PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

Title: Biomass fired cogeneration system in Sarsini of Punjab, India

Version 1.0
Date: 14-10-2022
First CoU Issuance Period: 9 Years, 9 months
Date: 01/01/2013 to 30/09/2022

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

BASIC INFORMATION	
Title of the project activity	Biomass fired cogeneration system in Sarsini of Punjab, India
Scale of the project activity	Small scale
Completion date of the PCN	14/10/2022
Project participants	1. T. C. Terrytex Limited (Developer) 2. First Climate (India) Private Limited (Aggregator)
Host Party	INDIA
Applied methodologies and standardized baselines	**UNFCCC CDM Methodology** AMS-I.C. Small-scale Methodology Thermal energy production with or without electricity (Version 22.0)
Sectoral scopes	Sectoral Scope: 01 Energy industries (renewable - / non-renewable sources)
Estimated amount of total GHG emission reductions	406,465 CoUs (406,465 tCO_{2eq}) {till 30th September, 2022} Henceforth, 42,711 CoUs (42,711 tCO_{2eq}) annually

SECTION A. Description of project activity

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

The project **Biomass fired cogeneration system in Sarsini of Punjab**, India is located in Village Sarsini, near Lalru, Tehsil Dera Bassi, District S.A.S. Nagar, Mohali, in the State of Punjab, in Country India.

The details of the registered project are as follows:

Purpose of the project activity:

The project activity includes an installation of two biomass-fired boilers, one of 12 TPH and another of 8 TPH in Sarsini Village of Punjab, India for generation of thermal energy as well as electricity. For the purpose of generating electricity, a 0.286 MW pressure losing turbine is connected to the 12 TPH biomass-fired boiler. The steam for the 8 TPH boiler is directly fed into the process, while the remaining thermal energy after generation of electricity from the 12 TPH boiler is fed into the process operations.

The purpose of the project activity is to replace the use of non-renewable energy sources (i.e., fossil fuels) with renewable energy sources like biomass. The preferred biomass for the project activity is rice husk, which is available in plenty in the state of Punjab[1].

In absence of this project activity, the Project owner would have met equivalent amount of its thermal and electrical energy requirements from fossil fuel, likely coal, as coal is the fuel of choice in India all across[2,3].

Thereby, by installing and commissioning the project, the project owner is reducing the use and dependence on coal as a fuel source and thereby avoiding GHG emissions from coal burning. Also, as biomass is a GHG- neutral substance[4], therefore; there is a net-positive impact of the use of biomass fired cogeneration system upon the environment, instead of a coal fired cogeneration system. Burning coal not only causes GHG emissions, air pollution and water pollution[5,6] but also reduces the coal reserves of the country and the world, which is drastically reducing day by day[7].

Beside this, coal mining is also a potent source of methane (a GHG) emissions[8] and coal burning supports and funds the coal mining industry. Therefore, by choosing biomass as a fuel source instead of coal, the project owner is also discouraging coal mining and thereby avoiding emissions from coal mining process.

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[1] https://doi.org/10.1016/j.biombioe.2011.12.011
[2] https://coal.nic.in/en/major-statistics/coal-indian-energy-choice
[3] https://coal.nic.in/en/major-statistics/generation-of-thermal-power-from-raw-coal#:~:text=%E0%A4%95%E0%A5%8B%E0%A4%AF%E0%A4%B2%E0%A4%BE%20%E0%A4%AE%E0%A4%82%E0%A4%A4%E0%A5%8D%E0%A4%B0%E0%A4%BE%E0%A4%B2%E0%A4%AF%20Ministry%20of%20Coal&text=However%2C%20Major%20production%20of%20Electricity,by%20the%20Central%20Electricity%20Authority
[4] https://www.eia.gov/energyexplained/biomass/biomass-and-the-environment.php#:~:text=Burning%20either%20fossil%20fuels%20or,a%20carbon%2Dneutral%20energy%20source.
[5] https://www.ucsusa.org/resources/coal-and-water-pollution
[6] https://www.greenpeace.org/international/story/21524/3-ways-coal-is-depleting-the-worlds-water-resources/
[7] https://coal.gov.in/en/major-statistics/production-and-supplies
[8] https://www.carbonbrief.org/coal-mines-emit-more-methane-than-oil-and-gas-sector-study-finds/

By installing and commissioning the above project, the project owner aims to avoid 42,711tonnes of CO_2 equivalence of GHG emissions annually. Emission reductions shall be claimed by the project owner for both the thermal and electrical component of energy so generated from choosing biomass as a fuel instead of fossil fuel.

The project activity thus reduces 42,711t-CO_2e/annum greenhouse gas (GHG) emissions- by avoiding fossil fuel combustion.

The project activity, beside "Climate action' (i.e., SDG 13), addresses multiple other UN SDGs too. The list of the SDGs addressed through the Project is mentioned below:

SDG	The Project contributes to	Description of contribution
 **SDG 7: Affordable and Clean Energy**	Target: 7.1 Indicator: 7.1.2 Target: 7.2 Indicator: 7.2.1 Target: 7.a Indicator: 7.a.1 Target: 7.b Indicator: 7.b.1	Biomass fired cogeneration system is a GHG neutral system and by requesting submission of this project under UCR, the project owner is evidently seeking international cooperation to facilitate investment into clean energy infrastructure. Also, rice being cultivated year round, rice husk fired systems are considered as sources of renewable energy.
 **SDG 8: Decent work and Economic Growth**	Target: 8.4 Indicator: 8.4.1	By using renewable energy sources for economic productivity to achieve same outcomes at the process level- the project owner aims to decouple environmental degradation, global warming and climate crisis from economic productivity.
 **SDG 9: Industry, Innovation and Infrastructure**	Target: 9.4 Indicator: 9.4.1	The project directly contributes to abatement of carbon dioxide emissions.

 **SDG 12: Responsible Consumption and Production**	Target: 12.2 Indicator: 12.2.1 Target: 12.5 Indicator: 12.5.1 Target: 12.a Indicator: 21.a.1	Rice husks, unless otherwise channelized into projects like the one discussed in this document, do not find any major use elsewhere- and hence become waste products. Using rice husks help in repurposing of waste and also contributes to the share of renewable energy in the country and reduces footprint.
 **SDG 13: Climate Action**	Target: 13.2 Indicator: 13.2.2	Biomass based cogeneration systems reduce the GHG emissions of the planet at large.
 **SDG: 17 Partnership for the Goals**	Target: 17.3 Indicator: 17.3.1 Target: 17.7 Indicator: 17.7.1 Target: 17.9 Indicator: 17.9.1 Target: 17.16 Indicator: 17.16.1	Submission of this document in a global GHG reduction / removal standard, involving multiple agencies and partners across the globe, for bringing in sustainable financing through the credits that can be generated from the Project stands testimony.

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 helped to alleviate poverty in the area by creating employment opportunities for the local people during the construction, operation and maintenance phases and also through handling of biomass material to the project plant.
- By discouraging use of coal and thereby mining of coal, the project activity reduces the exposure of coal miners to dangerous working conditions and toxic work environments.

- **Environmental 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 paddy husk in this project activity does not result in net increase of GHG emissions.
- Project uses rice husk to generate thermal and electrical energy. In absence of the project activity, rice husk, a waste product of rice milling process, would have been left unused and dumped in the open which would cause pollution in surrounded areas.
- By not using coal, which is a common practice fuel in India[9] as well as Punjab[10], the Project Owner is avoiding the acid mine drainage and methane emissions due to coal mining.

- **Economic benefits:**
- Employment generation for the local population which results in economic wellbeing- including better health, better education, better standard of living, etc.
- 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.

- **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 energy in the region.

[9] https://coal.nic.in/en/major-statistics/coal-indian-energy-choice#:~:text=Coal%20is%20the%20most%20important,in%20the%20last%20four%20decades.
[10] https://cea.nic.in/wp-content/uploads/annual_reports/2021/CEAAnnualReport_final.pdf

A.3. Location of project activity >>

Country: India
District: S.A.S. Nagar, Mohali
Village: Sarsini, near Lalru
Tehsil: Dera Bassi
State: Punjab
Code: 140501

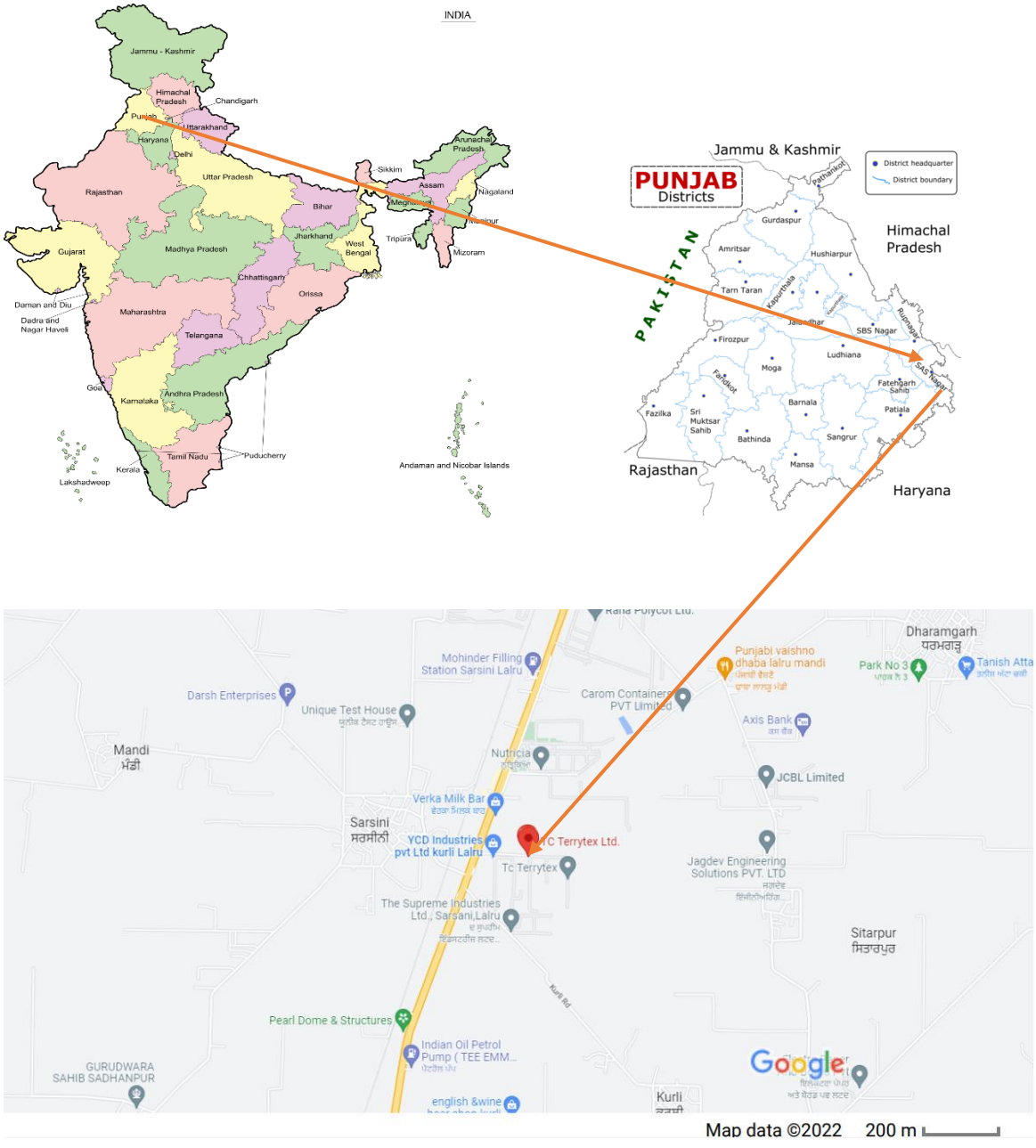

Figure 1: Location of the Project activity on the map (*the red balloon shows the Project Site***)**

A.4. Technologies/measures >>

The project activity entails establishment of a cogeneration facility involving commissioning of two biomass based boilers with a turbo-generator set, connected with one boiler to produce both steam and electricity. This electricity is used for captive consumption only. The turbine is connected with the 12 TPH boiler.

The entire system is fuelled using renewable biomass like rice husks sourced locally. By using locally sourced GHG-neutral biomass, the project owner is successfully able to avoid the fossil fuel and thereby GHG emissions due to in-house cogeneration energy requirements and also vehicular emissions due to sourcing of fuel from a large distance.

The technical details of the boiler and the turbo-generator set is mentioned as under:

Boiler technical details	Unit	Boiler 1	Boiler 2
Boiler rated capacity	TPH	8	12
Temperature of water entering boiler system (feed water temperature- boiler)	°C	100	100
Pressure of water entering boiler system (feed water pressure- boiler)	kg/cm^2	11.5	34
Temperature of steam coming out from boiler (steam temperature – boiler outlet)	°C	170	380
Pressure at which steam is coming out from the boiler (steam pressure- boiler outlet)	kg/cm^2	10.5	32

Table 1: Technical specifications of the boilers

Turbine technical details	Unit	Value
Type of turbine	Pressure losing turbine	
Turbine rated capacity	MW	0.286
Temperature at which steam is entering turbine (feed steam temperature- turbine)	°C	230
Pressure at which steam is entering turbine (feed steam pressure- turbine)	kg/cm^2	28
Quantity of steam entering the turbine	TPH	12
Quantity of steam exiting from the turbine	TPH	12

Temperature at which steam is exiting from turbine (steam temperature- turbine outlet)	°C	160
Pressure at which steam is exiting turbine (steam pressure- turbine outlet)	kg/cm^2	6

Table 2: Technical specifications of the turbine

Figure 2: Image of the turbine name-plate details at T. C. Terrytex Limited's Sarsini Plant

A.5. Parties and project participants >>

Party (Host)	Participants
India	Participant Name: **First Climate (India) Private Limited** Participant Type: **Aggregator** Participant Address: **Unit 903, ERGO Tower,** **Plot No.: A1-4, Block EP & GP,** **Sector V, Salt Lake,** **Kolkata- 700 091.**
India	Participant Name:

	T. C. Terrytex Limited Participant Type: **Developer** Participant Address: **Ambala Chandigarh Expressway,** **Behind Bhandari Export,** **Village Sarsini, Near Lalru,** **Tehsil Dera Bassi,** **District S.A.S. Nagar, Mohali,** **Punjab, India** **PIN: 140501**

Table 3: List of participants involved in this Project

A.6. Baseline Emissions>>

The baseline scenario identified at the PCN stage of the project activity is:

- Use of fossil fuel (which is primarily coal) in a coal-fired cogeneration system so as to meet both the steam and electricity requirements of process operations.

The baseline emission and project scenario is depicted in the diagram below:

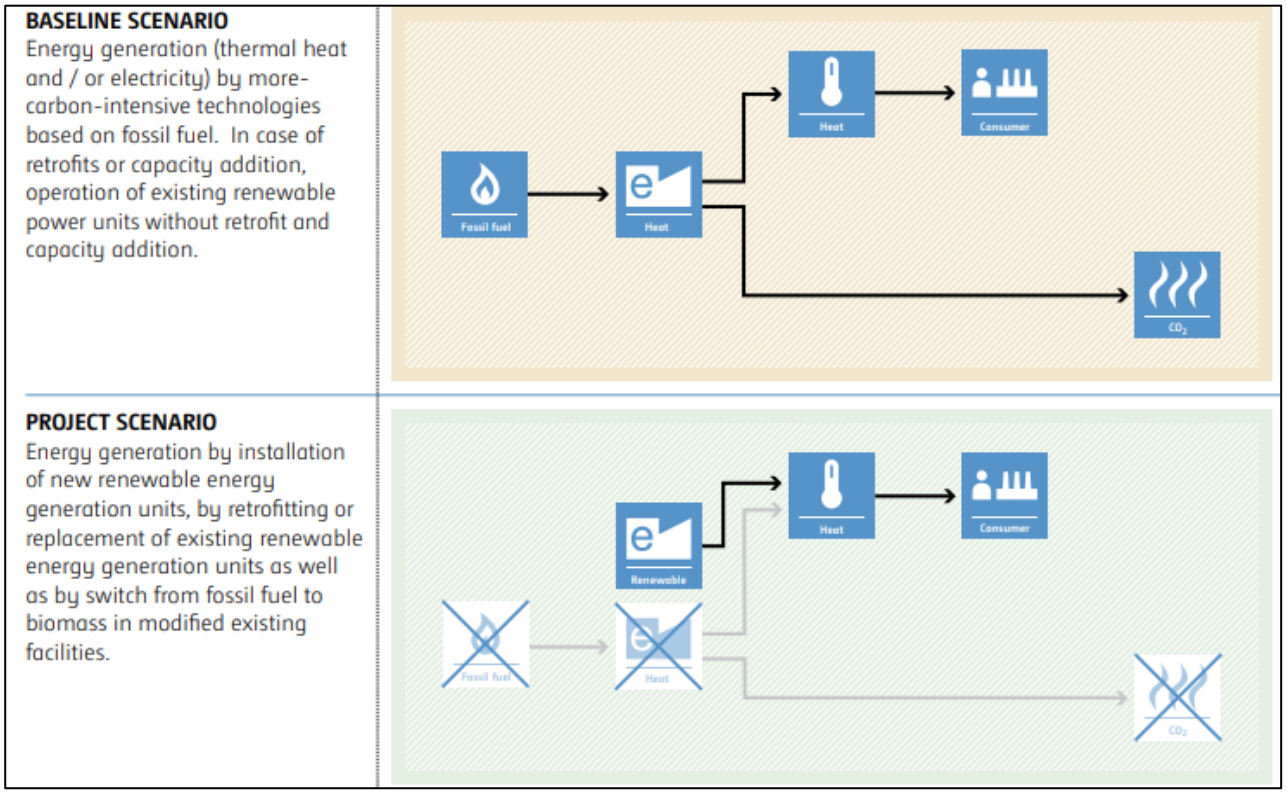

Figure 3: Image describing the project scenario and how is it different from the baseline scenario

(The diagram has been sourced from the CDM Methodology Booklet; with reference to AMS-I.C. Methodology)

A.7. Debundling>>

The concerned cogeneration project "Biomass fired cogeneration system in Sarsini of Punjab" of T. C. Terrytex Limited is not a debundled component of a larger project activity.

It is a standalone and independent project.

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. Small-scale Methodology
Thermal energy production with or without electricity (Version 22.0)
Clean Development Mechanism (CDM)

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

The project status is in line with the methodology AMS-IC, Version 22.0.

Applicability of AMS-I.C., Version 22: (Small scale Methodology- Thermal energy production with or without electricity)	**Project conformity with the given CDM methodology**
Biomass-based cogeneration and trigeneration systems are included in this category	**Applicable and Fulfilled** This condition applies to the project. The project meets and fulfils this applicability clause.
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** Clause (b) of the given applicability condition is fulfilled and met by the Project. Therefore, this condition applies to the Project.
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category.	**Not Applicable** There is no retro-fitting in this project. This is a greenfield exercise and this particular applicability clause does not apply to the Project.
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 a green field project and all the relevant guidelines has been applied.

<table>
<tr>
<td>The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal</td>
<td>Applicable and Fulfilled

This is a cogeneration project and the total rated thermal energy generation capacity of the boilers is 14.4 MWth which is less than 45 MW_{th} as shown in the following table:

<table>
<tr><td>Boiler capacity</td><td>12 TPH = 3.33 Kg/ sec</td></tr>
<tr><td>Enthalpy of steam (at 32 Kg /cm^2G (g) and 380ºC)</td><td>3181.30 KJ/ Kg = 3.20 MJ/Kg</td></tr>
<tr><td>Enthalpy of feed water (at 100ºC)</td><td>419.1 KJ /Kg = 0.42 MJ / Kg</td></tr>
<tr><td>Total thermal output from the 12 TPH boiler</td><td>3.33 * (3.20 – 0.42) MW_{th} = 9.26 MW_{th}</td></tr>
<tr><td>Boiler capacity</td><td>8 TPH = 2.22 Kg/ sec</td></tr>
<tr><td>Enthalpy of steam (at 10.5 Kg /cm^2G (g) and 170ºC)</td><td>2732.97 KJ/ Kg = 2.73 MJ/Kg</td></tr>
<tr><td>Enthalpy of feed water (at 100ºC)</td><td>419.1 KJ /Kg = 0.42 MJ / Kg</td></tr>
<tr><td>Total thermal output from the 8 TPH boiler</td><td>2.22 * (2.73 – 0.42) MW_{th} = 5.13 MW_{th}</td></tr>
<tr><td>Total thermal output from both the boilers</td><td>(9.26 + 5.13) MW_{th} = 14.39 MW_{th} ≈ 14.4 MW_{th}</td></tr>
</table>

Therefore, the proposed project meets and fulfils the prescribed criterion under this applicability clause.</td>
</tr>
<tr>
<td>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</td>
<td>Not Applicable

The proposed Project is not a co-firing energy generation system; hence this clause is not applicable to the given Project.</td>
</tr>
<tr>
<td>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</td>
<td>Applicable and Fulfilled

The project activity involves a biomass-based cogeneration system, which results in emission reductions from both the thermal and electrical energy generation.
The maximum installed energy generation capacity of the project activity is 14.4 MW_{th}, which is less than the limit of 45 MW_{th} as per the methodology used, hence this criterion is applicable for the project activity.</td>
</tr>
</table>

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; (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	
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	**Applicable and Fulfilled** This project activity is installation of a new captive cogeneration unit and does not involve the addition of renewable energy units at an existing renewable facility. The total rated thermal energy generation capacity of the boilers are 14.4 MWth which is less than 45 MW_{th} and within specified limits.
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 proposes to use rice / paddy husk and not briquette or any other derived biomass fuel. These paddy or rice husk is a natural biomass fuel for the boiler and is not derived from any other primary sources. Hence this clause is not applicable to the given Project.
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	**Not Applicable** The project so proposed does not intend to use any processed biomass as a fuel source and hence the given clause in its entirety does not apply to the Project.

solid biomass fuel production. Such a contract shall also ensure that there is no double-counting of emission reductions	
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 Project so proposed intends to use the generated thermal energy, stream and electrical energy for in-house captive use only. Hence, there is no provision of delivering the generated energy to any third party and hence all the mentioned concerns within this clause does not apply to the given Project.
If the project activity recovers and utilizes biogas for producing electricity 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.	**Not Applicable** The project neither targets biogas generation nor does it involve the use of biogas as a fuel source for energy generation purpose. Hence, the clause so mentioned here is not applicable to the given Project.
If project equipment contains refrigerants, then the refrigerant used in the project case shall have no ozone depleting potential (ODP)	**Not Applicable** The Project does not involve the use of any refrigerant within its boundaries and hence the given applicability clause is not fulfilled here. So, the concerns of the given applicability clause also do not apply for the project.
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	**Not Applicable** The proposed project is a biomass-fired captive cogeneration Project wherein rice husk collected from the agricultural produce is fed into the boiler system as a fuel. Therefore, the charcoal based biomass energy generation clause does not apply to the given Project.

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 of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.	
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 project is utilizating biomass residue and the project and leakage emission has been taken in to account in line with TOOL 16 at the relevant sections of the PCN

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

The project is owned by T. C. Terrytex Limited and this 8 TPH + 12 TPH cogeneration system project has not been considered for submission on any GHG (Greenhouse Gas) Reduction / Abatement standard or mechanism whatsoever.

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

Reading the methodology along with the project understanding, this cogeneration project boundary includes the storage facility for the biomass brought in from outside, both the boilers generating thermal energy, the turbine generating electric energy and process where the thermal and electrical is being utilized. The schematic diagram enclosing the project boundary is given as under:

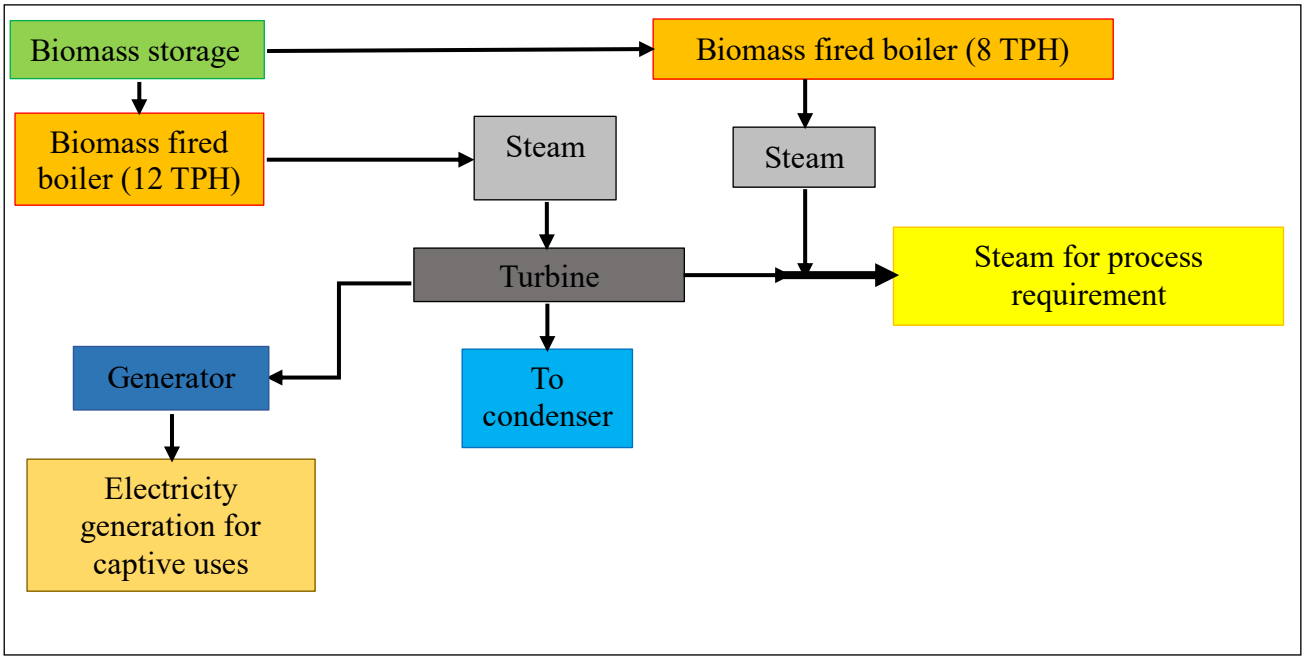

Figure 4: Schematic diagram of the project boundary

Latitude of the Project boundary: 30.4525 N
Longitude of the Project boundary: 76.7879 E

The geographic and physical boundary of the project is mentioned in the section A.3 of this document.

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	Emissions from burning fossil fuel like coal within project boundary	CO_2	Included	Major source of emission
		CH_4	Excluded	Not a major source of emission
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity		CO_2	Excluded	Biomass is considered as GHG or carbon neutral fuel, hence the emissions are not considered for the purpose of the project activity.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative

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

Paragraph 25 of the "General criteria on determining baseline emissions" (Section 5.2.1 of the Methodology), "*For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced*" mentions the baseline scenario.

Further, Paragraph 29 of Section 5.2.2 (Baseline scenario for electrical and/or thermal energy production) of the same methodology mentions:

"*Project activities producing both electricity and thermal energy shall use one of the following baseline scenarios:*

(a) Electricity is imported from a grid and thermal energy is produced using fossil fuel;

(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;

(c) A combination of (a) and (b);

(d) Electricity and thermal energy are produced in a cogeneration or trigeneration unit using fossil fuel (with a possibility of export of electricity to a grid/other facilities and/or thermal energy to other facilities);

(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;

(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;

(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);

(h) Electricity and/or thermal energy produced in a co-fired system;

(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);

(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."

And in paragraph 30 it is stated that "*The scenario mentioned in paragraph (g) 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*", while in Paragraph 30 it is noted that "*This scenario mentioned in paragraph (i) to a project activity that installs a new biomass cogeneration or trigeneration system that displaces electricity which otherwise would have been imported from a grid*."

As the project owner requires both steam and electricity, it becomes evident that the baseline scenario involves the use of common practice fuel (here, coal) to produce stream in-house (as there is no public / private commercial supply of steam available) and co-generate electricity from the same thermal energy source. **Therefore, (d) (as per Paragraph 29 of the AMS-I.C. CDM Methodology) becomes the baseline scenario in this case.**

In the same Methodology, Section 5.2.6 gives the formula for the "*Baseline emissions for electricity and heat production*", wherein, in Paragraph 39, it is stated:

"*For electricity and thermal energy produced in a baseline cogeneration or trigeneration unit, using fossil fuel (case (d)), the following equation shall be used to determine baseline emissions:*

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

Where:

$BE_{cogen/trigen,CO2,y}$	=	*Baseline emissions from electricity and thermal energy displaced by the project activity during the year y (t CO_2)*
$EG_{PJ,electrical,y}$	=	*Amount of electricity supplied by the project activity during the year y; (GWh)*
3.6	=	*Conversion factor (TJ/GWh)*
$EG_{PJ,thermal,y}$	=	*Net quantity of thermal energy supplied by the project activity during the year y (TJ)*
$EF_{FF,CO2}$	=	*CO_2 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, IPCC default emission factors can be used (t CO_2/TJ)*
$\eta_{BL,cogen/trigen}$	=	*Total annual average efficiency of the cogeneration or trigeneration plant using fossil fuel determined as per paragraph 0 or 0 below"*

And, in Paragraph 40 it is stated:

"*In the case of an existing baseline cogeneration or trigeneration plant, the efficiency shall be calculated as the total annual energy produced over the last three years using the historical data as prescribed in paragraph* ***Error! Reference source not found.*** *above (total electricity generated and total thermal energy extracted divided by the thermal energy value of the fuel use)."*

Meanwhile, in Paragraph 41 it is stated:

"*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;[11]

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."

In case of this project activity, option (b) has been considered; wherein under step i) the default steam turbine efficiency has been considered as 100% and then under step ii), the total annual average efficiency of the cogeneration activity using fossil fuel has been calculated as the product of the default efficiency value for the steam turbine and the default efficiency of the steam boiler, as both efficiency values are in the form of a percentage.

Also, as only the 12 TPH boiler is connected to the electricity generation unit (turbo-generator set) and the 8 TPH boiler supplies steam directly to the process, we shall also use the third equation of the Methodology, mentioned in Paragraph 34 of AMS-I.C. document:

[11] In case equipment is not available within the region the project proponent shall consider adjoining regions.

"*For thermal energy produced using fossil fuels and/or grid electricity the baseline emissions are calculated as follows:*

$$BE_{thermal,Co2,y} = \left(\frac{EG_{thermal,y}}{\eta_{BL,thermal}}\right) \times EF_{FF,CO2}$$

Where:

$BE_{thermal,Co2,y}$ = *Baseline emissions from thermal energy displaced by the project activity during the year y (t CO_2)*

$EG_{thermal,y}$ = *Net quantity of thermal energy supplied by the project activity during the year y (TJ)*

$EF_{FF,CO2}$ = *CO_2 emission factor of the fossil fuel that would have been used in the baseline plant obtained from reliable local or national data if available, alternatively, IPCC default emission factors can be used (t CO_2/TJ)*

$\eta_{BL,thermal}$ = *Efficiency of the plant using fossil fuel that would have been used in the absence of the project activity determined as per paragraph 0 or 0 0 above*"

Ex-ante calculation of baseline emissions:

- For the 8 TPH boiler directly supplying steam to the process:

Baseline Emission: $BE_{thermal,CO2,y} = (EG_{thermal,y} / \eta_{BL,thermal}]*EF_{FF,CO2}$		
Steam output from Boiler	tph	8
Operating days	days	340
Operating hours	hours	24
Efficiency of boiler using coal ($\eta_{BL,thermal}$)	%	85%
Coal emission factor ($EF_{FF,CO2}$) (considering mixed power plant)	tCO_2/TJ	96.1
Enthalpy of Feed Water entering into Boiler	kJ/kg	419.1
Enthalpy of steam at boiler outlet (at 10.5 kg/cm^2)	kJ/kg	2781.14
Net thermal energy output ($EG_{thermal,y}$)	TJ/year	154.19
Baseline emission ($BE_{thermal, CO2, y}$)	tCO_2/year	17433

- For the 12 TPH boiler supplying steam to process via TG set:

Baseline Emission: $BE_{cogen,CO2,y} = [(EG_{PJ,thermal,y} + EG_{PJ,electrical,y}*3.6)/\eta_{BL,cogen}]*EF_{FF,CO2}$		
Process steam from 12 TPH Boiler	TPH	11.5
No. of operating hours	hr/Yr.	8160
Enthalpy of extracted bleed steam (E_{Steam})	kJ/kg	2762.12
Feed water enthalpy (E_{FW})	kJ/kg	419.1
$EG_{PJ, thermal, y} = (Q_{Steam} \times (E_{Steam} - E_{FW}))$	TJ/annum	219.87
Electrical capacity	MW	0.286
Electricity generation	GWh/annum	2.33
Conversion factor	TJ/GWh	3.6
$EG_{PJ, electrical, y}$	TJ/annum	8.388
$\eta_{BL,cogen}$	%	85.00

Coal emission factor ($EF_{FF,CO2}$) (considering mixed power plant)	tCO_{2e}/TJ	96.1
$BE_{cogen,CO2,y}$ (for 12 TPH Boiler + 0.286 MW turbine)	tCO_{2e}/Year	25808

Now, as per the same methodology, the Project Emissions and Leakage Emissions must be accounted for and deducted from the total number of credits that can be generated on the baseline scenario.

As per Section 5.3.5, "Project emissions associated with biomass and biomass residue", in Paragraph 78 it is mentioned:

"*$PE_{Biomass,y}$ shall be determined by applying the provisions form the TOOL16, including the simplifications for small-scale and microscale project activities, and involve the following emission sources:*

(a) Project emissions resulting from the cultivation of biomass in a dedicated plantation of a CDM project activity that uses biomass (PE_{BC});

(b) Project emissions resulting from the transportation of biomass (PE_{BT});

(c) Project emissions resulting from the processing of biomass (PE_{BP});

(d) Project emissions resulting from the transportation of biomass residues (PE_{BRT}), if the project consumes biomass residues;

(e) *Project emissions resulting from the processing of biomass residues (PE_{BRP}), if the project consumes biomass residues*."

In this case:

- Clause (a) does not apply as the rice husk is not obtained from any dedicated plantation
- Clause (b) is minimal, as the rice husk is sourced from nearby rice mills with little transportation. However, as per paragraph 31 under Section 5.2 of the given methodology, one must "*For microscale and small-scale project activities, apply a default emission factor of 0.0142 tCO2/tonne of biomass*". Therefore, the project emissions are as follows:

Description	**Unit**	**Quantity**
Quantity of dry biomass residues consumed in 8 TPH boiler	MT / year	15,300
Quantity of dry biomass residue consumed in 12 TPH boiler	MT / year	22,000
Total quantity of dry biomass residue used in the project activity	Tonne / year	37,300
Default emission factor	tCO_2 / tonne	0.0142
Default emissions of the project activity from transportation of biomass residue	tCO_2 / year	530

- The rice husks so used is unprocessed and hence clause (c) does not apply
- The project uses the rice husks in entirety obtained from nearby mills, hence, clause (d) is neglected

- The Project does not involve processing rice husks, hence, clause (e) does not apply too.

Hence, for this project, Project Emissions is only considered for biomass residue transportation.

Therefore, $\mathbf{PE_y = 530\ tCO_2 / year}$

For Leakage Emissions, in Paragraph 79 to 81, under Section 5.4 of the Methodology document it is observed:

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

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[12] *as leakage.*

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."

For the concerned Project:

- The "energy generating equipment" is positioned within plant premises and project boundary and not been transferred from outside boundary.
- There is no involvement of refrigerant displacement in the given project boundary
- As per paragraph 49 under Section 6.2 "Leakage due to diversion of biomass residues from other applications in year y ($LE_{BR,Div,y}$)" of TOOL 16:

  "*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.*"

As already pointed out in section A.1 of this document, there is a surplus availability of rice husks and other renewable biomass resources in Punjab and the areas surrounding the Project activity, even if there is a competing application of rice husk, there is no compromise because of the overabundance of the said renewable energy resource.

[12] The global warming potentials used to calculate the carbon dioxide equivalence of anthropogenic emissions by sources of greenhouse gases not listed in annex A of the Kyoto Protocol, shall be those accepted by the Intergovernmental Panel on Climate Change in its third assessment report.

Hence, with regards to the Project, the leakage emissions can be safely considered to be zero (LE_y = 0).

Using the formula for emission reduction given in the Methodology,

"*Emission reductions are calculated as follows:*

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = *Emission reductions in year y (t CO_2e)*

BE_y = *Baseline emissions in year y (t CO_2e)*

PE_y = *Project emissions in year y (t CO_2)*

LE_y = *Leakage emissions in year y (t CO_2)*"

Therefore;

Emission Reduction: $ER_y = BE_Y - PE_Y - LE_Y$		
BE_y (from 8 TPH boiler)	tCO_{2e}/Year	17433
BE_y (from 12 TPH boiler)	tCO_{2e}/Year	25808
BE_y (total)	tCO_{2e}/Year	43241
PE_y (project emission)	tCO_{2e}/Year	530
LE_y (leakage emission)	tCO_{2e}/Year	0
ER_y (Emission reduction)	**tCO_{2e}/Year**	**42711**

Therefore, estimated Annual or Total baseline emission reductions (*BE_y*) = 42,711 CoUs / year (42,711 tCO_{2eq}/yr)

B.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits for the said crediting period.

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, 9 months – 01/01/2013 to 30/09/2022

B.8. Monitoring plan>>

The following parameters are used for baseline emission calculations and are fixed ex-ante:

Data/Parameter	$\eta_{BL,thermal}$
Data unit	%
Description	Efficiency of the 8 TPH boiler supplying only thermal energy to the process
Source of data Value(s) applied	Default 85%
Measurement methods and procedures	Not applicable
Monitoring frequency	The value is fixed for the entire crediting period
Purpose of data	To calculate baseline emissions

Data/Parameter	$\eta_{BL,cogen}$
Data unit	%
Description	Efficiency of the boiler supplying both thermal energy and electrical energy to the process
Source of data Value(s) applied	Default 85%
Measurement methods and procedures	Not applicable
Monitoring frequency	The value is fixed for the entire crediting period
Purpose of data	To calculate baseline emissions

Data/Parameter	$EF_{FF,CO2}$
Data unit	$tCO_{2\ equivalent}$ / TJ

Description	The CO_2 emission factor per unit of energy of the fuel (coal) that would have been used in the baseline plant
Source of data	Default, as provided by IPCC in 2006 guidelines.
Value(s) applied	96.1
Measurement methods and procedures	Not applicable
Monitoring frequency	The value is fixed for the entire crediting period
Purpose of data	To calculate baseline emissions

Data/Parameter	$EF_{transport,CO2}$
Data unit	$tCO_{2\ equivalent}$ / MT
Description	The CO_2 emission factor per MT of fuel transported.
Source of data	Default, as per Tool 16.
Value(s) applied	0.0142
Measurement methods and procedures	Not applicable
Monitoring frequency	The value is fixed for the entire crediting period
Purpose of data	To calculate project emissions

The following parameters shall be monitored for estimation and calculation of CoUs:

Data / Parameter:	$EG_{PJ,\ electrical,\ y}$
Data unit:	MWh/year
Description:	Amount of electricity supplied by project activity in an year y
Source of data:	Onsite measurement
Measurement procedures (if any):	Measurement would be done by installing 3 phase energy meter at HT side or LT side of generation end.
Monitoring frequency:	Continuous monitoring with energy meters. Recording and archiving maybe periodic in an electronic format or manually.
QA/QC procedures:	Installed energy meter would be as per national or IEC standard. Calibration would be carried out once in every five years.
Any comment:	Generation data would be archiving electronically up to 2 years from the end of crediting period.

Data / Parameter:	T_{FW1}
Data unit:	°C
Description:	Average temperature of feed water at 8 TPH boiler inlet.
Source of data:	Onsite Measurement
Measurement procedures (if any):	Measurement would be done by installed thermometer.
Monitoring frequency:	Continuous monitoring with thermometers. Recording and archiving maybe periodic in an electronic format or manually.
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:	T_{FW2}
Data unit:	°C
Description:	Average temperature of feed water at 12 TPH boiler inlet.

Source of data:	Onsite Measurement
Measurement procedures (if any):	Measurement would be done by installed thermometer.
Monitoring frequency:	Continuous monitoring with thermometers. Recording and archiving maybe periodic in an electronic format or manually.
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_{FW1}
Data unit:	KJ / kg
Description:	Average enthalpy of feed water at 8 TPH boiler inlet.
Source of data:	Steam Table
Measurement procedures (if any):	N/A
Monitoring frequency:	Monitoring procedure: Continuously from measured temperature of feed water. Data Type: Calculated Archiving method: Electronic
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:	E_{FW2}
Data unit:	KJ / kg
Description:	Average enthalpy of feed water at 12 TPH boiler inlet.
Source of data:	Steam Table
Measurement procedures (if any):	N/A
Monitoring frequency:	Monitoring procedure: Continuously from measured temperature of feed water. Data Type: Calculated Archiving method: Electronic
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:	$Q_{stream1}$
Data unit:	MT / year
Description:	Extracted steam from 8 TPH boiler supplied to process plant in the year y
Source of data:	Onsite Measurement
Measurement procedures (if any):	Net steam delivered = Present Reading – Previous Reading Archiving method: Electronic
Monitoring frequency:	Monitoring procedure: Daily from installed Steam flow meter. Data Type: Calculated Calculation method: Calculated by subtracting previous reading from present reading of steam flow meter reading.
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:	$Q_{stream2}$
Data unit:	MT / year
Description:	Extracted steam from turbine supplied to process plant in the year y
Source of data:	Onsite Measurement
Measurement procedures (if any):	Net steam delivered = Present Reading – Previous Reading Archiving method: Electronic
Monitoring frequency:	Monitoring procedure: Daily from installed Steam flow meter. Data Type: Calculated Calculation method: Calculated by subtracting previous reading from present reading of steam flow meter reading.
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 to be done by installed pressure gauge
Monitoring frequency:	Monitoring procedure: Daily from installed pressure gauge. Data Type: Calculated Recording frequency: Daily Average Archiving method: Electronic
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 calculate steam bleed enthalpy

Data / Parameter:	$E_{stream1}$
Data unit:	KJ / kg
Description:	Enthalpy of extracted steam from 8 TPH boiler
Source of data:	Steam Table
Measurement procedures (if any):	N/A
Monitoring frequency:	Monitoring procedure: Continuous. Data Type: Calculated Recording frequency: Daily Average / monthly average Archiving method: Electronic
QA/QC procedures:	Not Applicable
Any comment:	To calculate steam enthalpy

Data / Parameter:	$E_{stream2}$
Data unit:	KJ / kg
Description:	Enthalpy of extracted steam from 12 TPH boiler
Source of data:	Steam Table
Measurement procedures (if any):	N/A
Monitoring frequency:	Monitoring procedure: Continuous. Data Type: Calculated Recording frequency: Daily Average / monthly average Archiving method: Electronic
QA/QC procedures:	Not Applicable
Any comment:	To calculate steam enthalpy

Data / Parameter:	$B_{biomass, y}$
Data unit:	Tonne / year
Description:	Quantity (dry basis) of biomass (rice husk) 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. Net biomass consumption can be calculated by subtracting closing stock of biomass from opening stock of biomass.
Monitoring frequency:	Monitoring procedure: for each batch of purchased biomass. Data Type: Measured Recording frequency: Daily / Monthly Average Archiving method: Electronic
QA/QC procedures:	Consumption of biomass can be cross checked by comparing purchased quantity from invoices and by conducting energy balance.
Any comment:	

Data / Parameter:	GCV_k
Data unit:	kCal / Kg
Description:	Gross calorific value of biomass combusted in year y
Source of data:	Laboratory Test report
Measurement procedures (if any):	Value can be obtained by testing the biomass sample from third party lab.
Monitoring frequency:	Measuring procedure: Quarterly for first year of the crediting period. Data Type: Calculated Archiving method: Electronic
QA/QC procedures:	Biomass sample would be sent to external lab for testing. Testing would be done quarterly for first crediting period. Average of the measured GCV of first crediting period would be fixed for entire crediting period.
Any comment:	To calculate energy generation