PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

Title: Exporting green electricity to the grid from biomass fired cogeneration at Rauzagaon

Version 1.0

Date 01/06/2023

First CoU Issuance Period: 10 years, 0 months

Date: 01/01/2013 to 31/12/2022

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

BASIC INFORMATION	
Title of the project activity	Exporting green electricity to the grid from biomass fired cogeneration at Rauzagaon
Scale of the project activity	Large Scale
Completion date of the PCN	01/06/2023
Project participants	Balrampur Chini Mills Limited (Owner) First Climate (India) Private Limited (Aggregator)
Host Party	INDIA
Applied methodologies and standardized baselines	CLEAN DEELOPMENT MECHANISM (CDM) Approved Consolidated Methodology ACM0006: Electricity and heat generation from biomass, Version 16.0
Sectoral scopes	SELECT SCOPE Sectoral Scope: 01 Energy industries (renewable - / non-renewable sources)
Estimated amount of total GHG emission reductions	146,289 CoUs / year (146,289 tCO_{2eq}/ year)
	1,462,890 CoUs for the first credit issuance period

SECTION A. Description of project activity

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

The project titled "Exporting green electricity to the grid from biomass fired cogeneration at Rauzagaon" is located in Village Rauzagaon, Tehsil Rudauli, District Ayodhya (and Barabanki), State Uttar Pradesh, Country India.

The project is located in the border areas of both Ayodhya and Barabanki districts; wherein the cogeneration system is present within Ayodhya and the 132 KV sub-station supplying electricity to the grid is located in Barabanki district.

The details of the registered project are as follows:

Purpose of the project activity:

The project activity includes the installation of two biomass-fired boiler, one of 70 TPH and another of 75 TPH capacity each, in Rauzagaon Village of Uttar Pradesh, India for generation of thermal energy as well as electricity. For the purpose of generating electricity, a 25.75 MW turbine is connected to the biomass-fired boilers, the biomass primarily being bagasse. The project activity is commissioned to simultaneously generate steam for meeting the process requirements, as well as to run the turbine and thereby produce electricity.

As the Rauzagaon plant so mentioned herein is a sugar mill, it produces enough bagasse as its own process waste. This carbon-neutral process waste is used to fuel the cogeneration system. However, excess electricity produced by the plant, more than its process requirements is exported to the regional grid, which is ultimately connected to the national grid. Emission reduction / avoidance credits shall be claimed by this project only for the part of the electricity being exported to the grid.

The project activity replaces non-renewable energy sources (i.e., fossil fuels) with renewable energy sources like biomass. The preferred biomass for the project activity is bagasse, which is available in plenty as it is the industry's own process waste. However, other such surplus biomass or agri-waste may be used too.

In absence of this project activity and non-availability of green power in the grid, the national / regional grid would have likely met equivalent amount of its electrical energy requirements from fossil fuel like coal, as coal is the fuel of choice in India all across[1,2].

Thereby, by exporting biomass fuelled electricity to the grid, the project owner is reducing the use and dependence on coal as a fuel source and thereby avoiding GHG emissions from coal burning. Also biomass being GHG- neutral substance[3], therefore; there is a net-positive impact of the use of biomass fired cogeneration system upon the environment. Burning coal not only causes GHG

[1] https://coal.nic.in/en/major-statistics/coal-indian-energy-choice
[2] 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
[3] https://www.eia.gov/energyexplained/biomass/biomass-and-the-environment.php#:~:text=Burning%20either%20fossil%20fuels%20or,a%20carbon%2Dneutral%20energy%20source.

emissions, air pollution and water pollution[4,5] but also reduces the coal reserves of the country and the world, which is drastically reducing day by day[6]. The project aims to increase the percentage of renewable energy in the country's total energy mix.

Beside this, coal mining is also a potent source of methane (a GHG) emissions[7] and coal burning supports and funds this coal mining. Therefore, by choosing green power instead of coal, the project owner is also discouraging emissions from coal mining process.

By exporting electricity to the grid, the project owner aims to avoid 146,289 tonnes of CO_2 equivalence of GHG emissions annually. Emission reductions shall be claimed by the project owner for the quantity of electricity so exported to the grid by burning surplus carbon-neutral biomass- a green fuel source.

Commissioned on 17th October, 2007; the crediting period of the project shall start from the 1st day of 2013, i.e., 01/01/2013.

The project activity thus reduces 146,289 t-CO_2e/annum greenhouse gas (GHG) emissions- by avoiding fossil fuel combustion which would have otherwise taken place at power generating stations for supplying equivalent quantity of electricity to the grid.

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	The electricity being exported to the grid is carbon-neutral, as it fired by renewable biomass. This increases the access to green power for people connected to the grid. Also, this increases green-power generation establishments and infrastructure within the nation. The project activity builds reliance on clean fuel and technology, beside increasing the renewable energy share in the total final energy consumption of the country. By requesting submission of this project under UCR, the project owner is evidently seeking international

[4] https://www.ucsusa.org/resources/coal-and-water-pollution
[5] https://www.greenpeace.org/international/story/21524/3-ways-coal-is-depleting-the-worlds-water-resources/
[6] https://coal.gov.in/en/major-statistics/production-and-supplies
[7] https://www.carbonbrief.org/coal-mines-emit-more-methane-than-oil-and-gas-sector-study-finds/

		cooperation to facilitate investment into clean energy infrastructure.
 **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	Biomass like bagasse is a process waste. By repurposing it as a fuel for energy generation, a circularity is established, thereby reducing material footprint. Had this electricity been not supplied to the grid, grid would have made up for its own requirements from other sources, mostly coal, increasing carbon footprint in that process. The efficient use of natural resources is ensured by recycling waste. This project also increases installed renewable energy-generating capacity in developing countries, like India
 **SDG 13: Climate Action**	Target: 13.2 Indicator: 13.2.2	Carbon neutral biomass is used as a fuel for generating energy which reduces the GHG emissions of the planet at large.

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:**
- By discouraging use of coal powered electricity and thereby mining of coal, the project activity reduces the exposure of coal miners to dangerous working conditions and occupational health hazards caused by chronic exposure to the mining environment[8,9].
- When industries adopt green practices, the optimistic news spreads across all layers of society, creating more awareness about adopting sustainable measures for a better future. A ripple is created.

- **Environmental benefits:**
- This project increases the ratio of green electricity availability in India's energy mixture.
- This project combats fossil fuel burning at electricity generating stations and therefore leads to Greenhouse Gas (GHG) emission avoidance
- By not encouraging coal fed electricity, which is a common practice fuel in India[10] as well as within the state of Uttar Pradesh[11], the Project Owner is avoiding the incidence of acid mine drainage[12,13] and methane emissions[14,15] which occurs due to coal mining.

- **Economic benefits:**
- The project activity promotes circular economy and effective utilisation of wastes, thereby increasing the resource efficiency of the country / region and also promoting wealth / economic value generation from waste. This also reduces demand for fresh natural resources, thereby preserving it for future exigencies.
- The more there is establishment of green infrastructure and installation of facilities that promote green economy, the more it brings down prices for the next unit (i.e., marginal cost), promoting economies of scale.

- **Technological well-being:**
- The technology facilitating use of biomass material for cogeneration is environmentally safe and not difficult to operate, compared to non-renewable energy utilizing facility of similar kind.
- 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.

[8] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2395565/
[9] http://niohenvis.nic.in/newsletters/vol13_no2_Health_Hazards_in_workers_of_the_mining_industry_in_INDIA.pdf
[10] https://coal.nic.in/en/major-statistics/coal-indian-energy-choice#:~:text=Coal%20is%20the%20most%20important,in%20the%20last%20four%20decades.
[11] https://cea.nic.in/wp-content/uploads/annual_reports/2021/CEAAnnualReport_final.pdf
[12] https://eprints.nmlindia.org/4093/1/158.pdf
[13] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/acid-mine-drainage#:~:text=Acid%20mine%20drainage%20describes%20a,and%20precipitation%20of%20ferric%20hydroxide.
[14] https://www.carbonbrief.org/coal-mines-emit-more-methane-than-oil-and-gas-sector-study-finds/
[15] https://insideclimatenews.org/news/15032022/coal-mining-methane/

A.3. Location of project activity >>

Country: India
District: Ayodhya (and Barabanki)
Village: Rauzagaon
Tehsil: Rudauli
State: Uttar Pradesh
Code: 224116

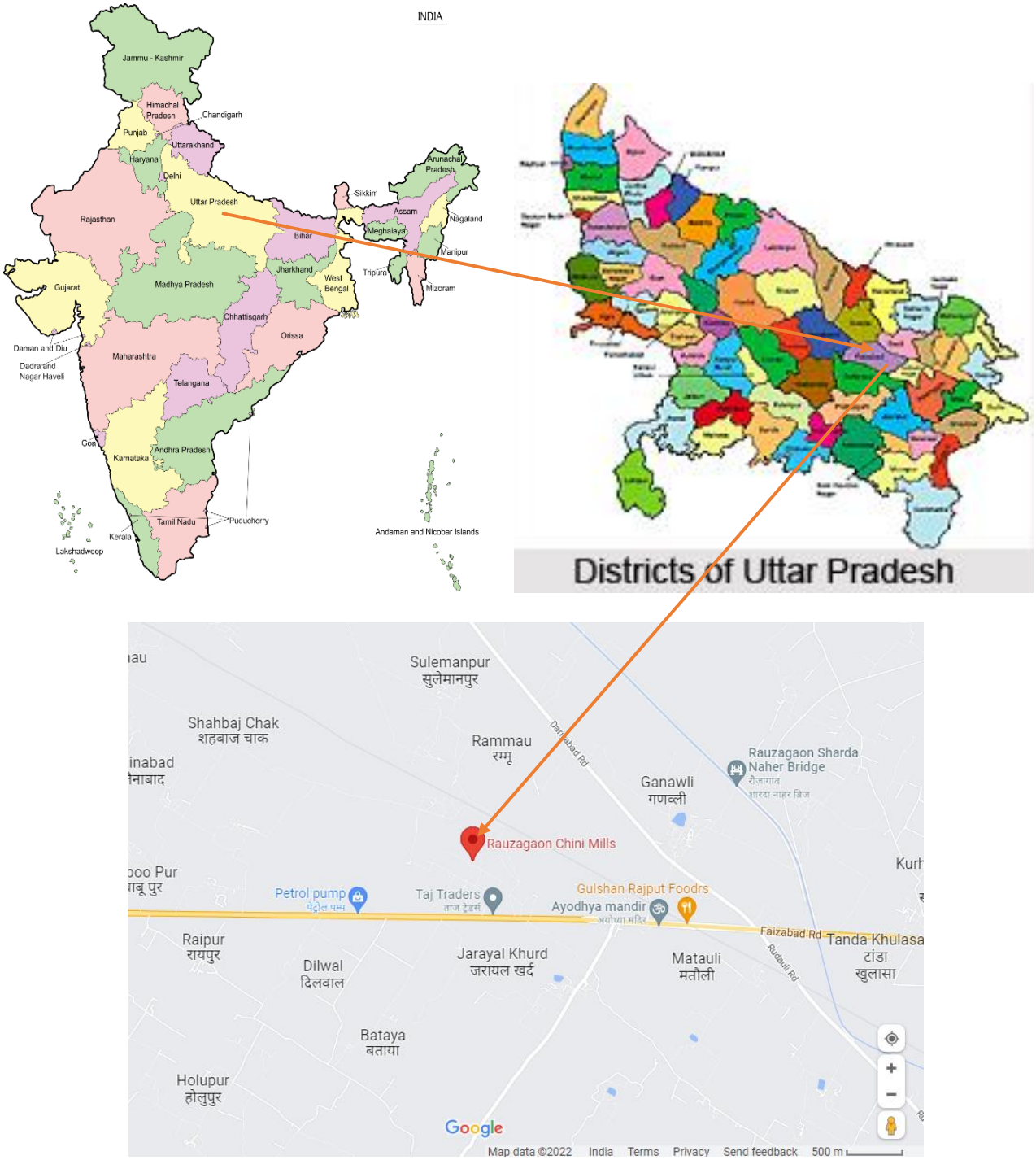

Figure 1: Location of Rauzagaon Chini Mills on the map, indicated by the red balloon. The plant is owned by Balrampur Chini Mills Limited.

A.4. Technologies/measures >>

The project activity includes a cogeneration facility where two boilers, 70 TPH and 75 TPH, are fired using bagasse, produced as a process waste of the plant. Using a common header, the boilers supply steam to a turbo-generator set of 25.75 MW capacity- to produce both steam and electricity. The electricity so produced by this system is in excess of process requirements and the excess amount of electricity, which is not used by the plant itself is exported to the grid.

The entire system is fuelled using renewable biomass like bagasse which is produced by the sugar mill as a process waste. Since the industry is using its own process waste to generate energy, emission reduction / carbon offset units shall be only claimed for the electricity being exported to the grid.

The plant being a sugar mill, it has a seasonal operation cycle. Since sugarcane (the parent product of sugar) is harvested only once a year, depending on the quantity of sugarcane available and the harvesting period of the sugarcane, the 'season' of the plant operation can be anytime between November to April usually, varying between 150 to 180 days. The plant remains operational for six to seven days more to complete the process of sugar manufacturing. The rest of the period in a year is 'off-season' for the sugar mill.

The Uttar Pradesh Power Corporation Limited (UPPCL) has a power purchase agreement (i.e., PPA) signed with Rauzagaon Chini Mills ratified in 2007; wherein the project shall supply a maximum of 16 MW of bagasse powered electricity to UPPPCL during 'season' and a maximum of 23 MW electricity during 'off-season'[16]. The electricity to be so provided to UPPCL shall be surplus power, up and above the consumption due to process requirements of the plant.

In case this carbon-neutral fuel powered electricity would not have been made available to the grid, the grid would have made up for its requirement anyway by obtaining electricity from other sources, which would have been primarily coal-fed, as coal is the most rampantly used fuel in power generation across India. Therefore, by supplying renewable electricity to the grid, the project is contributing to increase the renewable energy share in India's total energy mixture and also avoiding GHG emissions caused by burning of fossil fuels for generating equivalent quantity of electricity for grid supply.

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

Boiler technical details	Unit	Boiler 1	Boiler 2
Boiler rated capacity	TPH	70	75
Feed water temperature - boiler inlet	°C	105	105
Steam temperature – boiler outlet	°C	480	480
Steam pressure- boiler outlet	kg/cm^2	64	64

Table 1: Technical specifications of the boilers

[16] https://www.upenergy.in/uppcl-pdf/Rauzagaun-Chinni-Mills-Balrampur.pdf

Turbine technical details	Unit	Value
Type of turbine	Multi-stage turbine	
Turbine rated capacity	MW	25.75
Steam temperature- turbine inlet	°C	480
Steam pressure- turbine inlet	kg/cm^2	64
Quantity of steam entering the turbine	TPH	140.43
Quantity of steam exiting from the turbine (to process)	TPH	115
Extraction steam pressure- turbine outlet (third stage)	kg/cm^2	1.1

Table 2: Technical specifications of the turbine

Though the above technicalities define the cogeneration system in use, carbon offset units (CoUs) shall be only claimed against the quantity of electricity exported to the grid. The cogeneration system shall be fuelled using biomass like carbon-neutral bagasse, available in plenty as a process waste of the plant operations and hence need not be procured from outside.

The CoUs shall be calculated for the export of electricity to the grid during both the 'season' (a maximum of 16 MW electricity) and 'off-season' (a maximum of 23 MW electricity) periods of a year.

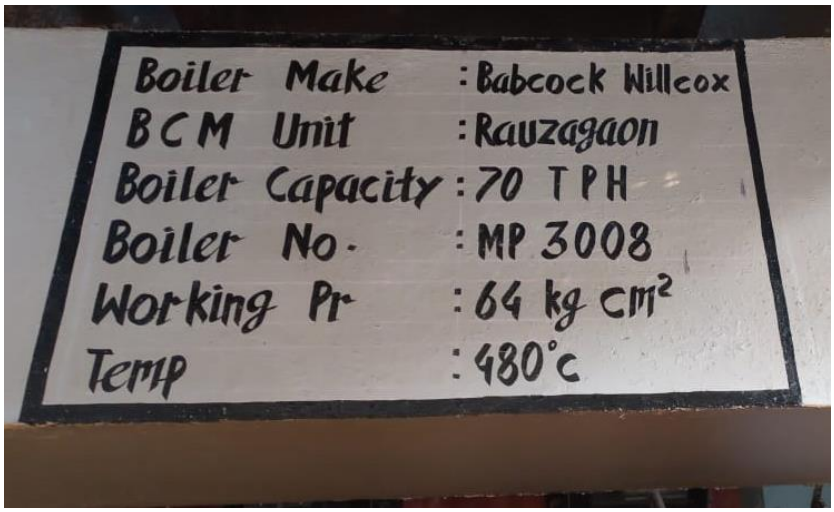

Figure 2: Brief technical specifications of the 70 TPH boiler operational within Rauzagaon Chini Mill

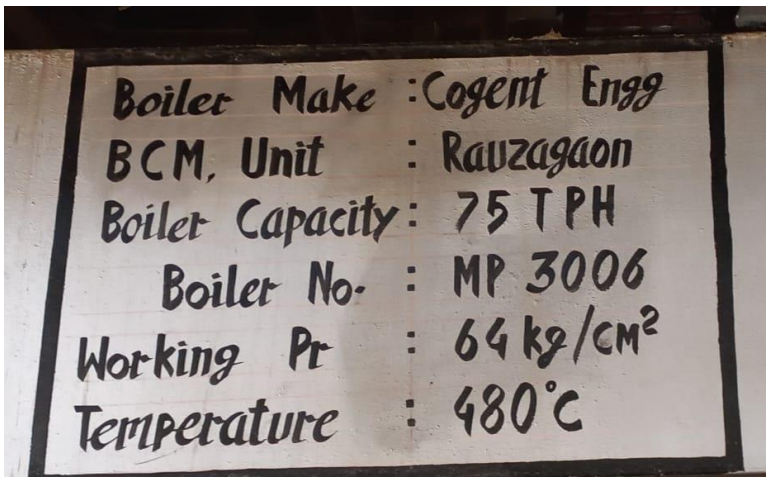

Figure 3: Brief technical specifications of the 75 TPH boiler installed at Rauzagaon Chini Mill

Figure 4: Nameplate details of the multi-stage steam turbine operating within the project discussed in this PCN.

A.5. Parties and project participants >>

Party (Host)	Participants
India	1. **Owner of the Project**: **Balrampur Chini Mills Limited**, Registered Address: **2nd Floor, FMC Fortuna,** **234/3A, A. J. C. Bose Road,** **Kolkata, West Bengal, India.** **PIN: 700 020.** 2. **Aggregator of the Project**: **First Climate (India) Private Limited**, Registered Address: **Unit: 903, ERGO Tower,** **Plot No.: A1-4, Block EP & GP,** **Sector V, Salt Lake,** **Kolkata, West Bengal, India.** **PIN: 700 091.**

A.6. Baseline Emissions>>

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

- Had the project not supplied the electricity sourced from renewable resources (i.e., biomass like bagasse) to the grid, the grid would have anyway made up for its requirements by sourcing the electricity mostly from coal-powered thermal power stations.

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

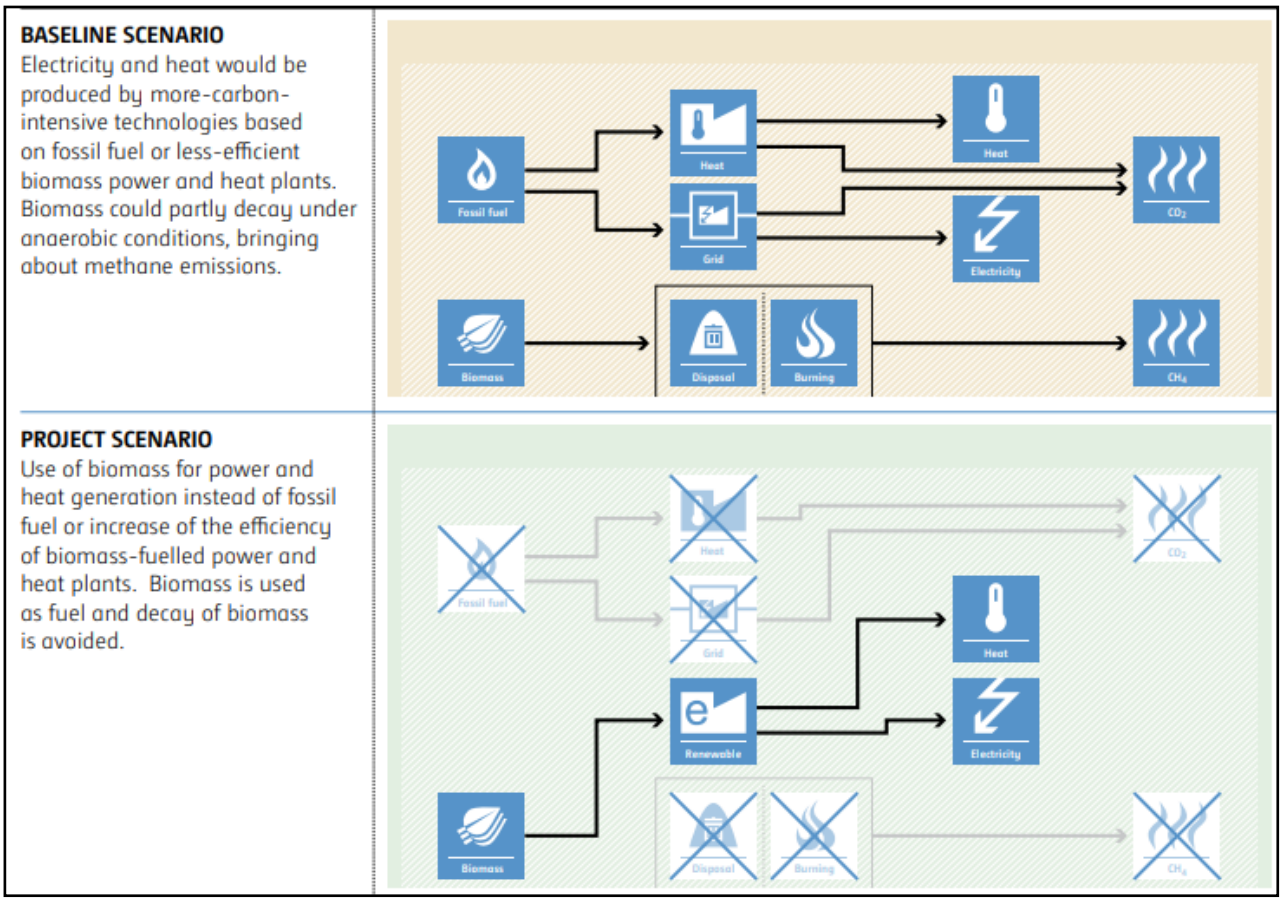

Figure 5: Image describing the project scenario and how is it different from the baseline scenario

(The diagram has been sourced from the CDM Methodology Booklet; from the section under ACM0006 Methodology)

A.7. Debundling>>

This "Exporting green electricity to the grid from biomass fired cogeneration at Rauzagaon" project is not a debundled component of a larger project activity.

This is an independent and standalone 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- Clean Development Mechanism (CDM)
Approved Consolidated Methodology
ACM0006 Electricity and heat generation from biomass
Version 16.0

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

Section 2 of the ACM0006 methodology version 16.0 discusses the applicability of the methodology under sub-section 2.2. The same is displayed in the table below, with justification on the applicability or non-applicability of individual conditions with respect to the Project activity.

Applicability of ACM0006	**Justification of its application or non-application with respect to the Project**
"The methodology is applicable under the following conditions: *(a) Biomass used by the project plant is limited to biomass residues, biogas, RDF and/or biomass from dedicated plantations;* *(b) Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 80% of the total fuel fired on energy basis;* *(c) For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of (the industrial facility generating the residues) raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;* *(d) The biomass used by the project plant is not stored for more than one year;* *(e) The biomass used by the project plant is not processed chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical degradation, etc.) prior to*	**Applicable and fulfilled** a) Biomass used by this project activity limited to biomass residue b) Fossil fuels are not envisaged to be co-fired within the boundary of the project activity. If fossil fuels are co-fired, the amount of fossil fuels co-fired shall not exceed 80% of the total fuel fired on energy basis c) The implementation of the project shall not result in increase of processing capacity of raw input or in other substantial changes in the process. The biomass so used in the project activity is a part of the sugarcane plant- the dry pulp left behind once the fluid has been extracted from it. Bagasse itself does not undergo any processing. It is nothing but a leftover for the sugar production process. As the sugar mills' main intention is to obtain sugar and the bagasse is eliminated as their process waste, the mill owners do not have any specific intention to increase production of waste in their processes.

combustion. Drying and mechanical processing, such as shredding and pelletisation, are allowed."	d) The biomass is not stored for more than a year as the biomass gets consumed in the process of operation. e) The biomass residues shall not be processed chemically or biologically prior to combustion. All the above conditions being addressed; the methodology stands applicable as per the given clause.
"*In the case of fuel switch project activities, the use of biomass or the increase in the use of biomass as compared to the baseline scenario is technically not possible at the project site without a capital investment in:* *(a) The retrofit or replacement of existing heat generators/boilers; or* *(b) The installation of new heat generators/boilers; or* *(c) A new dedicated supply chain of biomass established for the purpose of the project (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes); or* *(d) Equipment for preparation and feeding of biomass.*"	**Not Applicable** The Project Activity does not involve any fuel switch. Hence the clause so mentioned in its entirety does not apply here.
"*If biogas is used for power and heat generation, the biogas must be generated by anaerobic digestion of wastewater, and:* *(a) If the wastewater generation source is registered as a CDM project activity, the details of the wastewater project shall be included in the PDD, and emission reductions from biogas energy generation are claimed using this methodology;* *(b) If the wastewater source is not a CDM project, the amount of biogas does not exceed 50% of the total fuel fired on energy basis.*"	**Not Applicable** As the Project activity does not involve the use of biogas as a fuel for power or heat generation, the given clause in its entirety does not apply to the Project.
"*In the case biomass from dedicated plantations is used, the "TOOL16: Project and leakage emissions from biomass" shall apply to determine the relevant project and leakage emissions from cultivation of biomass and from the utilization of biomass residues*."	**Not Applicable** The Project does not procure bagasse from dedicated plantations and hence the given clause is not applicable to the Project so concerned.
"*The methodology is only applicable if the baseline scenario, as identified per the "Selection of the baseline scenario and demonstration of additionality" section hereunder, is:*	**Applicable and fulfilled** The details are discussed in subsequent section (B.5) of the PCN.

(a) For power generation: scenarios P2 to P7, or a combination of any of those scenarios; and *(b) For heat generation: scenarios H2 to H7, or a combination of any of those scenarios;* *(c) If some of the heat generated by the CDM project activity is converted to mechanical power through steam turbines, for mechanical power generation: scenarios M2 to M5: (i) In cases M2 and M3, if the steam turbine(s) are used for mechanical power in the project, the turbine(s) used in the baseline shall be at least as efficient as the steam turbine(s) used for mechanical power in the project; (ii) In cases M4 and M5, steam turbine(s) generating mechanical power to be used for the same purpose as in the baseline are not allowed;* *(d) For the use of biomass residues: scenarios B1 to B5, or a combination of any of those scenarios;* *(e) For the use of biogas: scenarios BG1 to BG3, or a combination of any of those scenarios.*"	
"*The methodology is not applicable if the baseline scenario involves the cultivation of biomass in dedicated plantations."*	**Not Applicable** The baseline of the Project activity is coal-based energy generation system and hence the given clause does not apply in case of this Project.

Hence, the given project activity satisfies CDM methodology ACM0006, Version 16.0.

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

The Project "Exporting green electricity to the grid from biomass fired cogeneration at Rauzagaon" has been installed and erected at a unique geo-location (26.7902 N, 81.6884 E) as indicated on the map in Section A.3. There is no other identical cogeneration set in that same geo-location. The electricity quantity actually exported to the grid from the plant can be verified from plant records and the meters installed.

Also, the project developer confirms that the same project has not been considered for development as any GHG offset development project for any standard / registry/ mechanism whatsoever until now.

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

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

- the storage facility for the biomass produced as process waste;
- 70 + 75 TPH boilers generating thermal energy from biomass residues;
- the 25.75 MW turbine generating electric energy;
- the process where the thermal and electrical energy is being utilized;
- and the substation exporting surplus electricity to the grid.

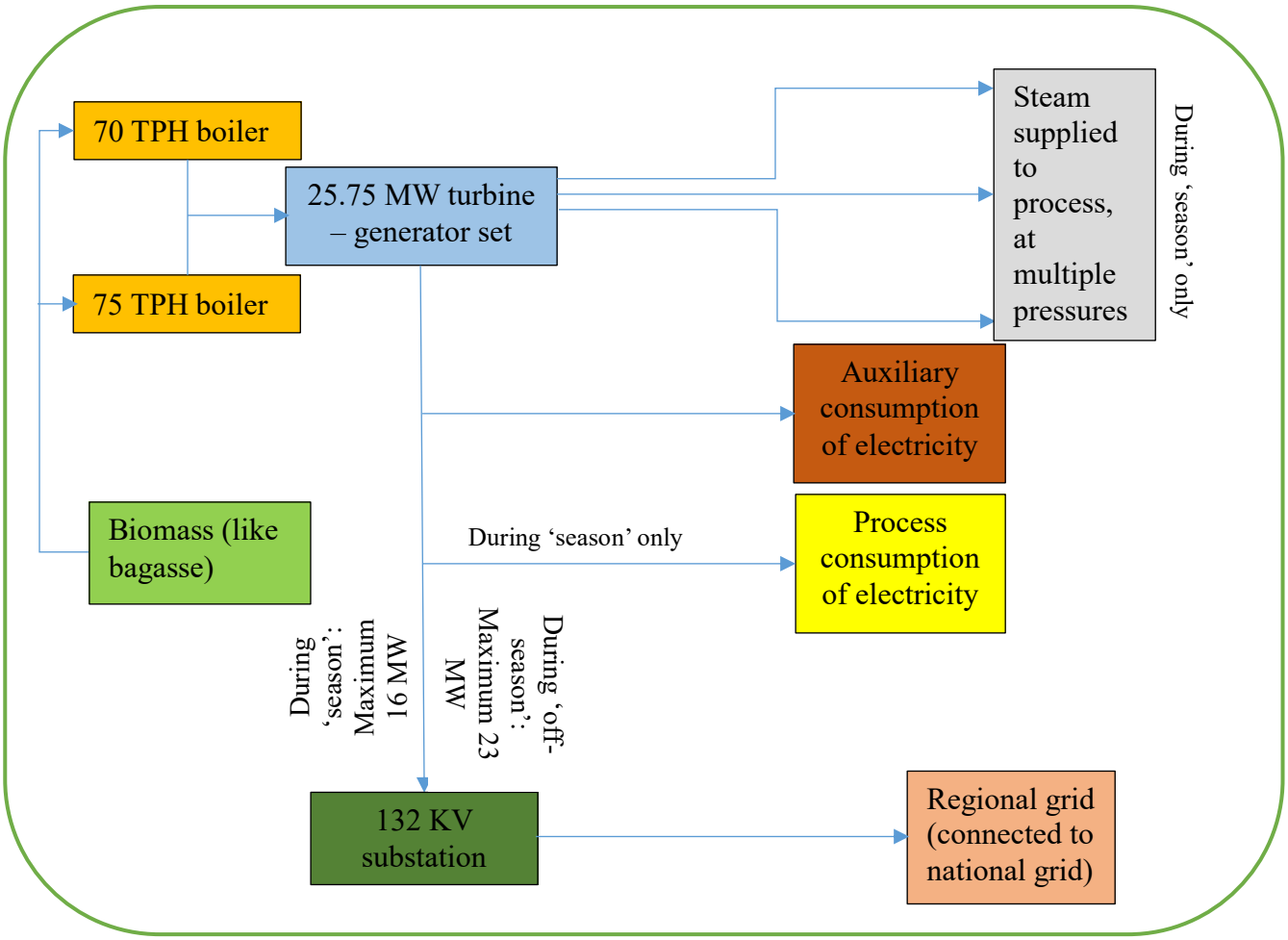

Figure 6: Project boundary of the Project Activity- schematic representation

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	Gas	Included	Justification/Explanation
Baseline	Electricity and heat generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification.

				This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification.
Project activity	On-site fossil fuel consumption	CO_2	No	Project Activity does not use fossil fuel.
		CH_4	No	Project Activity does not use fossil fuel.
		N_2O	No	Project Activity does not use fossil fuel.
	Off-site transportation of biomass	CO_2	No	Biomass is not transported to the outside of the plant premises.
		CH_4	No	Biomass is not transported to the outside of the plant premises.
		N_2O	No	Biomass is not transported to the outside of the plant premises.
	Combustion of biomass for electricity and heat	CO_2	No	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Not applicable, as not considered in baseline scenario either.
		N_2O	No	Excluded for simplification. This emission source is assumed to be small
	Wastewater from the treatment of biomass	CO_2	No	Biomass does not undergo any treatment. So no wastewater is generated.
		CH_4	No	Biomass does not undergo any treatment. So no wastewater is generated.
		N_2O	No	Biomass does not undergo any treatment. So no wastewater is generated.
	Cultivation of land to produce biomass feedstock	CO_2	No	Not applicable, as the biomass is not sourced from dedicated plantations.
		CH_4	No	Not applicable, as the

				biomass is not sourced from dedicated plantations.
		N_2O	No	Not applicable, as the biomass is not sourced from dedicated plantations.

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

In the absence of this project supplying green electricity to the grid, the grid would have anyway met up for its requirements by procuring more electricity from other power generating stations, whose main function is to supply electricity to the grid. Therein, the electricity so sourced would have been mostly coal-fired, as coal is the most convenient and conventional source of fuel for grid supply in the Indian economy[17,18].
The above statement representing our baseline scenario, fossil fuel fed electricity would have led to GHG emissions contributed by the burning of coal.

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

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

As this project shall only claim CoUs against the quantity of electricity exported to the grid, only P scenarios will be applicable in this case.

Also, as this project aspires for UCR registration, the term "UCR" has been used instead of "CDM" in baseline scenario analysis.

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

Baseline scenario for power generation (ACM0006, V.16.0)	**Description (of P Scenarios)**	**Justification for choosing or not choosing the alternative, while comparing it with the Project activity**

[17] https://www.brookings.edu/blog/planetpolicy/2019/03/08/coal-is-king-in-india-and-will-likely-remain-so/
[18] https://coal.nic.in/en/major-statistics/coal-indian-energy-choice

P1	The proposed project activity not undertaken as a UCR project activity;	This is a possible power generation baseline alternative to the UCR Project activity.
P2	The continuation of power generation in existing power plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the starting date of the UCR project activity;	The process steam / electricity requirements of the plant required the commissioning of new equipment and hence this situation is not applicable as possible baseline scenario.
P3	The continuation of power generation in existing power plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the starting date of the project UCR activity;	The process steam / electricity requirements of the plant required the commissioning of new equipment and hence this situation is not applicable as possible baseline scenario.
P4	The retrofitting of existing power plants at the project site. The retrofitting may or may not include a change in fuel mix;	The process steam / electricity requirements of the plant required the commissioning of new equipment and hence this situation is not applicable as possible baseline scenario.
P5	The installation of new power plants at the project site different from those installed under the UCR project activity;	This is a possible alternative scenario, with respect to power generation.
P6	The generation of power in specific off-site plants, excluding the power grid;	The cost of transportation of electricity from off-site generation point(s) shall be higher than on-site electric power generation system(s). Hence this alternative scenario is unattractive.
P7	The generation of power in the power grid.	This is a possible baseline alternative, with respect to electricity generation.

Also, paragraph 29 of ACM0006 Version 16.0 states:

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

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

Sr. No.	Project Emission	Justification
1	*"Project emissions resulting from cultivation of biomass in a dedicated plantation in year y ($PE_{BC,y}$)"*	**Not Applicable** As dedicated plantations are not exploited by the Project activity hence this entire section does not apply to the Project. So, $PE_{BC,y} = 0$
2	*"Project emissions resulting from transportation of biomass in year y ($PE_{BT,y}$) and Project emissions resulting from transportation of biomass residues in year y ($PE_{BRT,y}$)"*	**Not Applicable** As this project uses its own process waste, therefore no transportation is involved in obtaining biomass residue for cogeneration purposes. So, $PE_{BT,y} = 0$ and $PE_{BRT,y} = 0$
3	*"Project emissions resulting from processing of biomass in year y ($PE_{BP,y}$) and Project emissions resulting from processing of biomass residues in year y ($PE_{BRP,y}$)"*	**Not Applicable** As no bagasse processing is required or carried out, hence this section is not applicable to the Project. So, $PE_{BP,y} = 0$ and $PE_{BRP,y} = 0$

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

Or, $\mathbf{PE_y = 0}$

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

Sr. No.	Leakage Emission	Justification
1	*"Leakage due to shift of pre-project activities resulting from cultivation of biomass in a dedicated plantation in year y ($LE_{BC,y}$)"*	**Not Applicable** The project does not involve the use of resources from dedicated plantations. Hence, this clause is not applicable. Therefore, $LE_{BC,y} = 0$
2	*"Leakage due to diversion of biomass residues from other applications in year y ($LE_{BR,Div,y}$)"*	**Not possible** Uttar Pradesh has huge quantities of sugarcane residue in the form of bagasse available, as India is generally

		considered as the second-largest sugarcane producer in the whole world[19], and often overtakes Brazil to emerge in the number one spot[20]. Uttar Pradesh generally tops the list within India[21], seldom following Maharashtra in a close second. Hence, there is no dearth of bagasse within the state. More than enough bagasse is always available for channelizing it into different purposes. And it is only because of this excess availability of bagasse that even in 'of-season' sugar industry can export power to the grid. Also, as per the audit report of the Comptroller and Auditor General of India[22], Uttar Pradesh is only exploiting 53% of its biomass potential, as of March 2014. Hence, the surplus biomass availability is unquestionable and leakage due to diversion is neglected. So, $LE_{BR,Div,y}$ is considered as zero.
3	*"Leakage due to the transportation of biomass residues outside of the project boundary in year y ($LE_{BRT,y}$)"*	**Not applicable** So, $LE_{BRT,y}$ can be safely considered to be zero.
4	*"Leakage due to processing of biomass residues outside the project boundary in year y ($LE_{BRP,y}$)"*	**Not applicable** Bagasse to be used within the project boundary shall not require any processing and hence no leakage can occur due to processing of biomass with respect to the Project activity. Also, as mentioned in the justification to Leakage emission scenario 2 under this table, the sheer magnanimity of surplus biomass availability in Uttar Pradesh rules out all chances of leakages. Therefore, $LE_{BRP,y} = 0$

Thus it is seen that using CDM Methodological TOOL 16, the leakage emissions due to the project activity in is zero.

[19] https://www.isosugar.org/sugarsector/sugar
[20] https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1865320
[21] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=20717
[22] https://cag.gov.in/uploads/download_audit_report/2015/Union_Civil_Performance_Renewable_Energy_Report_34_2015_chap_6.pdf

Or, $\mathbf{LE_y = 0}$

Therefore, electricity produced from coal-fired thermal power stations supplying equivalent quantities of electricity to the grid being the baseline of the project, the key parameters to calculate the baseline emissions are:

Parameter	Unit	Value
Power exported to the grid- during season	MW	16 (max)
Power exported to the grid- during off-season	MW	23 (max)
Number of operational days of a season	Days / year	150 – 180 (+6 to 7)
Number of operational days in an 'off-season'	Days / year	209 - 179
Plant load factor during 'season'	%	93% – 95%
Plant load factor during 'off-season'	%	95% – 96%
Emission factor of national electricity grid	t-CO_2 e / MWh	0.90

For the purpose of calculation of baseline scenario, all parameters shall remain same as that of project scenario, except for the fact that in project scenario, green electricity is generated from bagasse and exported to the grid, whereas brown electricity is generated from fossil fuels and exported to the grid in baseline scenario.

Therefore, estimating the baseline emissions:

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

"*Emission reductions are calculated as follows:*

$$ER_y = BE_y - PE_y - LE_y$$

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

As already stated and demonstrated previously in this PCN, the PE_y and the LE_y due to the project activity is zero each. So in this case,

$$ER_y = BE_y$$

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

The Project owner shall claim identical quantity of carbon credits equal to ER_y achieved by the commissioning and operation of the Project activity, throughout the entire crediting period of the Project.

Baseline emissions applicable in this case using the ACM0006 methodology is calculated using the formula:

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

Where,

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

As per UCR guidelines, for sugar industry firing their own process waste, CoUs shall only be claimed against the electricity export and the appropriate formula to calculate the BE_y in this case gets reduced to:

$$BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y}$$

Where,
$EL_{BL,GR,y}$ = *Baseline electricity sourced from the grid in year y (MWh), and*
EF_{EG} = *Grid emission factor in year y (t CO_2/MWh)*

The project plant is exporting surplus energy to grid after captive consumption. Hence as per para 45 of the methodology, $(EL_{BL,y} - CAP_{EG,l,y})$ would be the quantity of electricity supplied to the grid by the project activity which is greater than zero.

Hence, $EL_{BL,GR,y}$ = ***Net electricity exported to the grid***

Estimated annual baseline emission reductions (ER_y) = 146,289 CoUs /year (146,289 t CO_2eq/ year).

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>>

The project has been commissioned on 17/10/2007. Therefore, adhering to UCR guidelines, issuance period shall start from 1st of January, 2013.
First Issuance Period: 10 years, 0 months – 01/01/2013 to 31/12/2022.

B.8. Monitoring plan>>

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

Data/Parameter	$EF_{grid,y}$
Data unit	t-CO_2e / MWh
Description	Grid emission factor of India's national grid
Source of data Value(s) applied	General Project Eligibility Criteria and Guidance UCR Standard (Updated August 2022) Version 6.0
Measurement methods and procedures	Not applicable
Monitoring frequency	The value is fixed for the entire crediting period
Purpose of data	To calculate the baseline emissions

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

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of this project activity in year y
Source of data:	Joint Electricity Meter and / or power sell invoices
Measurement procedures (if any):	This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Monitoring frequency:	Monthly recording of readings
QA/QC procedures:	-
Any comment:	CoUs / year shall be only claimed by the Project against the quantity of electricity exported to the grid in a year.