



**Verified Carbon
Standard**

BIOMASS BASED POWER GENERATION PLANT AT VILLAGE CHANNU, PUNJAB



Document Prepared by EKI Energy Services Limited

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity is undertaken by Universal Biomass Energy Private Limited (UBEPL) in Muktsar district of Punjab, India. The project involves installation of a new 14.5 MW Bio-mass Residue based Power Plant to generate electricity and export power to the regional grid. The project is already commissioned and operational since 30/10/2009. All facilities and equipment have been installed as it has been defined in the registered PDD. The details and specifications of the major component involved in the project is provided in section 3.1 of this document. The power plant is fired primarily with cotton stalk, a by-product of cotton cultivation with mustard stalk being other locally available agricultural wastes as the other fuel. The project activity thus reduces GHG emissions by displacing the fossil fuel dominated grid-based electricity with biomass residues based renewable electricity.

The purpose of the project activity is to utilize the surplus biomass available in the region namely cotton stalks and mustard stalk effectively for generation of power. Electricity thus generated is exported to the grid and hence contributes to Green House Gas (GHG) emission reductions and sustainable economic growth. The proposed project further helps to reduce the ever-increasing demand and supply gap of electricity in the host country, India.

The location of project in Muktsar District, Punjab was considered keeping in view the availability of cotton stalk in the area. Muktsar lies in southern Punjab which is the main cotton growing area of the state. Muktsar, Bathinda and Ferozepur districts of Punjab have been Identified as the other prime source of feedstock i.e., cotton stalk to run the power plant. The state of Punjab produces 25% of Country's cotton.

Project activity of UBEPL uses Rankine cycle of combustion technology, where the Biomass fuels can be directly fired inside the boilers to generate 14.5 MW.

1.2 The total GHG emission reductions achieved in the requested monitoring period, 01/03/2017 to 29/10/2019 is 216660 .Sectoral Scope and Project Type

Sectoral Scope: **01:** Energy industries (renewable - / non-renewable sources)

Project Type: The project activity is a type I i.e., Renewable Energy Projects.

The project activity is an individual project activity and not a grouped project.

1.3 Project Proponent

Organization name	Universal Biomass Energy Private Limited(UBEPL)
Contact person	Mr.Jasbir Singh
Title	Director
Address	Giddarbaha-Lambi Road, Village: Channu District: Muktsar, Punjab

	Post-152107
Telephone	+911637241501
Email	abhishek.garg@sael.co

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	DGM, Climate Change
Address	Office no. 201, Plot 48, Scheme 78 Part 2 Vijay Nagar, Near Brilliant Convention Centre Indore - 452010 (M.P, India) Website www.enkingint.org
Telephone	+91-7506167848
Email	saroj@enkingint.org

1.5 Project Start Date

30/10/2009 (Commissioning date of the project)

1.6 Project Crediting Period

Crediting Period: 30/10/2009 to 29/10/2019

1.7 Project Location

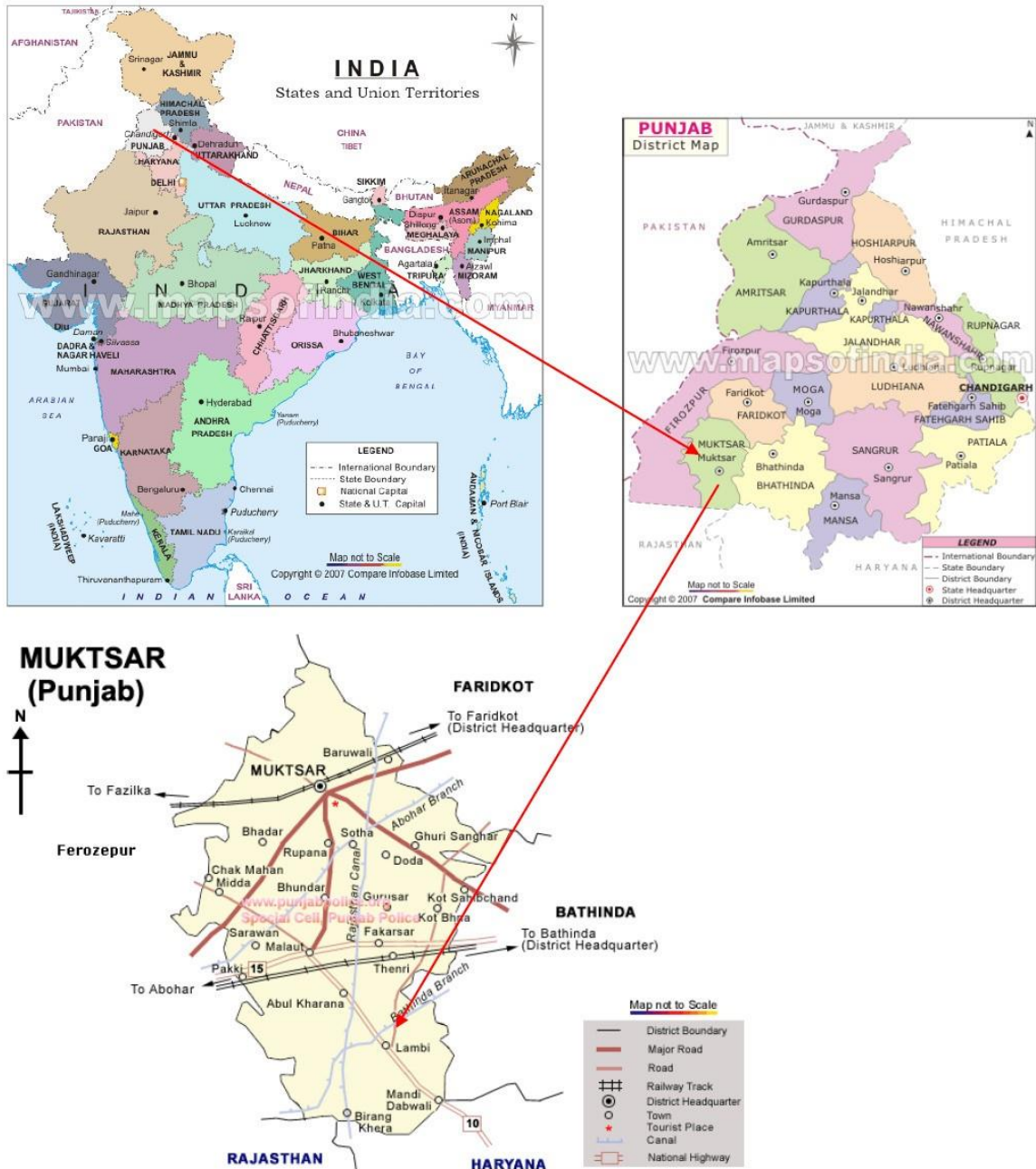
The project activity is located in village Channu, Tehsil Malout, District Muktsar Punjab state in India. Muktsar district is located in south western part of Punjab. It is surrounded by states of Rajasthan and Haryana in the south, district Faridkot in north, Ferozepur in west and Bathinda in the east. The western Himalayas in the north and Thar Desert in the south and south west determine the climatic condition of the district. It covers an area of 2615 sq km, which constitutes 5.19 % area of the state of Punjab. Muktsar city is well connected by rail and road. It is located at 260 km from Chandigarh and 356 km from New Delhi.

The coordinates of project activity site,village: Channu (Tehsil Malout)are:

Latitude-30 degree 07' 15.95"N to 30 degree 07' 21.38"N

Altitude-164 Metres above mean sea level.

The following map shows the exact location of the project activity.



1.8 Title and Reference of Methodology

Title	AMS ID: Grid connected renewable electricity generation
Version number	15
Reference	https://cdm.unfccc.int/UserManagement/FileStorage/7QXAZ5036WN8BEYKUDFRPJGL21V4I9

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. 4488.

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

This is to further declare that though the monitoring report for the same duration, 01/03/2017 to 29/10/2019 is webhosted at UNFCCC project page, the project proponent shall not claim any credit for the project under CDM for the same monitoring period, 01/03/2017 to 29/10/2019. 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 (ongoing monitoring period) is submitted at VERRA.

1.10 Other Forms of Credit

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period. A declaration to this regard shall be submitted to the DoE.

1.11 Sustainable Development

UBEPL management has envisaged that the project activity through the production of energy from biomass would contribute to sustainable development through the reduction of GHG emissions in the region. The sustainable development potential of the project activity is highlighted through the following indicators for sustainable development stipulated by Designated National Authority for CDM i.e., Ministry of Environment and Forests (MoEF), Government of India:

- Environmental well-being.
- Social well being.
- Economic well-being.
- Technological well-being.

Contribution to environmental well-being

- The project activity utilizes biomass potential available for power generation. The power thus generated is supplied to NEWNE regional grid, which is dominated by electricity generated using fossil fuels such as coal, lignite, petroleum fuels and gas etc. The project activity results in GHG emission reduction of 0.84 tCO₂e per MWh of electricity generated in the project plant.
- The project activity helps conserve local resources, reduces pressure on the local environment and provides improved health in addition to other environmental benefits. At the same time the uncontrolled burning of biomass in the absence of proposed project activity is prevented by use in power plant under controlled conditions, thus reducing the production of carbon monoxide and other harmful gases.
- In addition to the reduction in Carbon Dioxide emissions the project implementation results in reduction of other harmful gases (NO_x and SO_x) that arise from the combustion of fossil fuel used in conventional power generation.
- The project also leads to reduced ash generation since the ash content in cotton stalk and other similar biomass that is used in proposed project activity is lower than that of Indian coal.

Contribution to social wellbeing

- The project activity results in direct and indirect employment opportunities for local persons towards installation, operation and maintenance of the proposed project activity.
- Collection, transportation and handling of biomass residue from fields involve man power requirement throughout the year, hence generate employment opportunities to the rural people.
- Direct employment opportunity due to the project activity is expected to be for approximately 326 persons approximately. This contributes 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.
- The project engages both genders in construction of the project, biomass collection and handling etc. during entire operational lifetime of the project. This leads to an increase in gender equity and hence prevents social disparities.
- Project proponents have planned personal protective equipment's such as gloves etc., to provide them protection against the usual injuries during manual handling and collection of cotton stalk biomass.

Contribution to economic wellbeing

- The project has brought an investment of approximately Rs.7,459 Million as a Greenfield project in the under developed site of project location.
- The project activity acts as a nucleus for other economic activities such as setting up of shops, hotels etc in and around the area contributing to the economic development around the project site. It has resulted in increased business opportunities for local contractors and suppliers during the various phases.

- The project generates commercial value to crop residues enabling the farmers to get better price out of their produce augmenting their income.
- The biomass based power generating plant contributes to the availability of continuous and sustained power to the local industries and agricultural farmers located in remote areas, thereby avoiding the load shedding and improving quality of power. This further helps in improving the socioeconomic status of the region.

Contribution to technological well-being

- The technology selected for the proposed project is an energy efficient technology. The project uses a steam turbine generator with matching boiler of travelling grate type. The equipments being supplied for the project activity are from well established manufacturers.
- Installation of such plant at UBEPL substantially upgrades the technological status of the industry, developing superior skills and competencies and thus promotes similar projects in the region.
- A true redundant Distributed Control System (DCS) has been installed for efficient control of the power plant.
- The boiler control system is equipped with all required control loops namely; 1) Three element drum level control, 2) Furnace draft control, 3) Steam temperature control, 4) Deaerator level/pressure control and, 5) Soot blower pressure control.
- The project activity involves installation of an automated combustion control system to ensure highly efficient combustion of biomass in the boiler.
- The turbine is equipped with various protection controls such as over speed and over load, high vibration, differential expansion and low vacuum. Besides this efficient Automatic Tracking System (ATS) has been provided.

In view of the points discussed above, the project activity profoundly contributes to sustainable development criteria stipulated by Government of India, host country.

2 SAFEGUARDS

2.1 No Net Harm

There are no negative environmental impacts arising due to project activity, the positive environmental impacts arising from the project activity are:

- A reduction in carbon dioxide emissions from the replacement of fossil fuels which otherwise would have been used under the baseline scenario for generation of electricity.
- UBEPL has installed an ESP for the reduction of particulate emission to less than 100mg/Normal m³ to which is well below the limits prescribed by Central Pollution Control Board, India

Following factors were analyzed for assessing potential impacts and the conclusions are as follows:

1. Impact on Land: Ash generated from the project activity is disposed as per the State Pollution Control Board guidelines. It is used for Brick making if they find the same as per norms.
2. Impact on Water: The waste water generated from the project activity will be treated to meet required limits before disposal.
3. Impact on Air: As stated above, 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 monitored to ensure compliance as per State Pollution Board Guidelines and indicated consent conditions.
4. Impact on Ecology: The project activity does not foresee any harmful impact on the ecology. There are no nearby forests, or zones high on biodiversity, or other environmentally sensitive locations around the factory that might 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 will be provided adequate gadgets for protection.

The project activity has received the consent to establish from Punjab Pollution Control Board. During the operation of the power plant a yearly consent to operate is obtained from the PPCB for air and water pollution. The project operates within the stipulated limits set by PPCB and the same is monitored as part of the overall GHG emission reduction project compliance.

2.2 Local Stakeholder Consultation

The local stakeholders who face the immediate effect due to the project activity, which involves effect on the local environment, social life and economics, were identified on the basis of their involvement at various stages of project activity.

A local stakeholder meeting was organized by UBEPL management, inviting representatives from local community on 5th July 2008 at Village Channu, district Muktsar, Punjab, India. These local stakeholders were informed about the proposed project activity and CDM by circulating pamphlets in nearby local villages and by sending individual letters briefing the scope, nature and description of the project.

The minutes of meeting were made and sent to the participants. These minutes was made available to DOE during the validation process.

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

The agencies notified for the project activity are as below and these are satisfied as project participants have met their compliance:

1. State Expert Appraisal Committee, Govt. of Punjab
2. Punjab Pollution Control Board
3. Punjab State Electricity Regulatory Commission
4. Director of Industries and Commerce, Punjab
5. Department of Town and Country Planning, Punjab

6. Punjab Energy Development Agency

There are no pending issues related to the stakeholders, state and national agencies and project owners have received relevant formal consents.

The local stakeholders were informed about possible generation of employment, additional income to the farmers by the purchase of biomass and mitigation of air pollution as a result of the proposed biomass based power plant. The villagers were appreciative of the project and its associated benefits and no adverse comments had been received.

Statutory clearances from all the other stakeholders notified above have been obtained, reflecting the adherence to prescribed standards of compliance.

2.3 AFOLU-Specific Safeguards

Not applicable

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project activity is located at Channu village. Project was implemented and commissioned on 30/10/2009 which is before the registration¹ with UNFCCC. All facilities and equipment have been installed.

Major Technical Parameters of the 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	475 +/- 5 deg C.
Feed water temperature at the economizer inlet	126 deg C
Design code for pressure parts	IBR IWT-6212

Major Technical Parameters of the Steam Turbine Generator

Description	Parameters
No of Turbine	One (1)
Makers	Qingdao Jieneng Power Station Engineering Co., Ltd (QJPS)
Type	Condensing
Rated capacity of turbine	14.5 MW with 10TPH extraction at 2.5 ata

Steam conditions at turbine inlet pressure (g)	64.5281 kg/cm2
Temperature	485 deg C.
Condenser operational pressure	0.0098 M Pascal
Designed temperature drop in the cooling tower (deg C)	10
Rating at the generator terminals (MW)	14.50
Electrical generator	Jinan Power Equipment Factory

The operation of the project activity has been carried out as it has been described in the registered project design. There has not been observed any event during this monitoring period that may impact the GHG emission reductions or removals and monitoring.

The ownership of the project has been changed since the commissioning of the project, the project is owned and operated by Universal Biomass Energy Private Limited (UBEPL) during the entire monitoring plan.

Below are two major instances when the plant was kept shut down during the monitoring period under consideration.

Shutdown start		Resynch date		Remark
Hrs	Date	Hrs	Date	
00:00	03-08-2018	09:05	13-08-2018	Boiler Modification Work Done
00:10	02-04-2019	02:10	11-04-2019	Boiler Maintenance

All the measuring equipment required for monitoring ex-post GHG reduction from the project are installed as per the registered monitoring plan. None of the equipment has been found to be replaced except the weigh bridge the details of which is provided in the appendix 1: Calibration Details.

3.2 Deviations

3.3.1 Methodology Deviations

Not applicable

3.3.2 Project Description Deviations

Not applicable

3.3 Grouped Projects

Not applicable

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF_{CO_2}
Data unit	tCO ₂ e/MWh
Description	Combined margin (CM) value of CO ₂ baseline emission factor for the grid electricity displaced due to the project activity during the year y
Source of data	Central Electricity Authority, India "CO ₂ baseline database, version 5, November 2009" (https://cea.nic.in/wp-content/uploads/baseline/2020/07/user_guide_ver5.pdf)
Value applied	0.84
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.
Purpose of Data	Used for calculation of Baseline emissions
Comments	Baseline emission factor is constant as ex-ante based and fixed for entire crediting period.

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO ₂ e/MWh
Description	Operating Margin(OM) emission factor for northern grid
Source of data	Central Electricity Authority, India "CO ₂ baseline database, version 5, November 2009" (http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf)
Value applied	1.01
Justification of choice of data or description of measurement methods and procedures applied	CEA has calculated Operating margin as per ACM0013 Version 2.1 and Tool to calculate emission factor for electricity system, version 1.1, for year 2008-09. The operating margin describes the average CO ₂ intensity of the existing stations in the grid which are most likely to reduce their output if a CDM project supplies electricity to the grid (or reduces consumption of grid electricity).
Purpose of Data	Used for calculation of Baseline emissions

Comments	-
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Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO ₂ e/MWh
Description	Build Margin(OM) emission factor for northern grid
Source of data	Central Electricity Authority, India "CO ₂ baselinedatabase, version 5, November 2009" (http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf)
Value applied	0.68
Justification of choice of data or description of measurement methods and procedures applied	CEA has calculated Build margin as per ACM0013 Version 2.1 and Tool to calculate emission factor for electricity system, version 1.1, for year 2008-09. The built margin is calculated in this database as the average CO ₂ intensity of newly built power stations that will be (partially) replaced by a CDM project. In accordance with the Grid Tool, the build margin is calculated in this database as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation
Purpose of Data	Used for calculation of Baseline emissions
Comments	-

Data / Parameter	$EF_{km,CO_2,y}$
Data unit	tCO ₂ e/km
Description	Average CO ₂ emission factor for the trucks during the year, y
Source of data	The emission factor has been determined using appropriate net Calorific values and CO ₂ emission factor from national reliable default values and/or IPCC default values.
Value applied	0.00044
Justification of choice of data or description of measurement methods and procedures applied	The emission factor has been determined using appropriate net calorific values and CO ₂ emission factor from national reliable default values and/or IPCC default values.
Purpose of Data	Used for calculation of Project emissions
Comments	-

Data / Parameter	$EF_{DieselCO_2}$
Data unit	tCO ₂ /TJ
Description	The CO ₂ emission factor of Diesel
Source of data	National CO ₂ emission factor for diesel

Value applied	71.4
Justification of choice of data or description of measurement methods and procedures applied	National CO2 Emission factor for Diesel as mentioned in the report on India"s initial National Communication to UNFCCC.
Purpose of Data	Used for calculation of project emissions
Comments	National CO2 Emission factor for Diesel as mentioned in the report on India"s initial National Communication to UNFCCC.

Data / Parameter	SFC _{biomass}								
Data unit	Kg/kWh								
Description	Specific fuel consumption of biomass fuel types envisaged to be utilized in the project activity								
Source of data	“Detailed Project Report”, prepared by Subhash Kamboj & Associates.								
Value applied	<table><tr><td>Type of biomass</td><td>SFC(kg/kWh)</td></tr><tr><td>Cotton stalk (75%)</td><td>1.188</td></tr><tr><td>Mustard stalk (25%)</td><td>1.188</td></tr></table>			Type of biomass	SFC(kg/kWh)	Cotton stalk (75%)	1.188	Mustard stalk (25%)	1.188
Type of biomass	SFC(kg/kWh)								
Cotton stalk (75%)	1.188								
Mustard stalk (25%)	1.188								
Justification of choice of data or description of measurement methods and procedures applied	The detailed calculation of arriving at this value is provided by the Third party consultant U Bandyopadhyay in the Biomass Survey report as specified above and shall be submitted as evidence.								
Purpose of Data	To crosscheck the generation. Theoretical electricity Generation calculated using the specific fuel consumption of each biomass used in the project activity.								
Comments	-								

4.2 Data and Parameters Monitored

Data / Parameter	EG_{BL,y}
Data unit	MWh
Description	Quantity of Electricity exported to the grid by the project during the monitoring period.
Source of data	Joint Meter reading
Description of measurement methods and procedures to be	Electric power exported to grid will be measured monthly using calibrated meters by both project proponent and Punjab State Power Corporation Ltd. (PSPCL) as specified in the PPA and records

applied	maintained.
Frequency of monitoring/recording	The data is measured continuous and recorded monthly
Value monitored	259241
Monitoring equipment	The electronic meters are calibrated annually to ensure correct readings throughout the project life. The calibration details for both main and check meters is furnished in the appendix-1.
QA/QC procedures to be applied	The meters are Tri-vector meters of 0.2 S accuracy class. Power exported to the grid and measured by state utility are checked for consistency comparing the readings with the meter installed at the project site. This is crosschecked with the records for the sold electricity. This is to be noted that the accuracy class of the energy meters are defined to be 0.5s whereas the accuracy class of the energy meters used during the monitoring period is 0.2s which is more of more accuracy and hence appropriate. The previously used energy meters for the measurement were of accuracy class 0.5s which were replaced on 05/03/2014 with the new energy meters with accuracy class 0.2s. The new set of energy meters with accuracy class 0.2s are in place since then.
Purpose of the data	To calculate Baseline emission
Calculation method	It is calculated based on the electricity export and import. <u>Calculation method applied for Oct 2019 month of generation.</u> The start date of the monitoring period, 01/03/2017 is also the start date of billing cycle for the JMR for the month of Mar 2017. However, the end date of the monitoring period is 29/10/2019 whereas the end date of the billing cycle for the month of Oct 2019 is 02/11/2019. In the initial version of MR and ER sheet, the entire generation as per the JMR for the month of Oct 2019 was considered which is wrong. To subtract the generation for 4 additional days (i.e., 30/10/2019, 31/10/2019, 01/11/2019 and 02/11/2019), 4 times of highest

	recorded single day generation in the entire month, Oct 2019 as per the daily generation report recorded at the site has been considered. This is conservative and hence should be acceptable. The calculation is included in the revised ER sheet. Though this is a deviation from the registered monitoring plan, this does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology. Hence, this should be acceptable.
Comments	This data is used for calculation of emission reductions after the subtraction of the electricity imported from the grid. The data would be archived for 2 years beyond the crediting period.

Data / Parameter	$Q_{y,cottonstalk}$
Data unit	Tonnes
Description	Quantity of cotton stalk received in the project activity
Source of data	Plant records/log books
Description of measurement methods and procedures to be applied	- All the biomass is received truck wise and is recorded on daily and collated on monthly basis. - Each truck that enters the site will be recorded at the weigh bridge installed at the factory.
Frequency of monitoring/recording	Batch monitoring (every truck of biomass is monitored)
Value monitored	233562
Monitoring equipment	Weigh bridge is used to measure the weight of the biomass that is received. The details of the weigh bridge are provided in appendix 1.
QA/QC procedures to be applied	The weigh bridge records could be tallied against transporters receipts or against the computer generated payment invoices. The weigh bridge is calibrated annually to ensure proper functioning. The calibration details of the weigh bridge are provided in appendix 1
Purpose of the data	Not used in calculation of emission reduction. Used for cross checking purpose.
Calculation method	It is calculated based on the weight of the loaded truck and the empty truck.
Comments	All data will be kept for a minimum of 2 years in soft copies following issuance of certified emission reductions or the end of the crediting period, whichever is later.

Data / Parameter	$Q_{y, \text{mustardstalk}}$
Data unit	Tonnes
Description	Quantity of mustard stalk received in the project activity
Source of data	Plant records/log books
Description of measurement methods and procedures to be applied	- All the biomass is received truck wise and is recorded on daily and collated on monthly basis. - Each truck that enters the site will be recorded at the weigh bridge installed at the factory.
Frequency of monitoring/recording	Batch monitoring (every truck of biomass is monitored)
Value monitored	59726
Monitoring equipment	Weigh bridge is used to measure the weight of the biomass that is received. The details of the weigh bridge are provided in appendix 1.
QA/QC procedures to be applied	The weigh bridge records could be tallied against transporters receipts or against the computer generated payment invoices. The weigh bridge is calibrated annually to ensure proper functioning. The calibration details are provided in the appendix 1.
Purpose of the data	Not used in calculation of emission reduction. Used for cross checking purpose.
Calculation method	It is calculated based on the weight of the loaded truck and the empty truck.
Comments	All data will be kept for a minimum of 2 years in soft copies following issuance of certified emission reductions or the end of the crediting period, whichever is later.

Data / Parameter	$BF_{k,y, \text{cottonstalk}}$
Data unit	Tonnes of cotton stalk
Description	Quantity of biomass residue(cotton stalk) combusted in project plant during the year monitoring period
Source of data	Plant records
Description of measurement methods and procedures to be applied	Biomass received is analyzed for moisture content. Analysis is carried out in the laboratory at the project site itself. The quantity of biomass is measured by weighbridge at the project site.
Frequency of monitoring/recording	Batch monitoring(every truck of biomass is monitored)
Value monitored	299444

Monitoring equipment	Periodically quantity of fuel actually used on a particular day is weighed on the weight bridge and data recorded. The same is also crosschecked with monthly stock balance. The details of the weigh bridge used for the measurement are provided in the appendix 1.
QA/QC procedures to be applied	Biomass combusted in the boilers is shall be cross checked through an energy balance undertaken on quarterly basis for the project activity. This will include the calculation of the both types of biomass residues used in the boilers. Please refer the calibration details of the weigh bridge provided in the appendix 1.
Purpose of the data	Not used in calculation of emission reduction. Used for cross checking purpose.
Calculation method	It is calculated based on the weight of the loaded truck and the empty truck.
Comments	All data will be kept for a minimum of 2 years in soft copies following issuance of certified emission reductions or the end of the crediting period, whichever is later.

Data / Parameter	BF_{k,y,mustardstalk}
Data unit	Tonnes of mustard stalk
Description	Quantity of biomass residue (mustard stalk) combusted in project plant during the monitoring period.
Source of data	Plant records
Description of measurement methods and procedures to be applied	Biomass received is analyzed for moisture content. Analysis is carried out in the laboratory at the project site itself. The quantity of biomass is measured by weighbridge at the project site.
Frequency of monitoring/recording	Batch monitoring(every truck of biomass is monitored)
Value monitored	83188
Monitoring equipment	Periodically quantity of fuel actually used on a particular day is weighed on the weight bridge and data recorded. The same is also crosschecked with monthly stock balance. The details of the weigh bridge are provided in appendix 1.
QA/QC procedures to be applied	Biomass combusted in the boilers is shall be cross checked through an energy balance undertaken on quarterly basis for the project activity. This will include the calculation of the both types of biomass residues used in the boilers.

	Please refer the calibration details of the weigh bridge provided in the appendix 1.
Purpose of the data	Not used in calculation of emission reduction. Used for cross checking purpose.
Calculation method	It is calculated based on the weight of the loaded truck and the empty truck.
Comments	All data will be kept for a minimum of 2 years in soft copies following issuance of certified emission reductions or the end of the crediting period, whichever is later.

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 include the distance from the collection centers and weight carried out.
Frequency of monitoring/recording	Batch monitoring (every truck carrying biomass will be monitored)
Value monitored	78.6 (Average for the entire monitoring period)
Monitoring equipment	Plant records for the consignment that enters and the distance of the various centers from where it comes.
QA/QC procedures to be applied	Record of all distance of various collection centre from projects is maintained separately to crosscheck the distance travelled for each consignment.
Purpose of the data	To calculate project emission.
Calculation method	Total Round Trips of Cotton Straw and Mustard Straw/total no.of Trips of Cotton Straw and Mustard Straw
Comments	All data will be kept for a minimum of 2 years in softcopies following issuance of certified emission reductions or the end of the crediting period, whichever is later.

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	All consignments shall be entered in the log-book maintained at the main gate by security persons.
Frequency of monitoring/recording	Batch monitoring (every truck carrying biomass will be monitored)
Value monitored	32114 (for the entire monitoring period)
Monitoring equipment	Plant records for the number of consignment that enters
QA/QC procedures to be applied	These shall be crosschecked with the bills produced by suppliers for supply of biomass residues.
Purpose of the data	To calculate project emission.
Calculation method	-
Comments	All data will be kept for a minimum of 2 years in soft copies following issuance of certified emission reductions or the end of the crediting period, whichever is later.

4.3 Monitoring Plan

As per the requirement of monitoring methodology, following parameters are monitored:

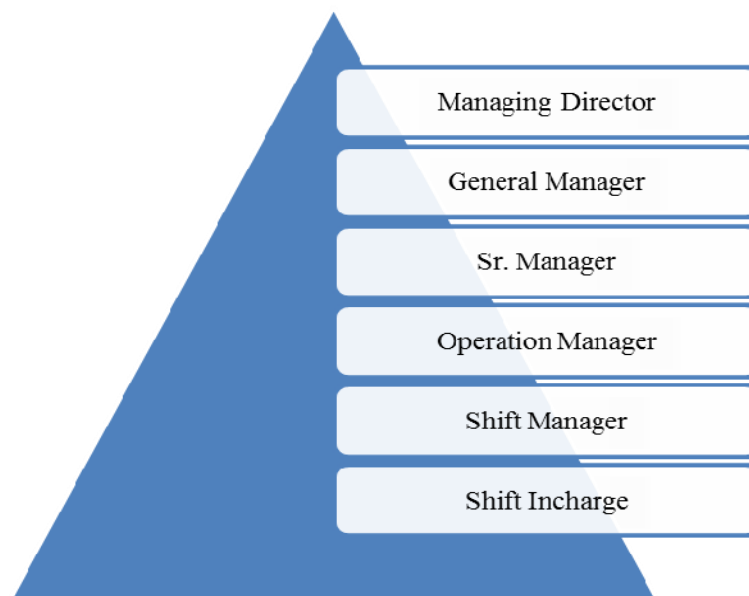
- Net electricity exported to grid.
- Quantity of each of biomass (cotton stalk and mustard stalk) received in project activity.
- Quantity of each of biomass (cotton stalk and mustard stalk) consumed in project activity.
- Average round trip distance between the point of fuel supply sites and the project site.
- Number of truck trips in a day.

All the above parameters have been monitored using the meters as detailed in the monitoring plan of the registered PDD.

Monitoring approach and QA/QC method. :

- The generated electricity is purchased by the state electricity utility of Punjab. The meters are therefore sealed and managed by the state electricity utility.
- The electricity generation measurements are required by the utility and the project proponent to assess electricity sales revenue.
- The power generation of the plant is metered by electronic Trivector main meter. The net electricity exported to the regional grid at a PSEB sub-station shall be monitored through a 2-way Trivector meter.

- There are check meters installed at site as well. Both electricity meters measuring power export have been calibrated as per outlines provided in the PPA which is annually. The weighbridge at the entrance that measures the quantity of biomass that comes is also calibrated on annual basis.
- Record of quantity of biomass residue procured is maintained at the factory gate and later transferred on daily basis to central record maintenance system for the GHG emission reduction activity.
- Records Receipts maintained at the main gate includes the type of biomass, name of collection Centre, net weight of biomass, date and time of receipt of consignment etc. This forms basis for monitoring the number of truck trips and the average distance travelled to determine the project emissions.
- There are no probabilities that project activity can lead to unpredicted GHG emissions, however, occurrence of any such possibility of emission will be monitored and corrective action taken. No need is envisaged for emergency preparedness in data monitoring considering unpredicted emissions.
- All the readings are recorded by shift in charge which are verified at difference hierarchy level to avoid any discrepancy or mismatch in the recorded data. The readings noted by the shift in charge are verified by the shift manager which are further rechecked by the general manager.
- The record after being verified by the general manger is handed over to the senior manager who is assigned with the role CDM coordinator to cross verify the data in reference to the registered monitoring plan for emission reduction calculation.
- The monthly verified data is finally handed over to the managing director who after overall verifies the data.



- The persons involved in monitoring and recording the parameters are provided training at regular intervals.

Basic Organizational Structure:

Roles and responsibilities

5 Q U A N T I F

Designation	Responsibilities
Managing Director	✓ Verification of the monthly data on the operational details of the project activity
Senior Manager	✓ Responsible for the operations of GHG activity ✓ Maintenance of all records pertaining to CDM activity ✓ To prepare monthly reports
General Manager	✓ Verification of the daily data ✓ Verification of monthly report ✓ Ensure that all persons required to monitor The project emissions are trained and competent
Shift Engineer	✓ To verify the readings taken by the shift in charge at the end of the shift ✓ To take action on the error reported
Shift In charge	✓ To note the hourly reading ✓ Report error in the system, if any

CATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Emission reductions due to displacement of electricity

The baseline emissions due to displacement of electricity are determined by the following equation,

$$BE_y = E_{GBL, y} * EFCO_2$$

Where,

- BE_y is Baseline Emissions in year y;tCO₂
- EGBL_y is Energy baseline in year y;kWh
- EFCO₂ is CO₂ Emission Factor in year y;tCO₂e/kWh

Determination of CO₂ emission factor (EFCO₂)

The emission factor for the displacement of electricity corresponds to grid emission factor (EFCO₂= EF_{grid}). The grid emission factor (EF_{grid}) has been fixed ex-ante and has been determined as per the guidance provided in “Tool to calculate the emission factor for an electricity system Version 1.1” (as per CEA CO₂ Baseline database for Indian Power sector, Version 5). The grid emission factor has been taken from the Central Electricity Authority, India “CO₂ baseline database, Version 5, November 2009. (Source: <http://www.cea.nic.in>). As per the CEA report the Northern Regional Grid was synchronized with the integrated Eastern, North Eastern and Western Grid in August, 2006 and the four regional grids have since been operating in synchronous mode. Hence the grid emission for northern grid is now determined from the synchronous grid emission factor of Northern, Eastern, Western and North Eastern Grids (NEWNE). The value is determined as follows:

Simple Operating Margin(tCO ₂ /MWh)			
Grid	2006-07	2007-08	2008-09
NEWNE	1.01	1.00	1.01
Southern	1.00	0.99	0.97
India	1.01	1.00	1.01

Build Margin (tCO ₂ /MWh)			
Grid	2006-07	2007-08	2008-09
NEWNE	0.63	0.60	0.68
Southern	0.70	0.71	0.82
India	0.65	0.63	0.71

Combined Margin = Average Simple OM x 0.50 + BM x 0.50 = 1.01 x 0.50 + 0.68 x 0.50 = 0.84
(Source: CEA, CO₂ baseline database, version 5, November 2009)

Determination of net electricity generation (EG_y)

As per the AMS-I.D. Version 15, $EGBL,y$ corresponds to Energy baseline in year, y ; kWh. Under the project activity this will be the net quantity of electricity exported to grid.

$$EGBL,y = EG_{export,y}$$

The calculation of baseline emission is tabulated as below.

Year	Quantity of Electricity exported to the grid by the project			Baseline Emission (BE _y)
	Export	Import	Net Export	
2017	86840	273	86567	72,716
2018	90739	449	90290	75,843
2019	84062	233	82384	69,202
Total	261641	955	259241	217761

5.2 Project Emissions

For most renewables the project emissions is considered to be zero as per applicable methodology. But PP has demonstrated with a conservative approach to demonstrate the possibility of emissions that may take place because of transportation of raw material. Although estimation of project emission indicates that all raw materials will be received by trucks, but it is highly probable that use of trolleys and bullock cart may be used for such low distance transmissions and these will be mentioned separately and excluded from possible project emissions. The possible project emissions account only due to transportation of biomass residue to project site. The following equation is used to calculate the total project emissions of the project activity during the monitoring period:

$$PET_y = N_y * AVD_y * EF_{km,CO_2}$$

Where,

PET_y is CO₂ emissions during the year y due to transport of the biomass residues to the project plant (tCO₂/yr)

- N_y is Number of Truck trips per during the monitoring period
- AVD_y is Average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the monitoring period (km)
- EF_{km,CO_2} is Average CO₂ emission factor for the trucks measured during the year, y (tCO₂/km)

The calculation of project emission is tabulated as below.

Year	Total number of trucks received	Avg. distance travelled km/trip	Project Emission (PE _y) (tCO ₂)
2017	9498	79.5	333
2018	12198	78.4	421
2019	16404	80.4	581
Total	15274	76.9	517

5.3 Leakage

As per the applied approved methodology, AMS-I.D.(Version15),leakage is to be considered if the energy generating equipment is transferred from another activity. The project activity is a green field biomass based power generation facility and the energy generating equipment used in the project activity has not been transferred from any other activity.

As per the attachment C to Appendix B it has been specified that for the small scale project activity, the leakage emission sources can be identified as follows:

As the project activity utilizes only cotton stalk and mustard stalk (biomass residue), the implementation of project activity did not lead to shifting of pre-project activities.

The biomass being used in the project activity is a waste generated from the cotton and mustard crop. This waste would have anyways been generated even in the absence of the project activity and would have burnt in the field in uncontrolled manner. The plant uses the waste generated and does not need application of fertilizer and clearance of land. Hence there are no emissions due to the same.

The only possible source of leakage in the project activity can be competing uses of biomass - The biomass residue may in the absence of the project activity be used elsewhere, for the same or a different purpose. To establish the same, UBEPL hired an independent agency to carry out a biomass residue assessment study in the surrounding area (surrounding area refers to the area within 50 km radius of the project activity). The results of the study pertaining to the surplus availability of cotton stalk and mustard stalk are available in the subject study report.

The biomass assessment study demonstrates that the quantity of available biomass in the region is larger than 25% after considering the biomass residue utilization in the area; hence this source of leakage is neglected.

5.4 Net GHG Emission Reductions and Removals

The emission reductions estimated from the project activity are the difference between baseline emissions, project emissions and leakage emissions. The formulae for calculating the emission reductions are provided below:

$$ER_y = BE_y - PE_y - LE_y$$

Where,

ER_y = Emission Reduction in year, y

BE_y = Baseline Emission in year, y

LE_y = Leakage Emission in year, y

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2017	72,716	517	0	72,199
2018	75,843	187	0	75,656
2019	69,202	397	0	68,805
Total	217761	1,101	0	216660

Comparison of Emission Reduction with registered PDD.

The actual number of emission reduction units achieved during the monitoring period under consideration (01/03/2017 to 29/10/2019) is found to be 8.52% higher than the ex-ante emission reduction as per the registered CDM PDD for the corresponding numbers of days involved in the monitoring period calculated on pro-rata basis. However, it should be noted that the project proponent has conducted the verification for the entire crediting period remaining together i.e., up to 29/10/2019. The VCS verification for the period 01/03/2011 to 28/02/2017 was undertaken in parallel with this verification period by other DoE. The issuance request for the period, 01/03/2011 to 28/02/2017 is already submitted to VERRA. The monitoring period had to be split and the verification was to be done by different DoE to meet the requirement outlined vide clause no. 4.1.20 of the VCS Standard, v4.1 where states that a validation/verification body may not verify more than six consecutive years of a project's GHG emission reductions or removals. Therefore, the comparison of emission reduction should not be done separately for the duration, 01/03/2017 to 29/10/2019 but the entire verification period, 01/03/2011 to 28/02/2017.

If the emission reduction comparison is done with the whole monitoring period from 01/03/2011 to 29/10/2019, the number of units of emission reduction achieved during the period is **5.83 % less** when compared with the ex-ante emission reduction as per the registered PDD for the corresponding period. Hence, this should be acceptable. The calculation of the emission reduction is produced as below.

Annual Emission reduction as per registered project design	74,891
Start date of current monitoring period	01-03-2011
End date of current monitoring period	29-10-2019
Total number of days involved in the current monitoring period	3,165
Estimated emission reduction as per registered PD for the current MP	649397
Actual ER during the period from 01-03-2011 to 29-10-2019	611533 (394873+216660)
Difference in Emission reduction	-37864

% Difference in Emission reduction	-5.83%
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APPENDIX 1: CALIBRATION DETAILS

Details of the energy meters used in monitoring, of the parameter, Quantity of Electricity exported to the grid by the project during the monitoring period are furnished as below.

Meter type	Model/Make	Acc. class	Sr. No.	Calibration dates			
Main Meter	Trivector meter of L & T	0.2s	13196703	07-05-2016	05-05-2017	04-05-2018	28-04-2019
Check Meter	Trivector meter of L & T	0.2s	12093212	07-05-2016	05-05-2017	04-05-2018	28-04-2019

Details of the weigh bridge used to measure quantity of the biomass are as below.

Serial Number	Model Number	Tolerance Value	Remark	Calibration date	
2008-043	FSD-501	10 Kg	Replaced on 12/08/2017	14-06-2016	
1017010k	Leotronics	10 Kg	Replaced on 03/04/2019	26-10-2017	09/10/2018
0516011k	IND/09/98/25	10kg	-	02/05/2019	18/06/2020