights and no discrimination will be tolerated against women.

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:**
- Improvement of air quality in the nearby region: With the avoidance of fossil fuel combustion in the proposed project activity, the exhaust gas emissions and direct localized air pollution will be substantially reduced in the neighbouring region. Air Pollution due to open dumping of biomass will be reduced.
- Employment creation: Besides providing direct employment to the local population in the operation of the boiler, the project activity also provides indirect employment to number of people in activities associated with biomass collection, processing and operation of the boiler.
- The technology being used in the project is proven and safe for power generation. An increase in such kind of projects shall enable all the technology suppliers to continuously innovate and modernize on the technology front. The local people will know the technology advancement and will help in capacity building.

- **Environmental benefits:**
- Reduction of fossil fuel combustion: The project activity is a renewable energy project, which utilizes biomass as a fuel for grid power generation, a move that is voluntary and not mandated under current environmental laws of India. Since this project activity generates green energy in the form of power, it has positively contributed towards the reduction in (Demand) use of finite natural resources like coal and oil, minimizing depletion and in turn increasing its availability to other important purposes. Therefore this project activity helps to environment sustainability by reducing GHG emission in the atmosphere.
- Utilization of Agricultural residues: The project activity utilizes agricultural residue, which is a carbon neutral fuel hence do not contribute to additional atmospheric CO_2 emission as compared to baseline coal.
- The project activity would ensure the agricultural residues are combusted efficiently in the boiler with proper air treatment and handling systems. Thus, preventing air and soil pollution and getting economic value from the wastes.
- As the biomass residues have inherently low sulphur and nitrogen content, the problems of NOx and SOx emissions is almost nil.

- **Economic benefits:**
- Reduction of dependence from fossil fuels: The project activity will reduce the Production facility's dependence on fossil fuel. This will reduce the overall dependence of the whole region from the imports and availability of fossil fuels and will allow other industries to use energy resources which will allow their development.
- The project activity creates employment opportunities during the project stage and operation and maintenance of the boiler and turbines.
- The various other benefits due to the project activity ensures that the project is contributing to the sustainable development of the region by bringing in green technologies and processes to a backward region. The technology is indigenous and by implementing such projects the country is showcasing its GHG mitigation actions in efforts to combat climate change.

A.3. Location of project activity >>

Country: India
District: Udham Singh Nagar

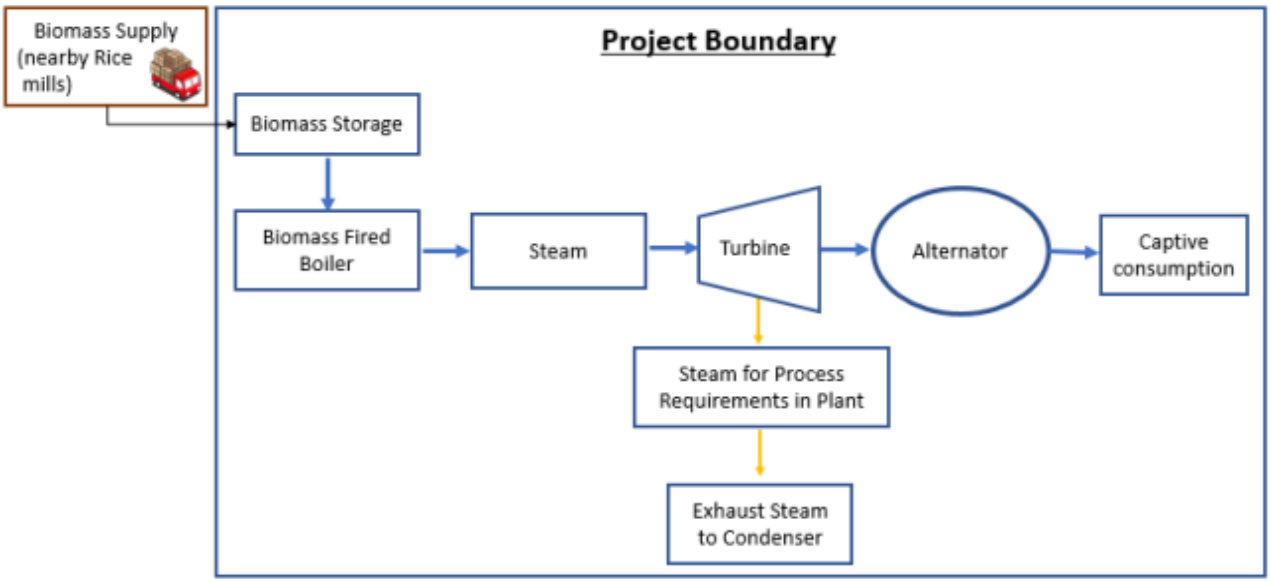
Village: Mahuakhera Ganj
Tehsil: Kashipur
State: Uttarakhand
Code: 244713

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: 29.154959˚
Longitude: 78.928759˚

A.4. Technologies/measures >>

Process Flow Chart:



Technical details of boiler and turbine is tabulated below:

Parameter	Unit	Details
Capacity	TPH	27
Temperature of output steam	˚C	490
Pressure of output steam	Kg/cm^2	65
Fuel Type	-	Agricultural Biomass
Capacity of Turbine	MW	4
Turbine Type	-	Back Pressure
Quantity of Steam bleed	TPH	23
Pressure of extracted steam	Kg/cm^2	3.7

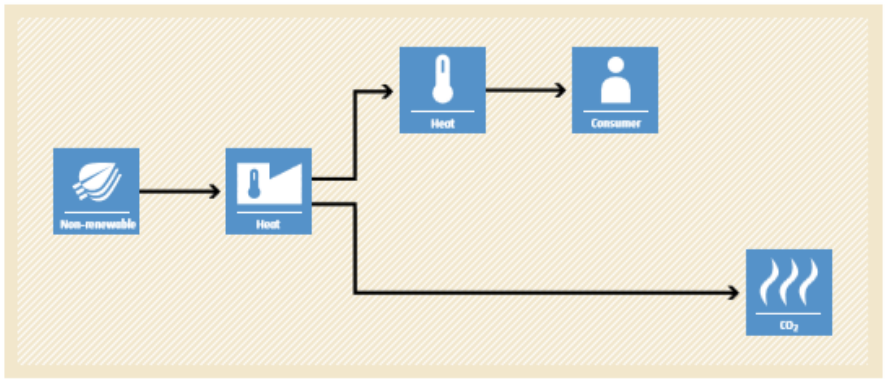
A.5. Parties and project participants >>

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- 700 020 **Bahl Papers Mills Limited (DEVELOPER)** Address: Mahuakhera Ganj, Kashipur, Udham Singh Nagar, Uttarakhand, India

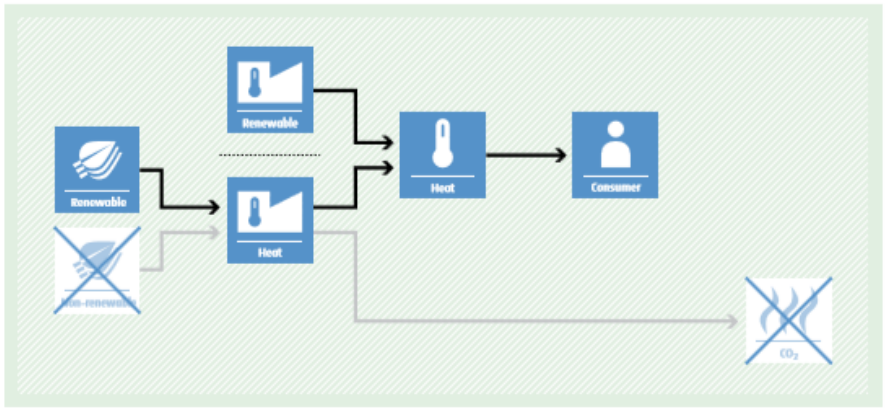
A.6. Baseline Emissions>>

The baseline scenario identified at the PCN stage of the project activity is a coal based co-generation system.

BASELINE SCENARIO
Thermal energy would be produced by more-GHG-intensive means based on the use of non-renewable biomass.



PROJECT SCENARIO
Use of renewable energy technologies for thermal energy generation, displacing non-renewable biomass use.



A.7. Debundling>>

This 4 MW Biomass based Cogeneration project is not a debundled component of a larger project activity nor a component of registered PoA.

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- AMS-I.C: Thermal energy production with or without electricity (Ver. 22)

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

The project activity is a biomass based co-generation system set to cater the electricity and thermal demand of the plant.

Applicability of AMS – I.C.	Project Status
3. Biomass-based cogeneration and trigeneration systems are included in this category.	**Applicable and fulfilled** The project involves biomass (renewable) based cogeneration unit for captive usage, thereby displacing fossil fuel-based cogeneration for the purpose. Hence, this criterion is applicable.
4. Emission reductions from a biomass cogeneration or trigeneration system can accrue from one of the following activities: (a) Electricity supply to a grid; (b) Electricity and/or thermal energy production for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).	**Applicable and fulfilled** The project involves simultaneous generation of electricity and thermal energy through biomass based cogeneration plant for captive usage. Hence, point (b) fulfilled.
5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category	**Not Applicable** Project activity is a Greenfield project activity and does not seek to retrofit or modify an existing facility for renewable energy generation.
6. In the case of new facilities (Greenfield projects) and project activities involving capacity additions the relevant requirements related to determination of baseline scenario provided in the "General guidelines for SSC CDM methodologies" for Type-II and Type-III Greenfield/capacity expansion project activities also apply.	**Applicable and fulfilled** The project activity is installation of a Greenfield cogeneration unit. Compliance with the "General Guidelines to SSC CDM methodologies" has been demonstrated at relevant places throughout the PCN.

<table>
<tr>
<td>7. The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal (see paragraph 9 for the applicable limits for cogeneration and trigeneration project activities)</td>
<td>Applicable and fulfilled

This is a cogeneration project and the rated generation capacity of the boiler is 21.51 MW_{th} which is less than 45 MW_{th} as shown in the following table:-

<table>
<tr><td>Boiler Capacity</td><td>27 TPH = 7.5 kg/sec.</td></tr>
<tr><td>Enthalpy of output steam from boiler</td><td>3.39 MJ/kg</td></tr>
<tr><td>Enthalpy of feed water</td><td>0.525 MJ/kg</td></tr>
<tr><td>Thermal Energy Generation Capacity</td><td>21.51 MW_{th}</td></tr>
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</td>
</tr>
<tr>
<td>8. For co-fired 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 9 for the applicable limits for cogeneration project activities).</td>
<td>Not Applicable

This project activity is solely renewable biomass- based co-generation project and co-firing is anticipated for this project activity.

Hence, this criterion is not applicable.</td>
</tr>
<tr>
<td>9. The following capacity limits apply for biomass cogeneration and trigeneration units:

(a) If the emission reductions of the project activity are on account of thermal and electrical energy production, the total installed thermal and electrical energy generation capacity of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating the 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 installed capacity of 15 MW(e) is equivalent to 45 MW thermal output of the equipment or the plant);
(b) If the emission reductions of the 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 shall not exceed 45 MW thermal;</td>
<td>Applied and fulfilled

This is a cogeneration project, i.e. plant would extract electrical as well as thermal energy from the project activity.
Total energy generation capacity is 21.51 MW_{th} which is less than the limit of 45 MW thermal.</td>
</tr>
</table>

(c) If the emission reductions of the 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 shall not exceed 15 MW	
10. The capacity limits specified in paragraphs 7 to 9 above 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 shall comply with capacity limits specified in the paragraphs 7 to 9, and shall be physically distinct from the existing units.	**Not Applicable** This project activity is solely renewable biomass based greenfield co-generation project. Nor addition or expansion is applicable for this project.
11. 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.	**Not Applicable** The project activity does not involve usages of solid biomass fuel such as briquette, but biomass (renewable) residue and hence this criteria is not applicable.
12. 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	**Not Applicable** As mentioned against criterion 9 above, the project activity does not involve use of any processed solid biomass fuel, but biomass (renewable) residue and therefore no separate solid biomass fuel production process or emissions thereof are associated. Hence, this criterion is not applicable.
13. If electricity and/or thermal energy 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.	**Not Applicable** The electricity and steam produced by the project activity shall be used for in-house consumption and is not delivered to another facility or facilities within the project boundary.
14. If the project activity recovers and utilizes biogas for producing electricity	**Not Applicable**

and/or thermal energy and applies this methodology on a standalone 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 as per relevant procedures in the tool "Emissions from solid waste disposal sites" and/or "Project emissions from flaring". In the event that the biomass fuel (solid/liquid/gas) is sourced from an existing CDM project, then the emissions associated with the production of the fuel shall be accounted with that project.	The project activity does not involve use of biogas as fuel and hence this criterion is not applicable.
15. If project equipment contains refrigerants, then the refrigerant used in the project case shall have no ozone depleting potential (ODP).	**Not Applicable** The project activity does not use such equipment's which contains refrigerants. Hence, this criterion is not applicable.
16. Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources, 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: Avoidance of methane release from charcoal production by shifting from traditional open-ended methods to mechanized charcoaling process". 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	**Not Applicable** The project activity does not use charcoal for its operation. Hence, this criterion is not applicable.

of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.	
17. In the case the project activities utilizes biomass, the "TOOL16: Project and leakage emissions from biomass" shall be applied to determine the relevant project emissions from the cultivation of biomass and the utilization of biomass or biomass residues.	**Applicable and fulfilled** The biomass that would be used for this project would not be sourced from dedicated plantation. Project and leakage emission for utilization of biomass or biomass residue is demonstrated in the relevant place of the PCN as per Tool-16.

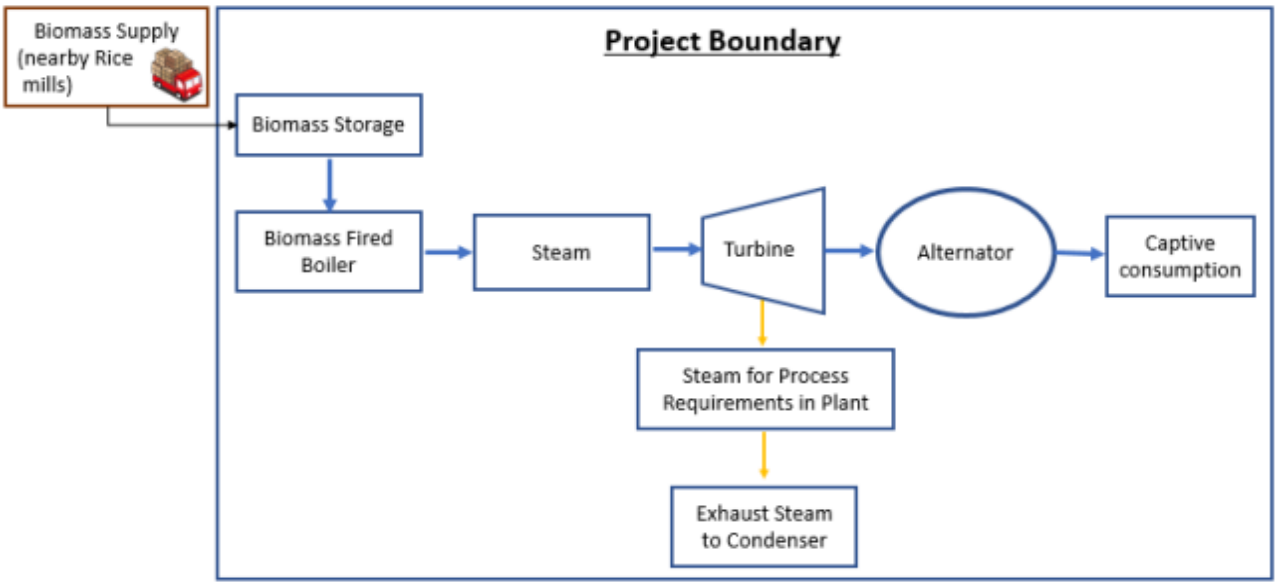
B.3. Applicability of double counting emission reductions >>

The biomass boilers and turbines are installed by the project proponent within the project boundary. The biomass boilers, turbine and energy meters have unique IDs, which is visible on the units. The same will be provided to the UCR verifier during the verification process.

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,

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



In line with this methodology, the project boundary encompasses the industrial facility of the company, equipment installed for the operation of cogeneration plant, the biomass storage facility, the facility (paper mill) consuming the energy (electrical and thermal) generated by the project activity plant; Plant would use biomass as a renewable fuel of the boiler. Quantity of the biomass

purchased from outside by the plant activity would be used as fuel for project boiler.

The project boundary includes the physical, geographical site(s) of:

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

Source		GHG	Included?	Justification/Explanation
Baseline	Coal fired co-generation for thermal and electrical energy generation	CO_2	Included	Major source of emission
		CH_4	Included	Minor source of emission
		N_2O	Excluded	Minor Emission Source
Project Activity	Biomass based Co-generation for thermal energy and electrical energy generation	CO_2	Excluded	As the renewable biomass is carbon neutral fuel, no CO2 emitted from this project
		CH_4	Excluded	Minor Source.
		N_2O	Excluded	Minor source of emission.

B.5. Establishment and description of baseline scenario (UCR Standard or Methodology) >>

As per the paragraph 29 of approved methodology AMS – I.C., version 22, "*Project activities producing both heat and electricity shall use one of the following baseline scenarios*".

Baseline Scenarios	**Justification for choosing the most suitable baseline option**
a) Electricity is imported from a grid and thermal energy is produced using fossil	Purchasing electricity from grid and thermal energy generation using fossil fuel may be an

fuel;	alternative to the project activity. However, unit cost of grid electricity in Uttarakhand is on higher side. Further there is constant power shortages and power cuts during peak hours. Thus, depending on the grid based electricity supply for operation of the plant is not a feasible option. Hence, this scenario is considered.
b) Electricity is produced in an on-site captive power plant using fossil fuel (with a possibility of export to the grid) and thermal energy is produced using fossil fuel;	The combined system efficiency for separate heat and power generation would be lower compared to cogeneration plant. The captive power plant and fossil fuel-based steam generation system on account of its lower operating efficiency would result in higher fuel consumption than the cogeneration plant and hence results in higher cost of generation than the cogeneration system. Hence, this scenario is not considered as a plausible baseline alternative.
c) A combination of (a) and (b);	Since, option (a) and (b) has been eliminated, thus, this option is also not considered.
d) Electricity and thermal energy are produced in a cogeneration or tri-generation unit using fossil fuel (with a possibility of export of electricity to a grid/other facility and/or thermal energy to other facilities)	For the project activity, fossil fuel-based cogeneration unit can be a possible alternative. Abundant availability and usage of coal in the state for energy generation is a prevailing practice. Hence, this option is considered as an alternative baseline scenario for project activity.
e) Electricity is imported from a grid and/or produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid); thermal energy is produced using biomass;	As discussed against point (b) and (a) above, separate generation of energy is less efficient and more fuel consuming leading to higher cost of energy generation. Hence, this scenario is not considered as a plausible baseline alternative
f) Electricity is produced in an on-site captive power plant using biomass (with a possibility of export to a grid) and/or imported from a grid; thermal energy is produced using fossil fuel;	As discussed against point (b) above, separate generation of energy is less efficient and more fuel consuming leading to higher cost of energy generation. Hence, this scenario is not considered as a plausible baseline alternative.
g) Electricity and thermal energy are produced in a biomass fired cogeneration or trigeneration unit (without a possibility of export of electricity either to a grid or to other facilities and without a possibility of export of thermal energy to other facilities);	As per AMS – I.C. version 22, paragraph 30, this scenario applies to a project activity that installs a new grid connected biomass cogeneration or trigeneration system that produces surplus electricity and this surplus electricity is exported to a grid. Hence, this scenario is not considered as a

	plausible baseline alternative
h) Electricity and/or thermal energy produced in a co-fired system;	This alternative is similar to the project option with the only difference being the provision of co-firing. Unit cost of generation with coal is lower than that using biomass, evidently the unit cost of generation in a co-fired system will be higher than a coal-based system. Hence, this scenario is not considered as a plausible baseline alternative
i) Electricity is imported from a grid and/or produced in a biomass fired cogeneration or trigeneration unit (without a possibility of export of electricity either to the grid or to other facilities); thermal energy is produced in a biomass fired cogeneration or trigeneration unit and/or a biomass fired boiler (without a possibility of export of thermal energy to other facilities);	As discussed in bullet point (a) and (b). above, separate generation of energy is less efficient and more fuel consuming leading to higher cost of energy generation. Hence, this scenario is not considered as a plausible baseline alternative.
j) Electricity is imported from a grid and/or produced in an on-site captive power plant using fossil fuel and thermal energy is produced using electricity.	As cost of electricity is high in Uttarakhand, thermal energy generation using electricity is costlier than generating thermal energy through coal-based co-gen system. Apart from that separate generation of energy is less efficient and more fuel consuming leading to higher cost of energy generation. Hence, this scenario is not considered as a plausible baseline alternative.

Hence, the baseline condition for this project is Coal fired co-generation system. The emission reduction calculation has been done as per the SSC methodology AMS-I.C., Version 22.

Baseline Emission:

In the absence of project activity, steam and power would have been generated using coal in coal fired cogeneration unit of similar specifications. As per AMS-I.C., Version 22, paragraph 39, "For electricity and thermal energy (steam/heat) produced in a baseline cogeneration unit, using fossil fuel (case 19 (d)), the following equation shall be used to determine baseline emissions:"

$$BE_{cogen,CO2,y} = [(EG_{PJ,thermal,y} + EG_{PJ,electrical,y} * 3.6) / \eta_{BL,cogen}] * EF_{FF,CO2}$$

Where,

$BE_{cogen,CO2,y}$ = Baseline emissions from electricity and thermal energy displaced by the project activity during the year y; tCO_{2e}

$EG_{PJ,thermal,y}$ = The net quantity of thermal energy supplied by the project activity during the year y; TJ

$EG_{PJ,electrical,y}$ = The amount of electricity supplied by the project activity during the year y; GWh

$\eta_{BL,cogen}$ = The total efficiency (including both thermal and electrical) of the cogeneration plant using fossil fuel determined in accordance with paragraphs 28 and 29 of the methodology.

$EF_{FF,CO2}$ = The CO2 emission factor of the fossil fuel that would have been used in the baseline cogeneration plant; obtained from reliable local or national data if available, alternatively, alternatively, IPCC default emission factors are used (tCO_2/TJ)

Now, since the project activity plant is a Greenfield plant, therefore guidance for efficiency calculation is followed as given in paragraph 41 of AMS I.C, Version 22, which states that
"*In the case of a Greenfield project cogeneration or trigeneration plant where the baseline is a cogeneration or trigeneration plant (e.g. using a steam turbine and steam generator that would have been built in the absence of the project activity), the total annual average efficiency of the cogeneration or trigeneration plant using fossil fuel shall be defined as the ratio of thermal energy and electricity produced to total thermal energy value of the fuel use. This ratio shall be determined using one of the two following options (in preferential order*):

(a) Calculated as a single value with consideration of the following:

(i) ***Step 1:***

a. *The total annual average efficiency of the cogeneration or trigeneration plant using fossil fuel is determined using documented efficiency specification for new steam turbines and steam generators provided by two or more manufacturers for each type of such equipment within in the region;*

b. *Efficiency values for the steam turbine(s) and steam generator(s) shall be based on turbines and steam generators with specifications nearly equivalent to baseline units that would have been utilized in the absence of the project activity;*

c. *The efficiency values utilized shall be the highest individual efficiency values (over the full range of expected operating conditions of the baseline cogeneration or trigeneration system) that can be achieved by the steam turbine(s) and steam generator(s).*

(ii) ***Step 2:***

a. *The total annual average efficiency of the cogeneration or trigeneration plant using fossil fuel is then calculated as the product of the highest efficiency value for the steam turbine(s) and the highest efficiency value of the steam generator(s), assuming both efficiencies are in the form of a percentage of output per input;*

(b) Calculated as a single value with consideration of the following:

(i) ***Step 1****:*

a. *A default steam turbine efficiency of 100 per cent;*
b. *Default steam generator efficiency determined using the values provided in appendix;*

(ii) ***Step 2:***

a. *The total annual average efficiency of the cogeneration or trigeneration plant using fossil fuel is then calculated as the product of the efficiency value for the steam turbine(s) and the efficiency value of the steam generator(s), assuming both efficiencies are in the form of a percentage of output per input.*

Following option (a) of the above guidance, efficiency of the turbine has been calculated based on the operational data and default efficiency of boiler as 85% has been taken. Thereafter, the total annual average efficiency of the cogeneration plant using fossil fuel has been calculated as the product of the calculated efficiency value for the steam turbine(s) and the default efficiency value of the steam generator.

Project Emission:

As per paragraph 66 methodology:

"Project emissions shall be calculated using the following equation:
$PE_y = PE_{FF,y} + PE_{EC,y} + PE_{Geo,y} + PE_{ref,y} + PE_{Biomass}$

Where,

PE_y *= Project emissions from the project activity during the year y (t CO2);*
PE_{FF} *= Project emissions from fossil fuel consumption during the year y (t CO2);*
PE_{Ec} *= Project emissions from electricity consumption during the year y (t CO2);*
PE_{Geo} *= Project emissions from a geothermal project activity in year y (t CO2);*
PE_{ref} *= Project emissions from use of refrigerant in project activity in year y (t CO2);*
$PE_{Biomass}$ *= Project emissions associated with biomass and biomass residues in year y (t CO2e)*

This is not a geothermal project. The project activity however does not envisage using any fossil fuel during the crediting period. Auxiliary power is supplied from the project itself. Hence, for ex-ante estimations project emissions due to consumption of fossil fuel and electricity consumption has been considered 0. As project does not use any refrigerant in the project activity, project emission related to refrigerant is considered as 0.

Hence, for simplification,
$PE_y = PE_{Biomass}$

As per paragraph 14 of Tool 16, "Project emissions involve emissions resulting from the cultivation of biomass, transportation of biomass, processing of biomass, transportation of biomass residues and processing of biomass residues."

Project does not have any dedicated plantation or cultivation of biomass and raw biomass is being fired in the boiler without any further processing. Hence, project emission would only be calculated for transportation of biomass residue. As per Tool 16 para 31(a), project emission would be calculated based on the default emission factor of 0.0142 t-CO2/ton of biomass.

Leakage Emission:

As per the paragraph 79 of AMS – I.C. version 22,

"If the energy generating equipment currently being utilized is transferred from outside the boundary to the project activity, leakage is to be considered."

For this project activity there is no transfer of equipment and therefore leakage due to equipment transfer has been taken to be zero.

As per the paragraph 80 of AMS – I.C. version 22,

"*If the displaced refrigerant is a greenhouse gas as defined in annex A of the Kyoto Protocol or in paragraph 1 of the Convention and is not destroyed, emissions from its storage or usage in equipment must be considered as leakage*."

In the project scenario, displacement and storage of refrigerant is not relevant for this project. Hence, this criterion is not applicable.

As per the paragraph 81 of methodology,

"For project activities utilizing biomass and/or biomass residues, the TOOL16 shall be applied to determine the leakage. Project participants shall indicate in the PDD which leakage sources are included. If emission sources are not considered, the project participants shall provide proper justification in the PDD"

As per the paragraph 49 of Tool 16 Methodological tool: Leakage in biomass small-scale project activities Version 04.0

"This section is applicable for project activities which utilise biomass residues. It quantifies leakage due to diversion of biomass residues to the project to be used as either fuel or feedstock. These biomass residues could have been used outside the project boundary in competing applications, and due to the implementation of the project activity these competing application might be forced to use inputs which are not carbon neutral."

In the project scenario, biomass residues being used as fuel is purchased by the project activity and transported from the nearby areas. Round trip distance for transportation of biomass is less than 200 km. As biomass is surplus near the project location, there is no leakage from competing uses of biomass.

The key parameters for baseline emission calculation are presented below in a tabular format:

Paramter	Unit	Value
Steam to Turbine	Tph	27
Extraction Steam (considering capacity utilization @ 85%	Tph	23
Operating days	Days	330
Operating Hours	Hours	24
Electricity generation capacity	MW	4
Efficiency of boiler using coal	%	85%
Coal emission factor ($EF_{FF,CO2}$)	tCO_2/TJ	96.1

Estimated Annual or Total baseline emission reductions (BEy) = 69260 CoUs /year (69260 tCO_{2eq}/yr)

B.6. Prior History>>

The Project has received no public funding. The project activity has not applied to any other GHG program for generation or issuance of carbon credits or credits for the current crediting period. Hence, project will not cause double accounting of carbon credits. (i.e. CoUs)

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

There is no change in the start date of crediting period.

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: 9 years, 11 months – 21/01/2013 to 21/12/2022

B.8. Monitoring plan>>

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

Data/Parameter	**$\eta_{BL,cogen}$**
Data unit	%
Description	Co-generation efficiency
Source of data Value(s) applied	Boiler specification sheet and actual calculated turbine efficiency.
Measurement methods and procedures	N/A
Value of Monitored Parameter	71.93
Monitoring frequency	The value is fixed for entire crediting period.
Purpose of data	To calculate baseline emission.

Data / Parameter:	**$EF_{FF,CO2,coal}$**
Data unit:	tCO_{2e}/TJ
Description: Source of data:	The CO2 emission factor per unit of energy of the fuel(coal) that would have been used in the baseline plant As per Table 2.2, Chapter-2, Volume-2,IPCC 2006 guidelines
Measurement procedures (if any):	N/A
Value of Monitored Parameter	96.1
Monitoring frequency:	This value is fixed for entire crediting period

Following Parameters being monitored for emission reductions determination:

Data / Parameter:	**$EG_{PJ,\ electrical,\ y}$**
Data unit:	MWh/year
Description:	Amount of electricity generated by the project activity in an

	year.
Source of data:	Onsite measurement
Measurement procedures (if any):	Measuring would be done by installing 3 phase energy meter at HT side or LT side of generation end.
QA/QC procedures:	Installed energy meter would be as per national or IEC standard. Calibration would be carried out once in every 5 years.
Any Comment:	Generation data would be archiving electronically up to 2years from the end of crediting period.

Data / Parameter:	**T_{FW}**
Data unit:	˚C
Description:	Average temperature of feed water at boiler inlet.
Source of data:	Onsite measurement
Measurement procedures (if any):	Measurement would be done by installed thermometer
QA/QC procedures:	Temperature Gauge will be standard make and recalibrated at appropriate intervals according to manufacturer specifications. If any malfunction noticed, meter would be change with immediate effect.
Any Comment:	Data would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	**E_{FW}**
Data unit:	KJ/kg
Description:	Average enthalpy of feed water at boiler inlet.
Source of data:	Steam Table
Measurement procedures (if any):	N/A
QA/QC procedures:	As value would be calculated from steam table, data would be authentic.
Any Comment:	Data would be used to evaluate enthalpy change in boiler.

Data / Parameter:	**Q_{steam}**
Data unit:	MT/Year
Description:	Extracted steam supplied to process plant in year y.
Source of data:	Onsite measurement
Measurement procedures (if any):	Net steam delivered = Present Reading – Previous Reading Archiving method: Electronic
QA/QC procedures:	Steam flow meter will be certified by third party as per national or international standards and recalibrated at appropriate intervals according to manufacturer specifications.
Any Comment:	Data would be used to evaluate net quantity of thermal energy delivered by the project and would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	**$P_{process}$**
Data unit:	Kg/cm^2 (g)
Description:	Pressure of steam bleed extracted from turbine to supply to the process.
Source of data:	Onsite measurement
Measurement procedures (if any):	Measurement would be done by installed pressure gauge.
QA/QC procedures:	Pressure gauge will be certified by third party as per national or international standards and recalibrated at appropriate intervals

	according to manufacturer specifications;
Any Comment:	To evaluate the enthalpy of the steam bleed.

Data / Parameter:	**E_{steam}**
Data unit:	KJ/kg
Description:	Enthalpy of extracted steam.
Source of data:	Steam table
Measurement procedures (if any):	N/A
QA/QC procedures:	As data would obtain from steam table, no need any QA/QC.
Any Comment:	Data would be used to evaluate enthalpy of the steam.

Data / Parameter:	**$B_{biomass,y}$**
Data unit:	Tonne/Year
Description:	Quantity of biomass combusted in year y
Source of data:	Onsite measurement
Measurement procedures (if any):	Measurement would be done for each batch of purchased biomass during the entry inside the plant by installed mechanical weighbridge and recorded monthly basis.
QA/QC procedures:	Consumption of biomass can be cross checked by comparing purchased quantity from invoices.
Any Comment:	Data would be archived electronically.

Data / Parameter:	**GCV_{k}**
Data unit:	Kcals/kg
Description:	Gross calorific value of biomass combusted in an year y
Source of data:	Lab Test report
Measurement procedures (if any):	Value can be obtained by testing the biomass sample from third party lab.
QA/QC procedures:	Biomass sample would be sent to external lab for testing. Testing would be done half yearly for first crediting period. Average of the measured GCV of first crediting period would be fixed for entire crediting period.
Any Comment:	Data would be archived electronically.