15 MW BIOMASS RESIDUE BASED POWER PROJECT AT GHAZIPUR, INDIA

Document Prepared by EKI Energy Services Limited

Project Title	15 MW Biomass Residue Based Power Project at Ghazipur, India
Version	01.3
Report ID	624
Date of Issue	15/06/2022
Project ID	624
Monitoring Period	01/01/2012 to 31/12/2017
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project undertaken by Sukhbir Agro Energy Limited (SAEL) in Ghazipur district of Uttar Pradesh, India was registered with UNFCCC on January 12, 2010. The project involves installation of a new 15MW steam turbine to generate electricity that meets the in-house requirements and export surplus power to the national grid. The project uses rice husk, a by-product of paddy processing, as fuel. It has thus contributed to reduction of GHG emissions by displacing fossil fuel dominated grid based electricity with biomass residue based renewable electricity.

SAEL has installed a new 70 tonnes per hour (TPH) capacity travelling grate boiler and a new 15 MW extraction cum condensing turbine to generate electricity, along with all accessories and equipment's. The cogeneration system has been commissioned within the premises of a 40 TPH milling capacity Rice Mill for paddy processing and a 500 tonnes per day (TPD) Solvent Extraction Plant.

The commissioning and other key dates pertaining to the project are provided below.

Event description	Date	
	70 TPH Boiler	15 MW Turbine
Commissioning date	December, 2008	January, 2009
Trial run	January, 2009	February, 2009

Grid synchronization with UPPCL	February 14, 2009

Before the project, a 10 TPH rice husk fired boiler was used to meet the heat demand of facility and the electricity demand was met through supply from grid. After the implementation of the project activity the captive heat and electricity demand of the rice mill and solvent extraction plant has been met by the project activity. The surplus electricity from the project activity is exported to the national grid of India. The project operates during the season as well as off-season period of the rice mill. Rice husk is combusted for generation of electricity. In this project, part of the rice husk requirement is met by inhouse generation of rice husk in the rice mill and the remaining quantity is procured from nearby areas.

The project was operating in the monitoring period as it has been defined in the registered monitoring plant. Apart from routine periodic operation and maintenance related outage, no major shut down was observed during the entire monitoring period under consideration.

During the reported monitoring period 01-January-2012 to 31-December-2017 (First and last date included) the project activity has supplied 507,887 MWh of electricity, and thus contributing to the GHG reductions of 403,634 tCO_2e

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1.2 Sectoral Scope and Project Type

Sectoral Scope Number: 1 Sectoral Scope:Energy industries (renewable/non-renewable).

Project Type: Renewable Energy Projects

This is not a grouped project

1.3 Project Proponent

Organization name	Sukhbir Agro Energy Limited
Contact person	Mr. Abhishek Garg
Title	Sr. Manager
Address	Village: Fatehullahpur, Varanasi Gorakhpur Highway
Telephone	9810912563
Email	ghaziapur@sukhniragroenergy.com

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Mr. Saroj Sahoo
Title	Deputy General Manager
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Telephone	+91 7506167848
Email	saroj@enkingint.org and registry@enkingint.org

1.5 Project Start Date

Project Start Date: 14-February-2009 (Date of project commissioning)

1.6 Project Crediting Period

Duration of Crediting period: 14-February-2009 to 13-February-2019 .

Type of crediting period: Fixed crediting period. (10 years)

1.7 Project Location

Host Party (ies):

India

Region/State/Province etc.:

Uttar Pradesh

City/Town/Community etc:

Village: Fatehullahpur, District: Ghazipur

Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity is located in the premises of a rice mill and solvent extraction plant of Sukhbir Agro Energy Limited at Village Fatehullahpur, district Ghazipur, Uttar Pradesh, India. The project is located on Varanasi-Gorakhpur highway and is about 60 Km away from Varanasi. The project is about 10 km away from Ghazipur railway station. Nearest airport is Babatpur in district Varanasi which is about 65 km away. The coordinates of Ghazipur are:

Latitude – between 25° 19' and 25° 54' North

Longitude – between 83° 4' and 83° 58' East

1.8 Title and Reference of Methodology

- Approved combined baseline and monitoring methodology ACM0006[1] (version 6.2) "Consolidated methodology for electricity generation from biomass residues" is applied to the project activity

[1] https://cdm.unfccc.int/methodologies/DB/VMJVDQP3A9KKUEE1B57OVHBDEPO7R0

- Approved combined baseline and monitoring methodology ACM0002[2] (version 8) "Consolidated methodology for grid-connected electricity generation from renewable sources" is used to determine the baseline grid emission factor.

Tools used:

- Tool to calculate the emission factor for an electricity system, version 8.0[3]

Combined tool to identify the baseline scenario and demonstrate additionality, version 02.2.

1.9 Participation under other GHG Programs

The project is also registered under Clean Development Mechanism (CDM) at United Nations Framework Convention on Climate Change (UNFCCC), UNFCCC Ref no. 2708.

The project proponent shall not claim any credit under CDM for the monitoring period under consideration. A declaration to this regard has been submitted to the DoE.

This is to further declare that though the monitoring report for the duration, 01/01/2012 to 13/02/2019 is webhosted at UNFCCC project page, the project proponent shall not claim any credit for the project under CDM for the same monitoring period, 01/01/2012 to 13/02/2019 (which includes the monitoring period considered in this monitoring report, i.e., 01/01/2012 to 31/12/2017). The monitoring report web hosted at UNFCCC web page for the same period shall be withdrawn once the verification request for the same monitoring period is submitted at VERRA.

1.10 Other Forms of Credit

The Project has no intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

The project is registered under Clean Development Mechanism (CDM) at United Nations Framework Convention on Climate Change (UNFCCC), UNFCCC Ref no. 2708. The project proponent shall not claim any credit under CDM for the monitoring period under consideration. A declaration to this regard has been submitted to the DoE.

The project has not sought or received any other form of GHG-related environmental credit, including renewable energy certificates, neither claimed credits under any other Emission Trading Programs or any binding limits during this monitoring period. A declaration to this regard is submitted to the DoE.

1.11 Sustainable Development

SAEL management envisaged that the project activity through the production of renewable energy contributes to sustainable development through the reduction of GHG emissions in the region. The project will also provide direct and indirect employment opportunities to the local community.

[2] https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

The sustainable development potential of the project activity is highlighted through the following broad categories:

- Contribution to environmental well-being.
- Contribution to socio-economic well-being.
- Contribution of technical well-being

Contribution to environmental well-being

- The project activity will result in GHG emission reduction of 0.8 tCO2e per MWh of electricity generated in the project plant by utilizing biomass residues as fuel and displacing fossil fuel dominated grid electricity.
- 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 will also lead to reduced ash generation since the ash content in rice husk is lower than that of Indian coal.

Contribution to socio-economic well - being

- The project activity will result in direct and indirect employment opportunities for local persons towards installation, operation and maintenance of the proposed project activity.
- The proposed project activity will result in increased business opportunities for local contractors and suppliers during the various phases. Also, the collection and transportation of biomass residue will involve manpower requirement throughout the year, thereby creating an opportunity for employment generation. This will contribute towards improvement of the local economic structure and the social status of the people involved, clearly indicating positive socio-economic impact in the local area.

Contribution to technological well-being

- In the state of Uttar Pradesh, biomass residue-based power projects are primarily been dominated by bagasse based cogeneration projects in the sugar mills. There are very few other biomass residues based grid connected power projects in the state1 The Uttar Pradesh state is the second largest producer of rice in the country (approximately 13.38% of the India production[2)] and despite this rice husk based power generation is still not actively prevalent in the state. The installation of proposed project activity will significantly contribute towards technological well being in the region by promoting similar projects.
- The technology being used in the project activity represents the environmentally safe technology for the application of power generation. The equipment being supplied for the project activity are from well-established equipment manufacturers. Installation of such plant at SAEL substantially upgrades the technological level of the industry, introducing superior skills and competencies.

The information mentioned above concludes that the subject project activity of rice husk based cogeneration project is first of its kind project of such large capacity in the state of Uttar Pradesh in spite of large capacity of rice mills available in the state. Project activity's contribution to sustainable development parameters of the host country has been described and it is evident that project activity meets all the criteria of sustainable development policy of host country.

2 SAFEGUARDS

2.1 No Net Harm

There are no negative environmental impacts that arises as a result of the project activity. However, the following factors were analyzed for potential impacts and these are handled as per applicable statutory guidelines and are mentioned as follows:

1. Impact on Land. The ash generated from the project activity are disposed as per the state Pollution Control Board guidelines.
2. Impact on Water. UP Pollution Control Board (UPPCB) has identified the norms of water consent and SAEL ensures that waste water generated from the project activity treated to meet required limits before disposal.
3. Impact on Air. The project activity leads to reduction of GHG emission and also the particulate emission is reduced to permissible limits by use of an ESP. Vent through stacks is also controlled as per State Pollution Board Guidelines and consent conditions.
4. Impact on Ecology. The project activity does not have any harmful impact on the ecology. There are no nearby forests, or zones high on biodiversity, or other sensitive locations around the factory that may be affected negatively due to the project. Further, no harmful impact is caused on the aquatic ecology as well as on the local vegetation. Individuals working in high noise zones is provided adequate gadgets for protection.

The project activity has received the consent to establish from Uttar Pradesh Pollution Control Board. During the operation of the project activity yearly consents to operate are obtained from the UPPCB for air and water pollution. The project operates within the stipulated limits set by the UPPCB and the is monitored as part of the overall GHG emission reduction project compliance.

2.2 Local Stakeholder Consultation

The local stakeholders were identified and informed about the proposed project activity by circulating pamphlets in nearby local villages and by sending individual letters briefing the scope, nature and description of the project. PP has considered that since newspaper may not reach all concerned stakeholders (villagers) and has adopted an approach of contacting the persons personally through personalized invitations. The local stakeholders were invited them to submit their opinion and comments.

A local stakeholder meeting was also organized by SAEL management, inviting representatives from local community. The minutes of meeting were made and sent to the participants. The same has been made available to DOE during the validation process.

The project activity has received the “consent to establish” form the Uttar Pradesh Pollution Control Board.

The other stakeholders notified for the project activity are:

- Uttar Pradesh Power Corporation Limited,
- State Boiler Inspectorate, and
- State Electrical Inspectorate.

There are no pending issues related to these stakeholders and project owners have received relevant formal consents.

The project proponent has devised a system for local stake holder interaction during the operation of the project. Local stake holders are allowed to visit the project site and raise their concern about the project. A grievance register is maintained at the project site in which the feedback and concerns are reported. There is no adverse comment recorded to be reported during the monitoring period under consideration. The copy of grievance register is submitted to the DoE.

2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The proposed power project will consist of following main units:

- One 70 TPH capacity biomass residue fired boiler.
- One 15 MW capacity extraction cum condensing type turbo generator.

The project activity will also include all auxiliary installations and systems, including Electrostatic precipitator (ESP), cooling water system and cooling tower, ash handling system, feed water system, raw water system and DM plant, electrical system and control and instrumentation.

Important dates:

Event description	Date	
	70 TPH Boiler	15 MW Turbine
Commissioning date	December, 2008	January, 2009
Trial run	January, 2009	February, 2009

Grid synchronization with UPPCL	February 14, 2009

The technical specifications of the key equipment are as follows:

Major Technical Parameters of Boiler

Description	Parameters
No of boilers	One (1)
Makers	ISGEC John Thomson (IJT)
Type	Bi-drum, natural circulation, balanced draft, bottom supported, outdoor water tube type travelling grate
Steam flow at main steam stop valve outlet (100% BMCR)	70 TPH
Steam pressure at main steam stop valve outlet	67 kg/cm^2 (g)

Steam temperature at main steam stop valve outlet	490 +/- 5 deg C.
Feed water temperature at the economizer inlet	126 deg C
Design code for pressure parts	IBR

The boiler is designed with following design codes:

- Pressure parts: IBR 1950 with latest amendments
- Piping: ANSI 31.1 & IBR 1950
- Boiler performance: ASME PTC 4.4 – Indirect Method

The Electrostatic Precipitator procured for installation at the downstream of boiler flue gases has been designed not only to meet the regulatory norms (150 ppm) of State Pollution Control Board but significantly decrease the SPM level before exhausting to atmosphere. It is expected to control SPM below 100 ppm.

The boiler supplied by IJT has added advantage in terms of quick and easy ash removal process, high efficiency, quick response to load change, greater reliability, ease of maintenance and step less (smooth) change in grate speed.

Major Technical Parameters of Steam Turbine generator

Description	Parameters
No of Turbine	One (1)
Makers	Qingdao Jieneng Power Station Engineering Co., Ltd (QJPS)
Type	Extraction cum condensing
Rated capacity of turbine	15 MW with 10TPH extraction at 2.5 ata
Steam conditions at turbine inlet pressure (abs)	64 kg/cm^2 (g)
Temperature	485 +/- 5 deg C.
Condenser operational pressure (ata)	0.106
Recommended temperature rise in the cooling tower (deg C)	9.6
Rating at the generator terminals (MW)	15
Electrical generator	One 11kV, 50Hz, 0.8 power factor

The turbine is designed and manufactured according to following standards:

For turbine, it is GB/T5578-1985 “Technical specifications for stationery steam turbine” which is equivalent to IEC 34:

For Generators, it is GB/T6064-2002, “General technical specification for turbo generator”, which is equivalent to IEC-34

DM Plant: This is single stream manually operated DM plant with flow rate of 6m^3/hr.

The power is generated at 11 kV from the turbine generator. The power output from the turbine generators is stepped up to 132 kV at SAEL plant and then connected to the grid line.

The technology of biomass-based power generation is well established in India and the project doesn’t involve any transfer of technology. The technology being used is environmentally safe and sound.

Shutdown:

Apart from routine periodic operation and maintenance related outage, no major shut down was observed during the entire monitoring period under consideration.

3.2 Deviations

2.3.1 Methodology Deviations

There is no methodology deviation observed in the monitoring period under consideration.

2.3.2 Project Description Deviations

There is no methodology deviation observed in the monitoring period under consideration

3.3 Grouped Projects

Not Applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{electricity,y}$
Data unit	tCO2 / MWh
Description	Combined margin (CM) value of CO2 baseline emission factor for the grid electricity displaced due to the project activity during the year y
Source of data	Central Electricity Authority, India "CO2 baseline database, version 4, Oct 2008)"[4]
Value applied	0.80 tCO2 / MWh
Justification of choice of data or description of measurement methods and procedures applied	As local data's are not available hence, Combined margin (CM) value by CEA is considered. CEA is the statutory organization constituted by Government of India to advise on matters relating to the national electricity policy, CEA also collects and record the data concerning to the generation, transmission, trading, and distribution. CEA has developed an emission baseline database for all Indian regional grids for prospective CDM projects. The database currently covers emission factors for fiscal years 2005-2008 and will be updated annually. CEA has calculated Combined margin (including inter-regional and cross-border electricity transfers) according to methodology ACM0002 for the year 2007 – 2008

[4] https://cea.nic.in/cdm-co2-baseline-database/?lang=en

Purpose of Data	Used for Baseline emission calculations
Comments	Baseline emission factor is held constant as ex-ante based and fixed for entire crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{projectplant,y}$
Data unit	MWh per annum
Description	Net electrical energy generated by the project activity
Source of data	Electricity meter at generation point.
Description of measurement methods and procedures to be applied	Hourly recordings of data is be taken from energy meters located at the project activity site. This data is recorded hourly by the Switch Board attendant and entered into logbooks on site. This hourly data is 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 meters are calibrated annually by an independent third party.
Frequency of monitoring/recording	Measuring Frequency – Hourly Recording Frequency – Hourly
Value monitored	507887
Monitoring equipment	The parameters gross generation ($EG_{Gross,y}$) and auxiliary consumption ($EG_{Aux,y}$ where, $EG_{Aux,y} = EG_{Aux1,y} + EG_{Aux2,y}$) are measured using energy meters EM-6, EM-3 & EM-4 respectively installed in the power plant. The details of the energy meters used for the measurement are enclosed in appendix 1.
QA/QC procedures to be applied	The data are archived electronically. The consistency of metered net electricity generation cab be cross checked with the quantity of biomass fired. The meters are calibrated annually by an independent third party. The calibration reports have been submitted to DOE.
Purpose of the data	Data used for baseline emission calculations
Calculation method	Net electricity generation is calculated by subtracting auxiliary electricity consumption from gross electricity generation. $EG_{project\ plant,y} = EG_{Gross,y} - EG_{Aux,y}$ Where, $EG_{Aux,y} = EG_{Aux1,y} + EG_{Aux2,y}$
Comments	-

Data / Parameter	BF_y

Data unit	Tonnes of dry matter; MT
Description	Quantity of biomass residue (rice husk) combusted in the project activity during the year y
Source of data	Plant log records
Description of measurement methods and procedures to be applied	The amount of biomass residue (rice husk) procured from outside are measured by the weigh bridge installed at the factory gate. The receipts of the same are the basis for monitoring the number of truck trips and the average distance traveled to determine the project emissions. The amount of biomass residue (rice husk) form the internal source is measured as a percentage of paddy processed by the rice mill. The amount of paddy processed is measured by the weigh bridge installed at factory gate.
Frequency of monitoring/recording	Continuous (as when received at site)
Value monitored	769,576
Monitoring equipment	The amount of rice husk procured from outside is measured by 2 weigh bridges of capacity 40 MT & 100 MT which are installed at the factory gate. The amount of rice husk from internal source is measured as a percentage of paddy processed by the rice mill. The details of the weigh bridges used in the project activity are provided in the appendix-1.
QA/QC procedures to be applied	The biomass combusted in the boilers is cross checked through an energy balance undertaken each year for the project activity.
Purpose of the data	Data used for baseline emission and project emission calculations
Calculation method	The measurement frequency is daily. For the biomass procured from outside, the recording is done as it arrives at the factory gate. The loaded truck is stationed on the weigh bridge and the weight is recorded as the gross weight. After unloading the biomass, the truck is stationed again on the weigh bridge and the tier weight is recorded. The difference in the gross and the tier weight is the quantity of rice husk procured. The quantity of rice husk collected from internal sources is measured as a percent of paddy processed. The weights are later adjusted for moisture content by measuring the same in the in house laboratory.
Comments	Data will be held for a period of 2 years after the end of the crediting period.

Data / Parameter	**Moisture content of biomass residues**
Data unit	% Water content
Description	Moisture content of biomass residue
Source of data	In house laboratory test reports and third party test reports

Description of measurement methods and procedures to be applied	The moisture content of biomass residue is determined in the in-house laboratory. Standard testing procedure will be used. The monitoring will be continuously, with mean values calculated annually
Frequency of monitoring/recording	Monitored continuously. Daily records are maintained with mean values calculated annually.
Value monitored	14.23%[5]
Monitoring equipment	
QA/QC procedures to be applied	The value can be checked for consistency by getting one sample analyzed at an authorised laboratory once in six months.
Purpose of the data	The data is used to determine leakage emissions, if any. Leakage emissions due to competing use of biomass was found to be insignificant and thus ignored.
Calculation method	-
Comments	Data will be held for a period of 2 years after the end of the crediting period.

Data / Parameter	AVD_y
Data unit	Km
Description	Average round trip distance (from and to) between biomass fuel supply sites and the project site
Source of data	Plant records
Description of measurement methods and procedures to be applied	Factory records maintained at the factory gate at the time of receipt of biomass residues at factory
Frequency of monitoring/recording	Monitored continuously. Daily records are maintained with mean values calculated annually.
Value monitored	95.9
Monitoring equipment	Records are maintained at the factory gate. Recording is done when a truck loaded with biomass arrives at the factory gate.
QA/QC procedures to be applied	The records can be checked from the receipts of biomass residue received from the transporters
Purpose of the data	Data used for project emission calculation
Calculation method	Factory records maintained at the factory gate at the time of receipt of biomass residues at factory gate.

[5] Average for the entire monitoring period

Comments	Data will be held for a period of 2 years after the end of the crediting period.

Data / Parameter	N_y
Data unit	-
Description	Number of truck trips for the transportation of biomass.
Source of data	Plant records
Description of measurement methods and procedures to be applied	Factory records maintained at the factory gate at the time of receipt of biomass residues at factory
Frequency of monitoring/recording	Monitored continuously. Daily records are maintained with mean values calculated annually.
Value monitored	62807
Monitoring equipment	Records are maintained at the factory gate. Recording is done as and when a truck loaded with biomass arrives at the factory gate
QA/QC procedures to be applied	The number of truck carrying rice husk and entering the plant premises are entered into the register and maintained at plant gate. They can be crosschecked with the receipts maintained for recording the quantity of biomass received and distance travelled.
Purpose of the data	Data used for project emission calculation
Calculation method	Factory records maintained at the factory gate at the time of receipt of biomass residues at factory gate.
Comments	Data will be held for a period of 2 years after the end of the crediting period.

Data / Parameter	$EF_{km,CO2,y}$
Data unit	tCO_2/km
Description	Average CO_2 emission factor for the trucks during the year y
Source of data	IPCC default value
Description of measurement methods and procedures to be applied	Vehicle mileage – Page No. 6 of the Registered PDD titled "15 MW Biomass Residue Based Power Project at Ghazipur, India" Version 05 dated 05/11/2009 with reference no. 2708 Density of diesel – http://www.siamindia.com/scripts/Diesel.aspx Net Calorific Value (NCV) for diesel - 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volme-2, Page 1.18 CO2 emission factor for diesel - Report of "India's Initial National Communication to UNFCCC" (Page: 41, Table: 2.6)

Frequency of monitoring/recording	Default values are used for calculation.
Value monitored	0.00044
Monitoring equipment	-
QA/QC procedures to be applied	The values are used from reliable default values
Purpose of the data	Data used for project emission calculation
Calculation method	Average CO_2 emission factor for the trucks = Vehicle mileage x Density of diesel x NCV of diesel x CO_2 emission factor for diesel
Comments	Data will be archived for a period of 2 years after the end of the crediting period

Data / Parameter	Quantity of biomass residues of type k that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region
Data unit	Tons
Description	Quantity of biomass residues of type k that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region
Source of data	Survey or statistics
Description of measurement methods and procedures to be applied	The monitoring/survey is be carried out by an authorized third party.
Frequency of monitoring/recording	Annual
Value monitored	156431 (average annual value)
Monitoring equipment	No monitoring equipment is used.
QA/QC procedures to be applied	The study is done by an authorized third party.
Purpose of the data	To calculate leakage emission (In case surplus of biomass, is less than the 25% of the total consumption of the biomass in the region (within 200 km radius of the project site) including the requirement of the project activity)
Calculation method	Based on third party assessment report
Comments	This parameter is monitored since approach L2 is used to rule out leakage

Data / Parameter	Quantity of available biomass residues rice husk in the region of 200 Kms. And as defined in B.3 and Biomass Assessment Survey report.
Data unit	Tons
Description	Quantity of available biomass residues of type k in the region
Source of data	Survey or statistics
Description of measurement methods and procedures to be applied	The monitoring/survey is carried out by an authorised third party. The monitoring is carried out once a year.
Frequency of monitoring/recording	Annual
Value monitored	981234 (average annual value)
Monitoring equipment	No monitoring equipment is used.
QA/QC procedures to be applied	The study is done by an authorized third party.
Purpose of the data	To calculate leakage emission (In case surplus of biomass, is less than the 25% of the total consumption of the biomass in the region (within 200 km radius of the project site) including the requirement of the project activity)
Calculation method	Based on third party assessment report
Comments	This parameter is monitored since approach L2 is used to rule out leakage

Data / Parameter	$EF_{Co2,LE}$
Data unit	tCO2/GJ
Description	CO2 emission factor of the most carbon intensive fuel used in the country
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume2, Table 1.4, Page 1.23
Description of measurement methods and procedures to be applied	IPCC default is used.
Frequency of monitoring/recording	Annual
Value monitored	260,000 (blast furnace gas: derived gas of coal tar)
Monitoring equipment	NA

QA/QC procedures to be applied	IPCC default value is used
Purpose of the data	The data is used to determine leakage emissions, if any. Leakage emissions due to competing use of biomass was found to be insignificant and thus ignored.
Calculation method	-
Comments	-

Data / Parameter	$Q_{project\ plant,\ y}$
Data unit	GJ
Description	Net quantity of heat generated from firing biomass in the project plant
Source of data	Steam Flow Logs
Description of measurement methods and procedures to be applied	The steam quantity is measured hourly.
Frequency of monitoring/recording	Measuring Frequency – Hourly Recording Frequency – Daily
Value monitored	6712601
Monitoring equipment	The details of the steam flow meter used are provided in appendix-1
QA/QC procedures to be applied	The steam flow meter is calibrated annually in accordance with manufacturer specifications. The metered net heat generation can be cross checked against the quantity of biomass fired by dividing the former by the latter. The resultant efficiency arrived at was found to be consistent with that quoted by the manufacturer.
Purpose of the data	This parameter is not used emission reduction calculation.
Calculation method	NA
Comments	NA

Data / Parameter	NCV_k
Data unit	GJ/ton of dry matter
Description	Net Calorific value of biomass residue type k (rice husk)
Source of data	Measurements

Description of measurement methods and procedures to be applied	NCV of rice husk is determined in an in-house laboratory. Standard testing procedure is followed. In addition to that the NCV test is done by a reputed external laboratory at least once in a six month period by taking at least three samples for each measurement.
Frequency of monitoring/recording	Daily records are maintained with mean values calculated annually.
Value monitored	3202[6]
Monitoring equipment	NCV of rice husk is determined in an in-house laboratory. Standard testing procedure is followed.
QA/QC procedures to be applied	The in-house measured values are cross-checked for consistency by getting sample analysed by authorized at least once in six months
Purpose of the data	Data used for project emission calculations
Calculation method	NA
Comments	NA

Data / Parameter	ε_{boiler}
Data unit	%
Description	Average net energy efficiency of heat generation in the boiler that would generate heat in the absence of the project activity. Under the project activity this would be the 10 TPH boiler
Source of data	Higher value among (a) the measured efficiency and (b) manufacturer's information on the efficiency
Description of measurement methods and procedures to be applied	Direct method (dividing the net heat generation by the energy content of the fuels fired during a representative time period) is used.
Frequency of monitoring/recording	The higher value of the following is considered: a) Measured Efficiency (historic 3 years data) b) Manufacturer specification a) The thermal efficiency of 10 TPH Boiler for the last 3 years b) The designed efficiency as specified by the manufacturer is 80% As the designed efficiency is greater than the measured efficiency, the efficiency of the 10 TPH boiler is 80%.
Value monitored	75.1%[7]

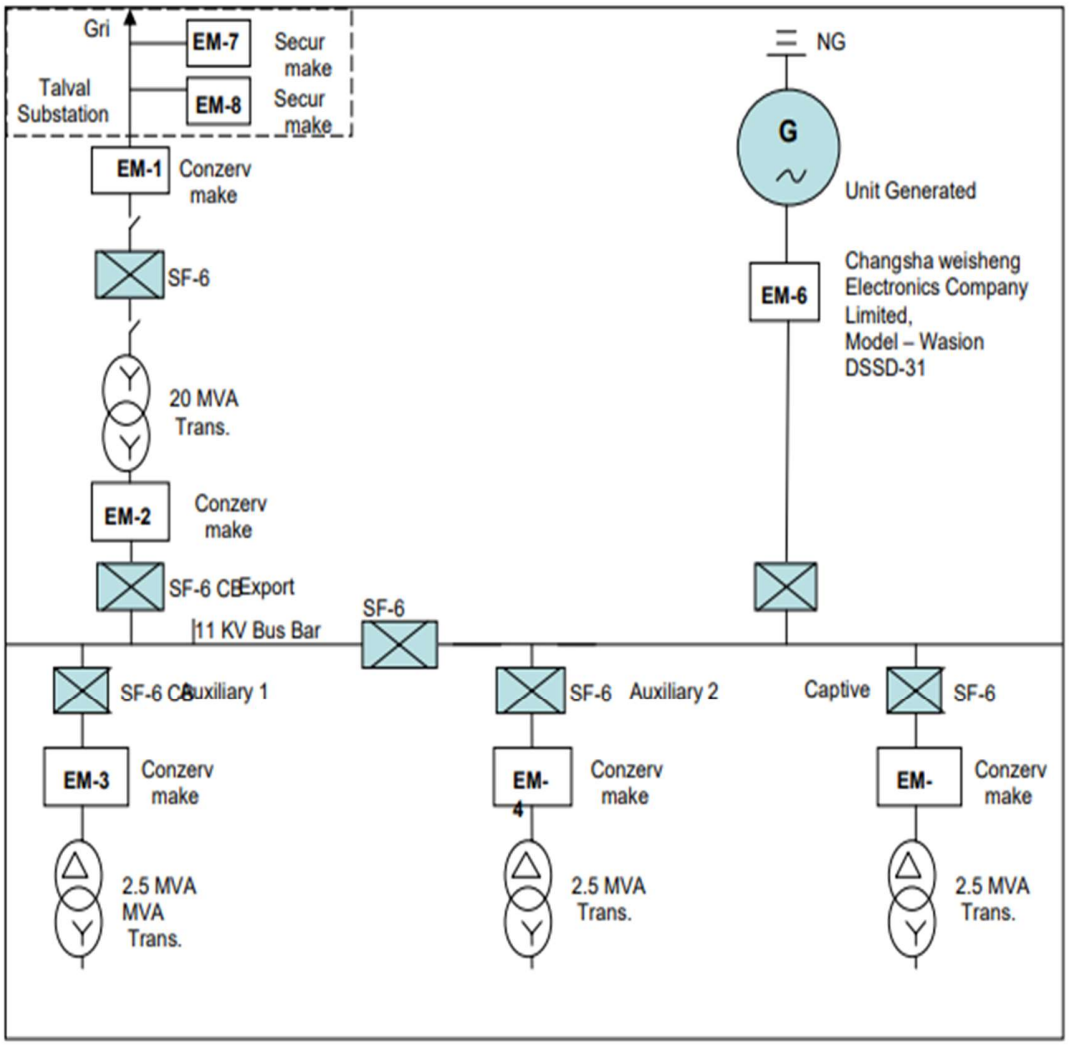
[6] Average for entire monitoring period

[7] Average for entire monitoring period

Monitoring equipment	No monitoring equipment is used for this parameter. This value is calculated using values of other monitoring parameters.
QA/QC procedures to be applied	Consistency can be checked with manufacturers' information or the efficiency.
Purpose of the data	The data is not used in the determination of emission reduction.
Calculation method	-
Comments	-

4.3 Monitoring Plan

Approved baseline and monitoring methodology involves the monitoring of electricity as well as fuel. Monitoring of electricity data revolves around power generation from the turbine generators and auxiliary consumption of the project activity. While the main meter attached to the turbine generator meters the total (or gross) generation, there are two separate meters installed to meter the auxiliary consumption. The meters installed are calibrated once a year. Diagram below details the electricity metering system for the project.



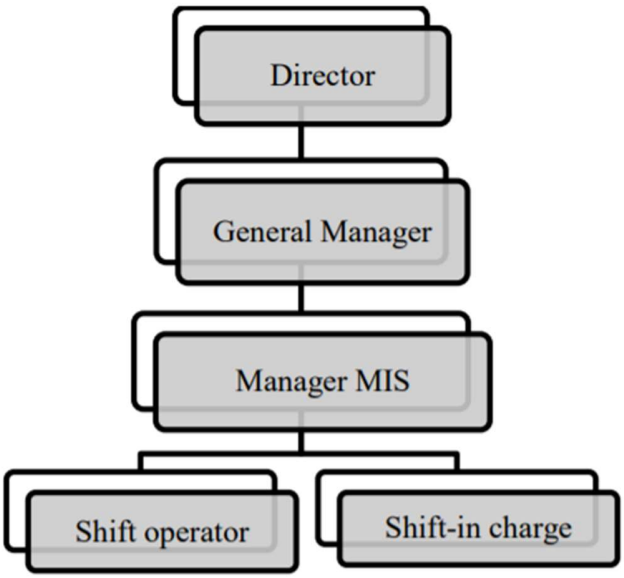
Monitoring is based on electricity meters 3, 4 & 6. Gross electricity is measured by EM-6 and auxiliary consumption is measured by EMs 3 & 4 respectively. The difference between gross generation and auxiliary consumption qualifies as net electricity for determining the baseline emissions for the project activity.

The amount of rice husk procured from outside is measured by 2 weigh bridges of capacity 40 ton & 100 ton installed at the factory gate. Receipts of the same form the basis for monitoring the number of truck trips and the average return trip distance to determine project emissions.

The amount of rice husk from internal source is measured as a percentage of paddy processed by the rice mill where, the amount of paddy processed in turn is measured by the weigh bridges. The weigh bridges are calibrated once a year to ensure accurate readings.

Operational and Management structure:

SAEL has established and maintained appropriate monitoring systems and quality control. The organizational structure of the team responsible for the CDM monitoring operations is given below:



The management of the plant has designated a Manager MIS to be responsible for the collection of data as per the monitoring methodology. The Manager MIS is entrusted to collect all data to be monitored as mentioned in the registered Project Design Document (PDD) and report to the General Manager (GM) of the plant. The overall CDM project management responsibility remains with the GM. The GM is also responsible for entire CDM related activities and ensures quality assurance on the final data and facts recorded. The GM is authorized any futuristic requirements and assess the appropriateness of the data at regular interval. The GM in turn reports to the Board Director on quarterly basis on the operational details of the project activity.

A person designated as Commercial Executive maintains daily records pertaining to procurement of rice husk from outside, generation of rice husk from in-house rice mill and their utilization as fuel for steam generation in project plant. A dedicated persons designated as CDM Executive maintains daily records pertaining to steam and electricity generation.

The hourly recording of data is done by shift operators that are checked by the shift in-charge at the end of each shift and re-checked by the Commercial Executive or the CDM Executive accordingly at the end of the day. The data is compiled as a daily report by the Commercial Executive or the CDM Executive accordingly in the formats developed at the site by the Manager MIS. The daily reports are sent to the GM for verification and are used to prepare a monthly report. The monthly reports are prepared by the Manager MIS and are re-sent to the GM for verification. The reports after verification become a part of the Management Information System (MIS) and are reviewed by the management during the review meeting. It is these verified monthly reports that are used for estimating emission reductions The Manager MIS is also responsible for archiving the data.

SAEL has engaged its existing resources to manage, monitor and ensure quality control on the monitoring and recording of the desired data for the project activity. The CDM monitoring personnel maintain and review all related factory records and are familiar with the process of monitoring and documentation.

Uncertainties and adjustment: procedure for identifying and dealing with them

If errors are detected, error detection and disposal reports are submitted to the General Manager. If these errors occur as a result of inadequacy of QA and QC procedure, the GM after assessing historic data makes necessary adjustments and recommends the Manager MIS to implement

the same. Any such observations are also documented in the daily report maintained by GM and can be found in the records along with its time of occurrence, duration and possible reasons behind such operational discrepancies.

Emergency preparedness plan

The project activity does not result in any unidentified activity that can lead to unpredicted and significant emissions. Hence, there is no need for emergency preparedness in data monitoring. Biomass storage is continuously monitored to ensure there is no decay of biomass that can lead to an increase in GHG emissions. Measures have been taken to maintain low moisture content of biomass residue at all times.

Training

Training is provided to the site persons at regular intervals about the measurement and recording procedure of the monitoring parameters. In addition to the regular training and skill development program, whenever a new person joins the monitoring team, it's ensured that adequate training and induction procedure is carried before he/she starts the routine monitoring activity.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per the consolidated methodology ACM0006, calculation of baseline emission associated with the electricity generation, the generation of heat and the usage of biomass. Broadly the emission reductions from the project are calculated from the application of the following equation:

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$$

Where:

ER_y Emissions reductions of the project activity during the year y (tCO2/yr)

$ER_{heat,y}$ Emission reductions due to displacement of heat during the year y (tCO2/yr)

$ER_{electricity,y}$ Emission reductions due to displacement of electricity during the year y (tCO2/yr)

$BE_{biomass,y}$ Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y (tCO2e/yr)

PE_y Project emissions during the year y (tCO2/yr)

L_y Leakage emissions during the year y (tCO2/yr)

Baseline emissions of the project activity constitutes emission reductions from displacement of electricity ($ER_{electricity,y)}$ alone and not emission reductions due to heat generation ($ER_{heat,y}$) and emissions reductions from biomass decay ($ER_{biomass,y}$). As $ER_{heat,y}$ and $ER_{biomass,y}$ are not been claimed, these are assumed as zero. Baseline emissions of the project activity are thus determined by the following equation:

$ER_{electricity,\ y} = EG_y . EF_{electricity,\ y}$

Where,

EGy is the net quantity of electricity generation as a result of the project activity.

$EF_{electricity,y}$ is the CO_2 emission factor for the electricity displaced due to the project activity during the year y in tons CO_2/MWh

The CO2 emission factor for the displacement of electricity corresponds to the grid emission factor ($ER_{electricity,y} = EF_{grid}$).

The grid emission factor (EF_{grid}) has been fixed ex-ante for the project activity and the value as per of the registered PDD is 0.80 tCO_2/MWh. Baseline emission calculation for the monitoring period is as follows:

Baseline emission calculation for the monitoring period is as follows:

Years	Gross power generation (MWh)	Auxiliary Consumption (MWh)	Net power generation (MWh)	EG_y ($EG_{project\ plant,y}$)	$EF_{electricity,y}$	$ER_{electricity,y}$ (tCO2)
2012	106941	9879	97063	97063	0.80	77650
2013	85878	8381	77496	77496	0.80	61996
2014	72590	7530	65060	65060	0.80	52048
2015	99175	9325	89850	89850	0.80	71880
2016	106440	12280	94160	94160	0.80	75328
2017	94595	10337	84258	84258	0.80	67406
Total	**565619**	**57732**	**507887**	**507887**		**406308**

5.2 Project Emissions

The only emissions attributed to the operation of the project activity are those from the transport of biomass residue (rice husk) to the project plant i.e. $PE_y = PET_y$.

Rice husk procured are transported to the project site by trucks and the CO_2 emissions resulting from transportation of rice husk to the project plant are calculated as per Option-1 on the basis of distance and the number of trips as:

$PET_y = N_y * AVD_y * EF_{km, CO2}$

Where,

PET_y is C_{O2} emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/yr);

Ny is the number of truck trips during the period y;

AVD_y is the average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the year y (km); and

$EFkm,C_{O2}$ is the average CO_2 emission factor for the trucks measured during the year y in t (CO_2/km)

Project emission calculation for the monitoring period is as follows:

Years	N_y	AVD_y (km)	$EF_{km,CO2}$ (tCO_2/km)	PET_y (tCO_2)
2012	10834	144.3	0.00044	689
2013	9191	100.1	0.00044	405
2014	9334	97.9	0.00044	402
2015	6890	81.8	0.00044	249
2016	11018	55.8	0.00044	271
2017	15540	96.2	0.00044	658
Total	**62807**			**2674**

5.3 Leakage

Based on biomass availability survey reports, it is found that there is a surplus of biomass, which is much more than the 25% of the total consumption of the biomass in the region (within 200 km radius of the project site) including the requirement of the project activity. Hence, as per the registered PDD, leakage emissions due to competing use of biomass is insignificant and ignored.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2012	77650	689	0	76961
2013	61996	405	0	61591
2014	52048	402	0	51646
2015	71880	249	0	71631
2016	75328	271	0	75057
2017	67406	658	0	66748
Total	**406308**	**2674**	**0**	**403634**

APPENDIX 1: DETAILS OF MEASURING EQUIPEMENT

Details of the Energy Meters used:

Meter ID no.	Meter Sr. No.	Make/Model	Accuracy class	Date of calibration						
M6	20070325010057/2008	WASION/DSSD331	0.5s	23-August-2011	22-August-2012	19-August-2013	16-August-2014	14-August-2015	13-August-2016	11-August-2017
M3	144917/135263-1008	Conzerv/6400	1	22-August-2011	22-August-2012	19-August-2013	16-August-2014	14-August-2015	13-August-2016	11-August-2017
M4	144917/135265/1008	Conzerv/6400	1	22-August-2011	22-August-2012	19-August-2013	16-August-2014	14-August-2015	13-August-2016	11-August-2017

Details of Weigh Bridge:

Capacity	Serial No.	Accuracy class	Date of calibration				
40 Tons	0411032K	Class III	20-May-2011	19- May -2012	08- May -2015	08- May -2016	30- May -2017
100 Tons	2001732	Class III	17-December-2011	12-December -2013	08-December -2014	03-March-2016	03-March-2017

Details of Steam Flow Meter:

Make	Model	Serial number	Date of calibration						
YOKOGAWA	EJA 110 A	91H542351	24-August-2011	22-August-2012	19-August-2013	16-August-2014	14-August-2015	13-August-2016	11-August-2017