# PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

**Title: TEIL Biomass Grid Supply Power Project, Sabitgarh, Uttar Pradesh**

Version 1.0

Date of PCN: 19/12/2022

1st CoU Issuance Period: 08 years and 02 months
1st Monitoring Period: 01/11/2014 to 31/12/2022
1st Crediting Period: 01/11/2014 to 31/12/2022

**PROJECT CONCEPT NOTE**

| BASIC INFORMATION | |
|---|---|
| Title of the project activity | TEIL Biomass Grid Supply Power Project, Sabitgarh, Uttar Pradesh |
| Scale of the project activity | Small Scale |
| Completion date of the PCN | 12/12/2022 |
| Project participants | **Project Proponent:** Triveni Engineering and Industries Ltd (TEIL)<br>**Aggregator:** Carbon Equalizers, KATNI<br>UCR ID : 660687753 |
| Host Party | India |
| Applied methodologies and standardized baselines | **CDM UNFCCC**<br>**Small-scale Methodology**<br>**AMS-ID**: Grid connected renewable electricity generation, Ver 18<br><br>UCR Standard for Baseline Grid Emission Factor |
| Sectoral scopes | 01 Energy industries (Renewable/NonRenewable Sources) |
| Estimated total amount of average GHG emission reductions per year (ex-ante) | **44214** CoUs/yr (**44214** $tCO_{2eq}$/yr) |

## SECTION A. Description of project activity

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

The project **TEIL Biomass Grid Supply Power Project, Sabitgarh, Uttar Pradesh** is located at Village: Sabitgarh, Tehsil: Khurja, District: Bulandshahar, State: Uttar Pradesh (UP), Country: India (Pin: 203129).

The details of the UCR project activity are as follows:

**Purpose of the UCR project activity:**
The purpose of the project activity by the project proponent (PP), Triveni Engineering and Industries Ltd (TEIL), is to generate green electricity using renewable biomass and thereby reduce greenhouse gas (GHG) emissions by displacing the fossil fuel dominated grid based electricity with biomass based renewable electricity. The PP exports the surplus power to the grid after meeting its captive and auxiliary power requirements at the project activity site.

The PP is one of the largest integrated sugar manufacturers in India, and across UP, it currently operates large grid-connected and smaller capacity co-generation plants (incidental co-generation facilities). The total installed power generation capacity in the project activity is **13.5 MWh** and the project activity was commissioned on **23/12/2005**.


The electricity produced by the project activity is directly contributing to climate change mitigation by reducing the anthropogenic emissions of GHGs into the atmosphere by displacing an equivalent amount of fossil power at grid. The project activity is displacing an estimated annual net electricity generation of approximately **49127 MWh** from the Indian grid system, which otherwise would have been generated by the operation of fossil fuel-based grid-connected power plants. The project activity doesn't involve any GHG emission sources. The estimated annual $CO_{2e}$ emission reductions by the project activity are expected to be **44214 $tCO_{2e}$**, whereas actual emission reductions achieved during the first CoU period shall be submitted as a part of first monitoring and verification.

The smaller capacity cogeneration plants within the portfolio of the PP (such as the project activity), operate mostly on medium pressure steam cycles (46 ata/440ºC). These plants are designed to conduct fully-automated operations, using the latest Distributed Control System

(DCS). Highly experienced and skilled manpower operates these plants, thus ensuring trouble-free efficient operations with high uptime and reliable operations, along with very high operating efficiencies. The PP puts significant emphasis on maintaining excellent management of the boiler feed water quality parameters to ensure sustained and troublefree operation of the boiler and the turbine.

As per the power purchase agreement (PPA) between the state electricity board (UPPCL) and PP, dated **04/08/2014**, the project activity, which has an installed total power generation capacity of 13.5 MWh, is contracted to supply approximately **6 MWh** of this bagasse based power to the grid.

The power synchronization is to the 132/133 KV Khurja-II, Palrajhal Tehsil-Khurja grid substation owned by UPPCL and was first completed in Oct 2014. The power generation is 11 KV, stepped up and evacuated to the 33 KV high voltage switchyard and exported to the UPPCL grid system. All the biomass used at the site qualifies under the definition of biomass residues as outlined in the UNFCCC CDM methodology, i.e. *the biomass residue is a by-product of agricultural activities and no other types of biomass is used*. In the case of the project activity, the biomass residue is bagasse, which is generated from the crushing of sugar cane.

Hence, the project activity is a grid-connected biomass (bagasse based) cogeneration power plant with a high pressure steam-turbine configuration. The high pressure boilers are fired by bagasse, a biomass byproduct from the sugar manufacturing process, to generate steam which in turn is fed to the steam turbine to generate power. The overall business is integrated with alcohol distillation and power generation. The power co-generation units generate biomass based power for captive consumption of the sugar plant and the sale of surplus power to the state grid. The project plant exports power to the Uttar Pradesh Power Corporation Limited (UPPCL), in absence of the project activity, UPPCL would have withdrawn electricity from northern regional grid.

The project activity uses bagasse as fuel for in the cogeneration power unit, which is a renewable bio-mass fuel and does not add any net carbon-dioxide to the atmosphere because of the carbon recycling during growth of sugar cane. Therefore, the project activity leads to zero $CO_2$ on-site emissions associated with bagasse combustion. The biomass residue is not prepared prior to its use in the boilers, the bagasse is transferred from the crushing process directly to the boiler or to the storage yard, from the storage yard the bagasse is returned to the boiler without any material change.

The project activity also induces environmental and sustainable development benefits. The project activity has introduced efficient high pressure cogeneration technology to the Indian sugar industry; reducing power shortages in the state of Uttar Pradesh (UP) India; and fostering sustainable economic growth through promoting energy self-sufficiency and resource conservation in India's sugarcane industry. The policy to grow in a sustainable manner with a commitment towards the environment has been adopted by TEIL. The technology used in the project activity is highly replicable as the country's sugar mills produce large quantities of bagasse that could be efficiently utilized to generate power.

The export of electricity hence reduces GHG emissions by replacing the fossil fuel dominated grid based electricity with a renewable source of electricity. The high pressure boilers are fired by bagasse, a byproduct from the sugar manufacturing process to generate steam, which in turn powers all the steam turbines to generate electricity.

The UCR project activity is the construction and operation of a power plant/unit that uses renewable energy sources and supplies renewable electricity to the grid. The UCR project activity is thus the displacement of electricity that would be provided to the grid by more-GHG-intensive means and provides long-term benefits to the mitigation of climate change. The UCR project activity qualifies under the environmental additional positive list of pre-approved project types under the UCR carbon incentive model for issuance of voluntary carbon credits.

**Assured supply of biomass fuel and other barriers to the UCR project activity**

One of the major constraints associated with the project activity is the availability of sugarcane and there is often a diversion of cane from sugar mill to khandsaris and ghur manufactures when sugar prices are high (typically periods of low availability of cane). These manufacturers offer higher price as they operate in unorganised sector and have no quality assurance plans. These diversions put a further constraint on cane availability and hence bagasse which again may impact the viability of the project activity. The uncertainty in weather conditions also plays an important role in determining the cane availability in the region. There is a continuous weather related risk for cane under rain fed cultivation conditions.

Along with that, there are often chances of diversion of cane by farmers to other sugar mills in the nearby areas. The uncontrolled growth of sugar mills in UP, has lead to competition among the sugar mills for the natural resource utilisation i.e. agriculture farm produce, and leading to farmer

option for getting varying prices among the sugar mills in the region. This diversion is an also important constraint faced by the project promoters and can significantly influence the cane crushing capacity and in turn the power generation capacity of the sugar mill.

The operation of bagasse based power plants for captive steam and electricity generation is common amongst the sugar industry. It is therefore fair to say that these options are consistent with the applicable laws and regulations as demonstrated by existing practices. There is no policy in India that mandates the generation of electricity **for grid supply from bagasse**, hence this is a voluntary project activity. The policy frameworks for bagasse based grid electricity supply are governed by the state electricity regulatory commissions which detail the terms of power purchase agreements for such investments.

The Indian sugarcane harvesting has been affected amid the COVID-19 pandemic situation prevailing in the country, and TEIL has focused on continuing to work closely with the thousands of farmers who rely on TEIL for their sustenance and livelihoods. TEIL has further stepped up efforts towards better cane development and farm management, through adoption of techniques such as intercropping, conservation of energy and water resources through drip irrigation, waste-water management, and rain-water harvesting.

Recently, Uttar Pradesh Electricity Regulatory Commission (UPERC) has notified the updated UPERC (Captive and Renewable Energy Generating Plants) Regulations, 2019 to supersede the earlier Regulations of 2014. Under the new regulations, the tariff of bagasse-based power generation and supply to UPPCL has been reduced by nearly Rs 2 per Kwh (unit) which has affected the financials of TEIL substantially, and hence earning CoUs (carbon offset units or credits) under the UCR program will help in ensuring financial stability for such biomass based grid supply green project activities.

## A.2 Do No Harm or Negative Impact test of the project activity>>

Host party regulations require TEIL to obtain environmental clearance in the form of "No objection Certificate" from State Pollution Control Board, which in this case is Uttar Pradesh Pollution Control Board. The Environmental Management Plan had been prepared and submitted to the pollution control board for approval. An Environmental Impact Assessment had been conducted for the project activity to understand if there are any significant environmental impacts and the study indicates that the impacts are not significant. The project activity is set up adjacent to existing sugar mill, in a common premise. No cutting of trees was involved and there was no deforestation required.

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

- **Social benefits:**
  - The project activity contributes to employment generation in the local area for both skilled & unskilled people for operation and maintenance of the equipments.
    The Indian sugarcane harvesting has been affected amid the COVID pandemic situation prevailing in the country, and TEIL has focused on continuing to work closely with the thousands of farmers who rely on TEIL for their sustenance and livelihoods. TEIL has further stepped up efforts towards better cane development and farm management, through adoption of techniques such as intercropping, conservation of energy and water resources through drip irrigation, waste-water management, and rain-water harvesting.
- It has created steady higher value jobs and skilled workers at the facility. The project activity is contributing to the national energy security by reducing consumption of fossil fuels.
- The technology being used in the project is proven and safe for power generation. An increase in such kind of projects shall enable all the technology suppliers to continuously innovate and modernize on the technology front. The local people will know the technological advancement and will help in capacity building.

- **Environmental benefits:**
- The project activity is a renewable energy project, which utilizes biomass as a fuel for grid power generation, a move that is voluntary and not mandated under current environmental laws of India. Since this project activity generates green energy in the form of power, it has positively contributed towards the reduction in (demand) use of finite natural resources like coal and oil, minimizing depletion and in turn increasing its availability to other important purposes. Therefore, this project activity helps to environment sustainability by reducing GHG emission in the atmosphere.
- Avoids global and local environmental pollution, leading to reduction of GHG emissions.
- Enabling regional grid to divert the electricity displaced by the project activity to the nearby needy areas.
  Indirect capacity building by providing a case example to other sugar mills in the region for switching to high capacity cogeneration configuration, for exporting electricity to grid.
  In addition to the reduction in carbon dioxide (CO2) emissions the project implementation will result in reduction of other harmful gases (NOx and SOx) that arise from the combustion of coal used in power generation. The project activity also leads to reduce ash generation since the ash content in bagasse is lower than that of Indian coal.

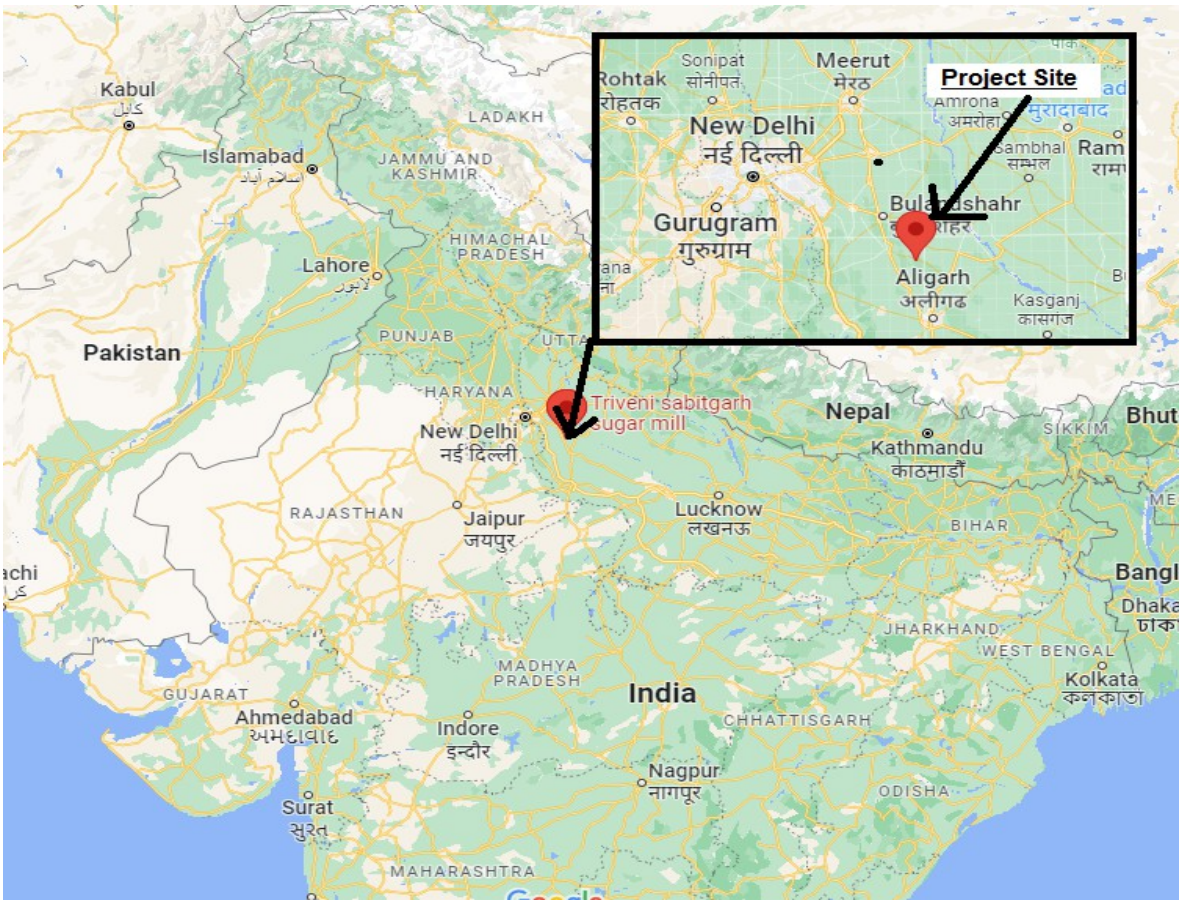
- **Economic benefits:**
- The project activity creates employment opportunities during the project stage and operation and maintenance of the boiler and turbines.
- The project activity helps in conservation of fast depleting natural resources like coal and

oil thereby contributing to the economic well being of country as a whole.

- The various other benefits due to the project activity ensure that the project is contributing to the sustainable development of the region by bringing in green technologies and processes to a backward region. The technology is indigenous and by implementing such projects the country is showcasing its GHG mitigation actions in its efforts to combat climate change.

## A.3. Location of project activity >>

Country: India
Village: Sabitgarh
Tehsil: Khurja,
District: Bulandshahar
State: Uttar Pradesh (UP),
Latitude: 28° 11' 47.22" N
Longitude: 78° 0' 19.44" E




## A.4. Technologies/measures >>

The UCR project activity is a grid-connected bagasse based cogeneration power plant with a high pressure steam-turbine configuration. The UCR project activity is the electricity generation capacity and the installation of facilities for allowing the export of electricity to the regional grid.

The project activity comprises of the following:

| Description | Boiler #1 | Boiler #2 | Turbine #1 | Turbine #2 | Turbine #3 |
|---|---|---|---|---|---|
| Capacity | 80 TPH | 25 TPH | 6 MW | 1.5 MW | 6 MW |
| Temp | 440 | 315 | 440 | 315 | 440 |
| Pressure | 45 | 11.6 | 45 | 11.6 | 45 |
| Commissioning Year | 2005 | 2008 | 2005 | 2008 | 2014 |

The plant is designed with all other auxiliary plant systems like

- Bagasse handling system with storage and processing arrangements,
- High pressure feed water heaters,
- Ash handling system,
- Water treatment plant,
- Compressed air system,
- Air conditioning system,
- Main steam, medium pressure and low pressure steam systems,
- Fire protection system,
- water system which include raw water system, circulating water system, condensate system, De-Mineralised water system and service with potable water system and
- The electrical system for its successful operation.

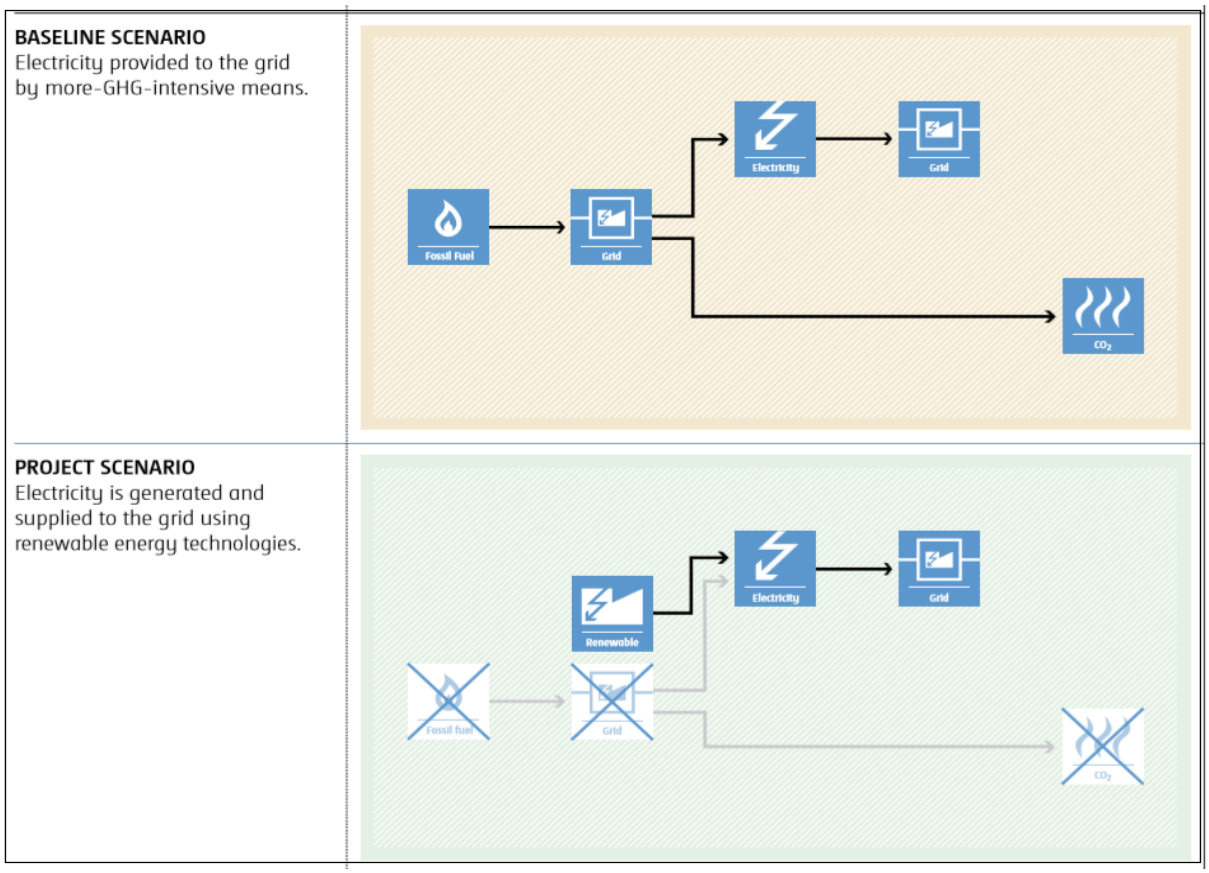
The technology of biomass residue based high steam pressure power generation itself is known and in use in India. The use of high pressure system allows for increased efficiency levels for electricity generation.

## A.5. Parties and project participants >>

Project activity does not involve any public funding from Annex I Party, which leads to the diversion of the official development assistance.

| Party (Host) | Participants/Aggregator |
|---|---|
| India | Project Owner: Triveni Engineering & Industries Ltd (TEIL)<br>Aggregator: Carbon Equalizers, KATNI<br>UCR ID : 660687753<br>Contact: Mr Vikas Chamadia<br>Email: vikaschamadia@rediffmail.com |

## A.6. Baseline Emissions>>




The approved baseline methodology has been referred from the indicative simplified baseline and monitoring methodologies for selected small scale UNFCCC CDM project activities that involve generation and export of power to the local or national grid using biomass.

Typical activities, under AMS ID comprises of renewable energy generation units, such as enewable biomass, including:

- (a) Supplying electricity to a national or a regional grid; or are new plants, capacity expansions, energy efficiency improvements or fuel switch projects.

The applicable methodology and simplified modalities and procedures for small scale CDM project activities is "*the baseline scenario is displacement of more-GHG-intensive electricity generation in grid.*"

**Emission coefficient of fuel used in the baseline scenario**

The $CO_2$ emission factor for grid connected power generation in year y calculated using UCR Standard emission factor is 0.9 tCO2/MWh for the period 2014-2022.

## A.7. Debundling>>

This project is not a debundled component of a larger registered carbon offset project activity.

## SECTION B. Application of methodologies and standardized baselines

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

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

TYPE I - Renewable Energy Projects (Small Scale)

UCR Positive List Environmental Additionality

CATEGORY- ***AMS I.D. Small Scale Consolidated Methodology***

"**Grid connected renewable electricity generation", version 18**

This methodology is applicable to project activities that comprises renewable energy generation units, such as renewable biomass involving:

*(a) Supplying electricity to a national or a regional grid;*

UCR CoU Standard is used to determine the baseline grid emission factor for the 2014-2022 period.

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

| |
|---|
| The project activity is a power generation project using a biomass (bagasse) and displaces CO2 emissions from electricity generation in power plants that are displaced due to the project activity. Since the project activity utilises biomass (bagasse) for the generation of power and supplies it to the local grid, it displaces fossil fuel (coal), and hence it meets the primary applicability criteria of the methodology. |
| The project activity is included in the Positive List of UCR Approved Scope under the UCR CoU Standard. |
| The total installed capacity of project activity is 13.5 MW, of which 6 MW is supplied to the grid, which is acceptable as per the applied small scale methodology, since the eligibility limit of 15 MW has been applied under this methodology. |
| The installation of a new biomass residue fired power generation unit, which replaces or is operated next to existing power generation capacity fired with either fossil fuels or the same type of biomass residue as in the project plant (power capacity expansion projects) is also included in this methodology. |
| The project activity is not a hydro power project. The project activity does not recover methane from landfill gas, waste gas, wastewater treatment and agro-industries. |
| For the purposes of this methodology, heat does not include waste heat, i.e. heat that is transferred to the environment without utilization, for example, heat in flue gas, heat transferred to cooling towers or any other heat losses. |
| The biomass used by the project plant is not stored for more than one year. The biomass used by the project plant is not processed chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemicaldegradation, etc.) prior to combustion. |
| The Project Activity uses biomass residues from a production process (e.g. production of sugar), and 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) or in other substantial changes (e.g. product change) in this process |
| The project activity unit does not co-fire fossil fuel and/or does not exceed the limit of 25% co-firing fossil fule criteria as per the UCR Protocol for such projects. |

| |
|---|
| Biomass generated power is used for direct grid supply and for meeting the captive needs at the facility. The project activity is involves the grid-connected bagasse based electricity generation capacity involving the installation of facilities for allowing the export of electricity to the regional grid |
| Biomass is not sourced from dedicated plantations. The existing installed boilers are fired by bagasse, a byproduct of the sugarcane processing and a biomass residue. |
| Bagasse is burnt in boilers as generated form the sugar mill and does not require any specific technology for its preparation before combustion. No fuel preparation equipment has been installed at site for preparation of bagasse. Hence no significant energy quantities are required to prepare the biomass residues for fuel combustion. |
| The project activity also does not include any GHG emissions related to the decomposition or burning of biomass. The baseline heat emissions for the project activity are not included in the project boundary nor does it claim for emission reductions from heat. |

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

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

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

- • Project is uniquely identifiable based on its location coordinates,
- • Project has dedicated commissioning certificate and connection point,
- • Project is associated with energy meters which are dedicated to the generation/feeding point with the grid.

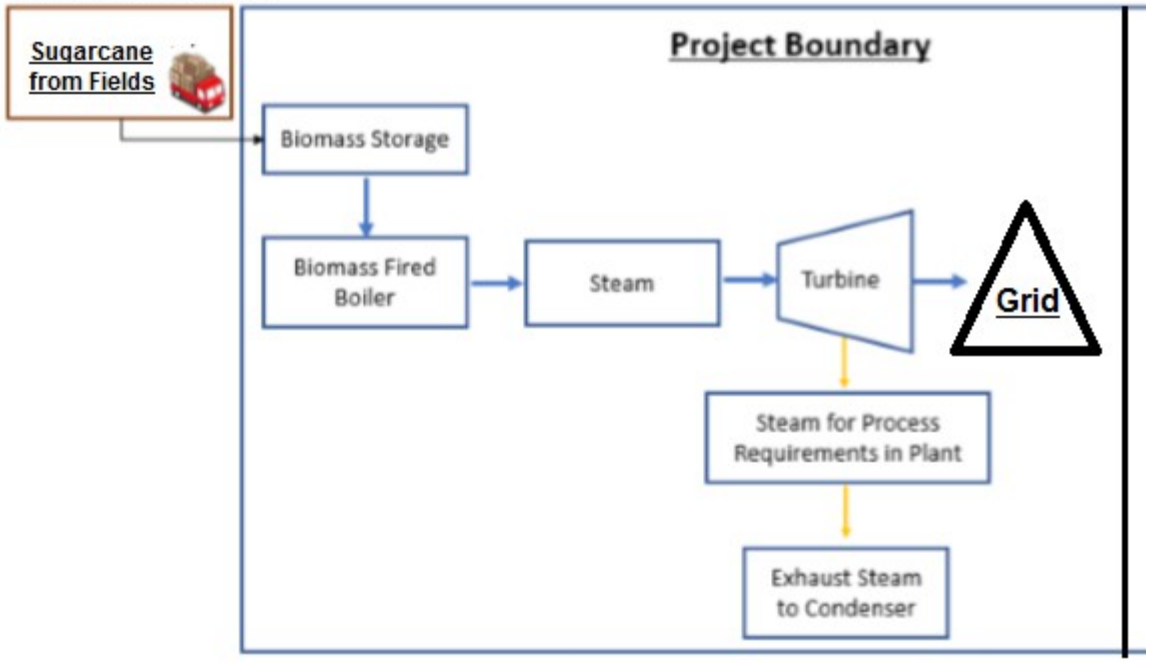
Hence the UCR project activity has never been issued voluntary carbon credits for the current 2014-2022 vintage years and there is no double counting of the credits envisioned. Additionally, the same has been stated in the undertaking provided in the Double Counting Avoidance Assurance Document (DAA) by TEIL.

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

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

(a) the project power plant and all power plants connected physically to the electricity system that the project activity is connected to.

Process flow chart:




Thus, the project boundary includes the biomass-based steam generator, steam turbine generators and the Indian grid system.

**Leakage Emissions ($LE_y$)**

Leakage emissions is not applicable as the project activity does not use technology or equipment transferred from another activity.

Hence $\mathbf{LE_y} = 0$

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Grid connected fossil fuel-based electricity generation | **$CO_2$** | **Yes** | **Main emission source** |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| | | Other | No | No other GHG emissions were emitted from the project |
| Project | Greenfield Biomass Power Project Activity | $CO_2$ | No | No $CO_2$ emissions are emitted from the project |
| | | $CH_4$ | No | Project activity does not emit $CH_4$ |
| | | $N_2O$ | No | Project activity does not emit $N_2O$ |
| | | Other | No | No other emissions are emitted from the project |

**Project Emissions (PEy)**
The project activity has not considered and never used any fossil fuel (as can be verified from the given data during verification) and to meet any requirement in the project activity; hence there is no emissions due to usage of fossil fuel.

Based on the biomass availability, there is sufficient biomass available in the region in less than 50 km surrounding the site of the project activity. It confirms that there is no such leakage anticipated. There is no other relevant source of leakage emission applicable to the project activity. Accordingly, the project activity does not result in any leakage emission.

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

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

*"the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid."*

The baseline emissions due to displacement of electricity are determined by net quantity of electricity exported as a result of the project activity (incremental to baseline generation) during the year y in MWh times the $CO_2$ emission factor for the electricity displaced due to the project activity during the year y in tons $CO_2$/MWh. Given that steam and electric power generation for internal consumption is part of the present project activity, ***emission reductions are only claimed from on-site incremental power generation that is injected to the grid***. Therefore, the baseline scenario is the emission of GHG from the present electricity generation mix of the UPPCL grid in the northern region.

Hence baseline emissions include only CO2 emissions from electricity generation in power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

Emission Reductions ($ER_y$) The emission reduction due to the project activity is calculated as the difference between the baseline emissions and the sum of the project emissions and the leakage:

$$\mathbf{ERy = BE_y - (PE_y + LE_y)}$$

$\boldsymbol{BE_y}$= Baseline emissions in year y (t $CO_{2e}$)

*As mentioned in the methodology the baseline emissions are calculated as follows:*

$$\boldsymbol{BE_y = EG_{pj,y} * EF_{grid,y}}$$

Where:
$\mathbf{EG_{grid,y}}$ = Quantity of net electricity generation that is fed into the local grid as a result of the implementation of the project activity in year y (MWh)

$\mathbf{EF_{grid,y}}$ = The $CO_2$ emission factor for grid connected power generation in year y calculated

using UCR Standard emission factor (0.9 tCO2/MWh for the 2014-2022 period). Also, for the vintage 2021-2022, the combined margin emission factor calculated from CEA database in India results into higher emission than this UCR default value. Hence, the same emission factor has been considered to calculate the emission reduction under conservative approach.

**$PE_y$** = Project activity emissions = 0

**$LE_y$** = Leakage emissions = 0

For this methodology, it is assumed that transmission and distribution losses in the electricity grid are not influenced significantly by the project activity and are therefore not accounted for and also the UCR grid emission factor results in conservative estimates of the carbon credits.

Direct off-site emissions in the project activity arise from the biomass transport. The same type of $CO_2$ emission occurs during transportation of coal from coal mines to thermal power plants (supplying power to state grid). However actual quantity of bagasse purchased shall be monitored and corresponding emissions due to its transportation shall be deducted from baseline for a given crediting year if significant and sourced from over a radius beyond 50 kms from the project site.

**Estimated yearly MWh grid supply = 49127_ MWh/yr**
**Estimated yearly ERs = 44214 CoUs/yr (ex-ante)**

## B.6. Prior History>>

The project has received no public funding. The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits for the current crediting period.

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

There is no change in the start date of crediting period , i.e. 1st Crediting Period: 01/11/2014 to 31/12/2022

## 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>>

1st Monitoring Duration: 08 years and 02 months
1st Monitoring Period: 01/11/2014 to 31/12/2022

## B.10. Monitoring plan>>

The monitoring of electricity data revolves around the power generation from the turbine generators and the auxiliary consumption of the power plant. All auxiliary units at the power plant is metered and there are also main meters attached to each turbine generator to determine their total generation.

Operational records and other evidences have been documented, collected and archived in either hard-copies or electronic manners. The energy generation is metered by calibrated meters. The

biomass consumption is measured by Weigh Bridge calibrated after every two year by state government organisation. Steam quantity, temperature and pressure are measured by calibrated meters. The date of calibration and next due date of calibration can be checked against the calibration certificates. All the values can be checked from the source data ie. plant records. The calorific value of biomass can be checked against the third party analysis reports.

The total amount of bagasse generated by the sugar plant can be calculated from the amount of cane crushed in the season (monitored variable), which is obtained from the in house records. Therefore, bagasse can be calculated using the formula:

**Bagasse = Cane + Added water – Juice**

This quantity will be cross-checked using an annual energy balance using the monitored steam values. The total heat generated as well as the heat generated by the project activity is monitored using the temperature and pressure values and calculating the enthalpies of the steam generated and the feed water.

The management of the plant has designated one person to be responsible for the collation of data as per the monitoring methodology. The designated person collects all data to be monitored as mentioned in this project concept note document (PCN) and reports to the head of the plant. The overall project management responsibility remains with the Plant Head. The electricity generation from turbines and auxiliary consumption is recorded continuously on an hourly basis by the operators in the shift. At the end of the day this data is collated by the engineer in charge and signed off by the power plant manager. The steam data is also manually recorded on an hourly basis from the meters. The data is recorded in logbooks by the operators and the engineer in charge collates the data from these log books and stores them electronically. This data is used by engineer in charge to prepare a monthly report and send it to Plant Head for verification. The monthly reports become a part of the Management Information System (MIS) and are reviewed by the management during the quarterly review meeting.

The monthly reports can be made available during the verification of the project activity, to estimate the monthly emission reductions, which are also, included in the MIS. The monitoring personnel are familiar with the process of monitoring and documentation. They have been maintaining and reviewing the factory records pertaining to the sugar manufacturing.

All the meters are checked and calibrated each year by an independent agency and they are maintained as per the instructions provided by their suppliers. Hence there are no uncertainties or adjustments associated with data to be monitored. An internal audit team, comprising of personnel from the factory but from a department other than utility, reviews the daily reports, monthly reports, procedure for data recording and maintenance reports of the meters. This team checks whether all records are being maintained as per the details provided in the PCN. The audit team also enlists the modifications/corrective actions required, if any, in more accurate monitoring and reporting. All the data and reports will be kept at the offices of the sugar mill until 2 years after the end of the crediting period or the last issuance of CoUs for the project activity, whichever occurs later.

Emergency preparedness plans have been laid out to meet with situations leading to unintended emissions. These emergency situations have been identified as:

1. Fire in the fuel yard
2. Fuel spoilage due to water. These emergency situations haven been taken care by putting up a fire safety system and a water drainage system in the fuel yard. T

| Parameters | Description |
|---|---|
| $Q_{S,y}$ | Quantity of steam supplied per year measured at recipient's end |
| $T_{steam,y}$ | Temperature of steam at the recipient's end |
| $P_{steam,y}$ | Pressure of steam |
| $E_{steam,y}$ | Enthalpy of the saturated steam supplied to the recipient |
| $T_{Feedwater}$ | Temperature of boiler feed water |
| $E_{Feedwater}$ | Enthalpy of feed water |
| $EG_{thermal,y}$ | Net quantity of thermal energy supplied by the project activity during the year y |
| $B_{Biomass,y}$ | Net quantity of biomass consumed in year y (on dry basis) |
| $MC_{biomass}$ | Moisture content of the biomass |

Monthly joint meter reading of main meters installed at interconnection points are taken and signed by authorised officials of TEIL and UPPCL on the first day of every month. Records of this joint meter reading are maintained by TEIL and UPPCL. Daily and monthly reports stating the net power export is prepared by the shift in-charge and verified by the plant manager. Power Purchase Agreement (PPA) with UPPCL has been signed. Reliability of energy data is maintained as per PPA. TEIL archives and preserves all the monthly invoices raised against net saleable energy and also archives the complete metering data at generation electronically. All the records are maintained at site. Uttar Pradesh Pollution Control Board (UPPCB) and Environment Department of Uttar Pradesh have prescribed standards of environmental compliance and monitor the adherence to the standards. TEIL has received the 'Consent to Operate' the plant. State's regulatory body of power is Uttar Pradesh Electricity Commission (UPERC) and they have issued consent for the installation of co-generation power plant of 13.5 MW capacity. As a buyer of the power, the UPPCL is a major stakeholder in the project and hold the key to the commercial success of the project.

| Data/Parameter | $\mathbf{NCV_k}$ |
|---|---|
| Data unit | GJ/t |
| Description | Net Calorific Value of Biomass Residue Type *K* |
| Source of data<br>Value(s) applied | Measurements will be carried out by reputed labs and reported in dry biomass basis. |
| Measurement methods and procedures | On site and in labs |
| Monitoring frequency | Every 6 months |
| Purpose of data | Quality control |

| Data/Parameter | $Q_{biomass,yr}$ |
|---|---|
| Data unit | MT/yr |
| Description | The quantity of bagasse used to generate steam in the boilers each year |
| Source of data<br>Value(s) applied | Plant records and log books receipts |
| Measurement methods and procedures | Monitoring: The quantity of biomass fed into the boiler is controlled.<br>Data type: Measured<br>Responsibility: Boiler Operator |
| Monitoring frequency | Daily |
| QA/QC | The amount of biomass used can be cross checked by the purchase orders and stock inventory.Quantity of biomass has been monitored. Biomass measuring device has an accuracy level of +/- 0.5% of full scale, and ranging between 0-120 TPH. |

| Data/Parameter | $EG_{project\ plant,\ y}$ |
|---|---|
| Data unit | MWh |
| Description | Net quantity of electricity generated in the project plant during the year y |
| Source | TEIL-factory records |
| Measurement methods and procedures | This value will be determined annually from the records maintained at the factory. All auxiliary units at the power plant are metered and there is also a main meters attached to each turbine generator to determine their total generation. |
| Monitoring frequency | The hourly recordings of data is to be taken from energy meters located at the project activity site. This data is to be recorded hourly by the shift attendant and entered into logbooks on site. This hourly data is to be signed off at the end of every shift by an engineer in charge of the shift and again at the end of each day and signed off by the power plant manager. The energy meters are calibrated annually by an independent third party |
| QA/QC | Net electricity production has been calculated by deducting auxiliary consumption from gross generation of the plant. Digital meters calibration procedures are planned. Daily productions details are kept in log books and electronic data base. Energy meters are of class 0.2 with tolerance of 0.5%. All Meters are calibrated by accredited external third party, as per standard procedures, periodically. |

| Data/Parameter | $EF_{grid,y}$ |
|---|---|
| Data unit | Grid Emission Factor |
| Description | $tCO_2/MW_h$ |
| Source of data<br>Value(s) applied | UCR CoU Standard Default for Indian grid<br>0.9 $tCO_2/MW_h$ for the period 2014-2022 |
| Measurement methods and procedures | NA |
| Monitoring frequency | NA |
| QA/QC | The parameter is conservative. |
| Purpose of data | To estimate baseline emissions |

| Data/Parameter | **$EG_{grid,y}$** |
|---|---|
| Data unit | MWh |
| Description | Net quantity of electricity exported to the grid |
| Source of data<br>Value(s) applied | JMR and/or Monthly Meter Readings |
| Measurement methods and procedures | Type: Calculated<br>Data type: Monitored<br>This parameter may be checked with the necessary invoices or JMR (issued by the state grid) each month. |
| Monitoring frequency | Daily |
| QA/QC | Energy meters on existing turbines are calibrated on annual basis by NABL accredited labs. Electricity generation in these units are recorded and kept in log books for verification purpose.Energy meters are of class 0.2 with tolerance of 0.5%. All Meters are calibrated by accredited external third party, as per standard procedures, periodically |
| Purpose of data | To estimate baseline emissions |