CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

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Title : 20 MW Capacity Biomass based Power Project of M/s. SHALIVAHANA GREEN ENERGY LIMITED
Version : 04
Date : 11/07/2012

A.2. Description of the project activity:

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M/s. SHALIVAHANA GREEN ENERGY LIMITED (SGEL) is establishing a green field biomass based power plant of capacity 20 MW which supplies electricity only to grid system. The power plant constitutes a Bubbling Fluidised Bed Combustion (BFBC) boiler which will use surplus biomass residues available in the region like paddy stalks, ground nut shell, stalks of red grams, mung, til, maize etc. agro industrial waste (rice husk) and woody biomass (juliflora & casuarina twigs, etc) from agricultural/waste lands. The electricity generated from the project activity will be supplied to the grid system owned by Orissa Power Transmission Corporation Limited (OPTCL), a state utility which is part of NEWNE grid. The project activity envisages to install 20 MW biomass based power plant. The project activity is installing a BFBC (Bubbling Fluidised Bed Combustion) boiler with high temperature and pressure parameters that can take multi-fuels to generate steam to drive the turbo-generator. The generation of electricity is achieved through sustainable means without causing any negative impact on the environment and contributes to climate change mitigation. The biomass fuel is considered as carbon neutral in nature and the electricity generation from the project activity is a clean form of energy.

The project activity utilizes renewable biomass residues for power generation, through Rankine cycle of direct combustion (technology) of biomass residues, since, the biomass fuel is considered as carbon neutral in nature, the electricity generation from the project activity is considered as a clean form of energy. The project activity exports the generated electricity to the carbon intensive NEWNE region grid that is highly dominated by thermal energy sources; thereby it reduces the equivalent amount of emissions in to the atmosphere. The project activity would protect and conserve the local environment by avoiding unintended emissions from the decay and uncontrolled burning of biomass, which is a common practice in the region.

The project activity is expected to generate 863,530 CERs during the crediting period of 10 years. The generated power would be evacuated to Hindmetal Industrial Karagprasad 132/ 33 kV substation which is a part of NEWNE grid, located at a distance of 1 km from the project location. The surplus power input to local substation would improve the quality and quantity of power in the region and ensures the economic development of the area.

Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines[1] for CDM projects.

a) Social well being
b) Economic well being
c) Environmental well being

[1] Ministry of Environment and Forest, web site: http://envfor.nic.in:80/divisions/ccd/cdm_iac.html

d) Technological well being

Each of the above indicators has been studied in the context of the project activity to ensure that the project activity contributes to sustainable development.

Social and Economic well being:

- The project is established in a rural area in the State of Orissa. Therefore, the project would lead to additional generation of direct and indirect employment and improving economic condition of the area.

- The plant site is an isolated rural area where unemployment, poverty and other economic backwardness are prevailing. The project would lead to the development of the region.

- During civil works, a lot of construction work will take place, which will generate employment for local people around the plant site.

- Other than these, there are various kinds of mechanical work, which generated /will generate employment opportunity on regular and permanent basis.

- Since, the biomass resources are collected and transported to the plant site from the fields, opportunities are generated for the rural people to collect and transport biomass. This results in the enhanced employment of the people.

- The primary biomass resource that will be utilised for power generation under the project will be surplus biomass residues available in the area.

- In addition to biomass residues from agricultural crop residues like paddy stalks, groundnut shells, stalks of red grams, mung, til, maize etc., agro industrial waste (rice husk) and woody biomass (juliflora & casuarina twigs, etc) from agriculture/waste lands that are available in proximity to the power plant. These residues are to be collected from farmers or agro industries. The project would generate additional revenue for farmers through the purchase of these crop residues, which are otherwise being un-utilised. In other words, the power plant would give commercial value to crop residues, thereby augmenting farmers' income.

- As rice husk is also considered as the fuel for power generation; rice millers and other related industries would receive additional income from the sale of the materials.

- Since the biomass resources are to be collected and transported to the plant site from the fields, opportunities are being generated for the rural people to collect and transport the biomass residues. This would result in indirect employment opportunities for the rural people.

- The possibility of setting up more and more rural industries will increase as a consequence of the power plant in the area. This would also result in infrastructure development in the area. The opportunities created by the power plant will also reduce migration from rural areas to cities.

- The biomass-based power plant facilitates the availability of uninterrupted power to the local industries and agricultural farmers located in nearby remote areas, thereby avoiding the load shedding and low frequency of power.

The above benefits due to the project activity ensure that the project would contribute to social and economic well being in the region.

Environmental well being

- The project activity utilises biomass potential available for power generation, which otherwise is left un-utilised (left to decay or burnt) thereby replaces part of power generated using predominantly fossil fuels such as coal, lignite and gas. The project would not result in increase of GHG emissions and cause no negative impact on the environment. The project generates real, measurable and long-term emission reductions.

- The project utilizes surplus biomass residues and thereby reduces dependence on fossil fuels.

- The project conserves local resources, reduces pressure on the local environment, and contributes for an improved health and other environmental benefits.

Technological well being

- The CDM project activity would lead to an increase in utilization of biomass resources for power generation and hence contribute to the energy security in the country.

  The project is designed in such a way that it will not require any valuable natural resources. Hence, the project will not impair the region, which is already scarce in natural resources such as water. In addition, the project will demonstrate the performance of high pressure boiler and water cooled condenser in the biomass power sector as an alternative to conventional designs. Successful implementation of this project would encourage other promoters to adopt similar technology in the relevant sector and hence the project leads to technological well being.

  Project proponent (PP) has decided to use 2% of annual CER revenue for sustainable development activities. Thus, SGEL has decided to keep Rs. 1.5 million aside for the same.

  SGEL has identified certain sustainable development activities as follows, Furthermore as per the requirement of Host country SGEL is committed to spend 2% of CER revenue for sustainable development activities and the same will be monitored by the SGEL management on a yearly basis as follows:

Table-1: Sustainable development activities planned

S.No	Activities	Yearly Expensive	Responsibility
1	Awareness campaign in local communities and schools	0.5%of the CERs Revenue	Managing Director
2	Capacity building measures for stakeholders	0.5%of the CERs Revenue	Managing Director
3	Plantation drives in neighbouring villages.	0.5%of the CERs Revenue	Managing Director
4	Medical facilities to member farmers	0.5%of the CERs Revenue	Managing Director

PP has carefully chosen the above activities as these will help in sustainability as well as will have positive impact on stakeholders and the project activity strongly contributes to sustainable development in the host country.

A.3. Project participants:

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Name of the party involved ((host) indicates a host party)	Private and/or public entity (ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Private entity: **Shalivahana Green Energy Limited.**	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party (ies):

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India

A.4.1.2. Region/State/Province etc.: >>

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Orissa State

A.4.1.3. City/Town/Community etc:

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Taluk & Dist : Dhenkanal
Village : Nimdha.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project is located at Nimdha village and is located on Sambalpur –Cuttak road. The nearest major town Dhenkanal which is at a distance of 40 km and railway station is Meera mandali, which is at a distance of 10 km from the project location. The geographical coordinates of the project site are 85°19'08.02"E and 20°46'35.25"N. The location of the site is shown in the following maps.

Physical location address of the project:

Shalivahna Green Energy Limited
Sy.no 299-301, 315,319 & 322
Nimdha Village
Dhenkanal Taluk & District
Orissa State, India.

Figure – 1: Location map

A.4.2. Category (ies) of project activity:

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The project activity falls under the following scope and category.

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

A.4.3. Technology to be employed by the project activity:

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Technology description

The project is a green field renewable energy power generation project connected to the grid and supplies electricity only to the grid. The project activity is generating electricity using biomass (agricultural residues) with a 90 TPH biomass fired boiler (BFBC) using a 23 MW turbine whose capacity will be governed at 20MW. On an annual average basis, the project exports around 124.57 GWh to the OPTCL grid, which is belongs to eastern grid, which is a part of the NEWNE grid. Considering auxiliary power consumption of 10 % the plant is expected to operate at an annual average plant load factor of 80%.

The boiler of 90 TPH is a multi-fuel fired boiler with a provision to fire coal to an extent of maximum 15% of total energy basis as specified in the MNRE[2] guidelines. The auxiliary equipment are fuel handling & preparation systems, Ash handling system, electrostatic precipitator, cooling tower, DM

[2] http://www.mnre.gov.in/scheme-main-shp.htm

plant, power evacuation system etc. The activity also included necessary civil works and site development, fire protection systems and electrical works. The steam conditions at the boiler outlet are 90 TPH of super heated steam at 89 kg/cm^2(a) pressure and 520 ± 5^{0}C.

The primary technology for the project activity is direct combustion of biomass residues, and power generation using the Rankine cycle technology. Power generation through this method involves combustion of biomass residues directly in the boiler, which is capable of taking multi fuel composition to generate high-pressure high-temperature steam, which is fed to a steam turbine that drives a generator.

The main elements of the power plant are as follows.

- A boiler unit which converts the energy available in the fuels into thermal energy;
- A steam turbine unit which converts thermal energy into mechanical energy;
- An alternator unit, which converts mechanical energy into electrical power.

A number of other equipment components, as listed below, also form part of the biomass power plant.

- Fuel and ash handling equipment
- Water cooled condenser system for cooling the exhaust steam
- DM Water system and Air Compressor Plant
- Electrical systems and Automation system

The project design employs high-pressure boiler, first of its kind in the state of Orissa, India in the biomass power sector whose design parameters are furnished in the following table.

Table-2: Technical details of the project activity

Boiler	
Manufacturer	Cethar Vessels Limited
Type	BFBC boiler
Boiler capacity (100 % load) / Steam Flow rate	90 TPH
Steam pressure at super heater outlet	89 kg/cm^2 (a)
Steam temperature at super heater outlet	520±5 ^{o}C
Turbo Generator	
Make	Triveni engineering & Industries Limited
Type	Impulse type Bleed cum Condensing turbine
Capacity	23 MW (Maximum)
Steam pressure at the TG inlet	88 kg/cm^2 (a)
Steam temperature at the TG inlet	515 ^{o}C
Exhaust steam pressure	0.1 kg/cm^2 (a)
Steam inlet quantity	88.24 TPH for 20 MW
Generator Voltage	11 kV ±10%
Frequency	50 Hz ±5%
Power factor	0.8
RPM	1,500
Condenser type	Surface condenser
Power evacuation	
Grid Voltage	132 kV
OPTCL Sub station	Hindmetals & Industries premises, Kharagprasad
Energy production	
Gross power	20 MW

Auxiliary consumption (10%)	2 MW
Net power for export after auxiliary consumption	18 MW

The PP has obtained In-principle clearance for setting up 20 MW Biomass power project in Dhenkanal Dist. from state nodal agency (OREDA) in July 2007. Subsequently the PP has obtained all statutory approvals for sanctioned capacity i.e. 20 MW. As marginal difference in the cost of TG set for 20 MW and 23 MW, the PP has finalized the TG set specification with 23 MW at generator terminal and placed P.O. in the month of March 2009. Further, there is no scope to produce 23 MW power generation with ordered 90 TPH boiler which is envisaged to produce & supply steam for 20 MW power generation. Further, PP confirmed that the plant would be operated in line with statutory approvals such as final sanctioned capacity 20 MW from nodal agency, and consent for operation from state pollution control board which are legal and regulatory requirements for the project activtiy. Copies of Final agreement with OREDA for project implementation, Consent for establish of unit from State Pollution Control Board (OPCB) and other approvals of confirmed capacity (20 MW) have been provided to DOE for validation.

The company has commenced the civil construction works at project site in the May 2009 and the plant is likely to be commissioned by January 2012.

Technology Transfer

No technology is transferred for the CDM project activity.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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The project activity will generate annually of about 86,353 tCO_2e starting from the date of registration of the project as a CDM project activity with UNFCCC.

Annual estimates of anticipated emission reductions from the project activity are furnished below.

Table-3: Estimated amount of emission reductions

Years	Estimation of annual emission reductions in tonnes of CO_2e
1st year *	76,516
2nd year	87,446
3rd year	87,446
4th year	87,446
5th year	87,446
6th year	87,446
7th year	87,446
8th year	87,446
9th year	87,446
10th year	87,446
Total estimated reductions (tCO_2e)	**863,530**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tCO_2e)	**86,353**

* 1st year corresponds to the period starting from 01/04/2012 to 31/03/2013 or from the date of registration of the project activity. Similar interpretation shall apply for the subsequent years.

A.4.5. Public funding of the project activity:

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No public funding from the Annex I parties is involved in the project activity

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Title: "Consolidated methodology electricity generation from biomass residues in power –only plants"

Reference: ACM0018/Version 01.3.0, EB 63

The additionality of the project activity shall be demonstrated and assessed using the "Tool for the demonstration and assessment of additionality"(Version 05.2.)

Other tools referenced in this report:

- Combined tool to identify the baseline scenario and demonstrate additionality (Version 03.0.1)
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 02)
- Tool to calculate the emission factor for an electricity system (Version 2)
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01)

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The project activity may include the following activities or, where applicable, combinations of these activities:

S.No	Particulars	Comments
1	The installation of new biomass residues (co-) fired power-only plants at a site where currently no power generation occurs (green field power projects);	The Project involves the installation of a new biomass residue co-fired power-only plant at a site where currently no power generation occurs, which is a green field power project.
2	The installation of new biomass residues (co-)fired power-only plants, which replace or are operated next to existing power-only plants fired with fossil fuels and/or biomass residues (power capacity expansion projects);	The project activity is a green field project and is a new power plant Hence; there is no existing power or heat plant operation at the project site. So It is not applicable
3	The improvement of energy efficiency of	The project activity is a green field

	existing biomass residues (co-)fired power-only plants (energy efficiency improvement projects), which can also lead to a capacity expansion, e.g. by retrofitting the existing plant	project and is a new power plant Hence, It is not applicable
4	The total or partial replacement of fossil fuels by biomass residues in an existing power-only plant or in a new power-only plant that would have been built in the absence of the project (fuel switch projects), e.g. by increasing the share of biomass residues use as compared to the baseline, by retrofitting an existing plant to use biomass residues, etc.	The project activity is a green field project and is a new power plant Hence, It is not applicable.

The project meets applicability conditions of ACM0018 and the justifications for the applicable conditions are furnished below:

Sr. No.	Applicable conditions of ACM0018	Justification on the applicability of ACM0018 to the Project
1	No other biomass types than biomass residues, as defined in the baseline methodology, are used in the project plant	The project activity is an Independent power producer that uses only surplus biomass residue as fuel in the boiler. According to Biomass assessment report the biomass residues such as paddy stalks, stalks of red grams, mung, til, maize, etc., rice husk, groundnut shells and woody biomass like juliflora, casuarina twigs from agricultural/ wastelands, are available in surplus quantity and the same are envisaged to use in the project activity.
2	Fossil fuels may be co fired in the project plant. However, the amount of fossil fuels co-fired shall not exceed to 80% of the total fuel fired on an energy basis;	The project activity may co-fire fossil fuel (coal) to an extent of 15% on annual energy basis conform to MNRE guidelines[3] as supporting fuel as & when required. According to an assessment made by the project proponent, the biomass residues proposed for the project activity are in surplus quantity as evidenced in the leakage table in section B.6.3 of the PDD. Hence there is no possibility to use coal more than 15% of total fuel fired on annual energy basis.
3	For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other	The project activity is proposed to use off-site biomass residues, which are available in the project region and there is no production process unit at project site from which biomass residues could be used.

[3] http://www.mnre.gov.in/scheme-main-shp.htm

	substantial changes (e.g. product change) in this process;	
4	The biomass residues used by the project facility should not be stored for more than one year;	The project activity would not store biomass residues for more than one year, since the project would run on a continuous basis throughout the year. As the project consumes the biomass residues on first come first serve basis; there is no possibility of storing the procured biomass for more than one year.
5	Projects that chemically process the biomass residues prior to combustion (e.g. by means of esterification, fermentation and gasification) are not eligible under this methodology. The biomass residues can however be processed physically such as by means of drying, pelletization, shredding and briquetting;	The identified and considered biomass residues are transported from source to the project site and if required mechanically treated prior to the combustion in the boiler. The project proponent is not proposing to use any chemical processing of the biomass residues.
6	No power and heat plant operates at the project site during the crediting period.	The project activity is a Greenfield power only plant to generate electricity to export to grid and no intention to produce heat (steam to process unit(s)) during the crediting period.
7	If any heat which is used for purposes other than power generation (e.g. heat which is produced in boilers or extracted from the header to feed thermal loads in the process) is generated during the crediting period or was generated prior to the implementation of the project activity, by any on-site or off-site heat generation equipment connected to the project site, the following conditions should apply: a) The implementation of the project activity does not influence directly or indirectly the operation of the heat generation equipment, i.e. the heat generation equipment would operate in the same manner in the absence of the project activity. b) The heat generation equipment does not influence directly or indirectly the operation of the project plant(e.g. no fuels are diverted from the heat generation equipment to the project plant); and c) The amount of fuel used in the heat generation equipment can be monitored and clearly differentiated from any fuel used in	The project activity involves a multi-fuel fired boiler to generate heat (steam) for electricity generation and no intension to connect heat produced by any other on-site or off-site equipment.

	the project activity.	
8	In the case of fuel switch project activities, the use of biomass residues or the increase in the use of biomass residues as compared to the baseline scenario is technically not possible at the project site without a capital investment in : • The retrofit or replacement of existing heat generators/boilers; or • The installation of new heat generators/boilers; or • A new dedicated biomass residues supply chain established for the purpose of the project (e.g. collecting and cleaning residues that would otherwise not be used for energy purposes); • Equipment for preparation and feeing of biomass residues.	The project is a Greenfield power plant and not a fuel switch project.

Finally, the methodology is only applicable if the most plausible baseline scenario, as identified per the "Procedure for the selection of the baseline scenario and demonstration of additionality" section hereunder, is:

- *For power generation: Scenarios P2 to P7, or a combination of any of those scenarios;*
- *For biomass use: Scenarios B1 to B8, or a combination of any of those scenarios. However, note that for scenarios B5 to B8, leakage emissions should be accounted for as per the procedures of the methodology.*

The plausible alternative scenarios are P1 & P5 for power generation and B1 & B3 for biomass use have been discussed in line with methodology under section B.4 of this report.

The project activity satisfies all the applicable criteria described above. Hence, the methodology ACM 0018 is applicable to the project activity.

B.3. Description of the sources and gases included in the project boundary

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Project boundary

As per the methodology, the spatial extent of the project boundary encomposses:

- The project activity power-only plant;
- All power plants connected physically to the electricity system (grid) that the project plant is connected to NEWNE region grid system;
- Transportation of biomass residues to the project site;
- The sites where the biomass residues would have been left for decay or dumped

Specific situation of the project activity:

- *For each power plant that has been operated at the project site during the most recent three years prior to the start of the project activity: the type and capacity of the power plant, the types and quantities of fuels which have been used in the power plant during the most recent three years prior to the start of the project activity, and whether the plant continues operation after the start of the project activity;*

- *For each boiler or other heat generation equipment that has been operated at the project site during the most recent three years prior to the start of the project activity: the type and capacity of the equipment, the types and quantities of fuels which have been used in the equipment during the most recent three years prior to the start of the project activity, and whether the equipment continues operation after the start of the project activity;*

- *For each power plant installed under the project activity: the type and capacity of the power plant, and the types and quantities of fuels which are planned to be used;*

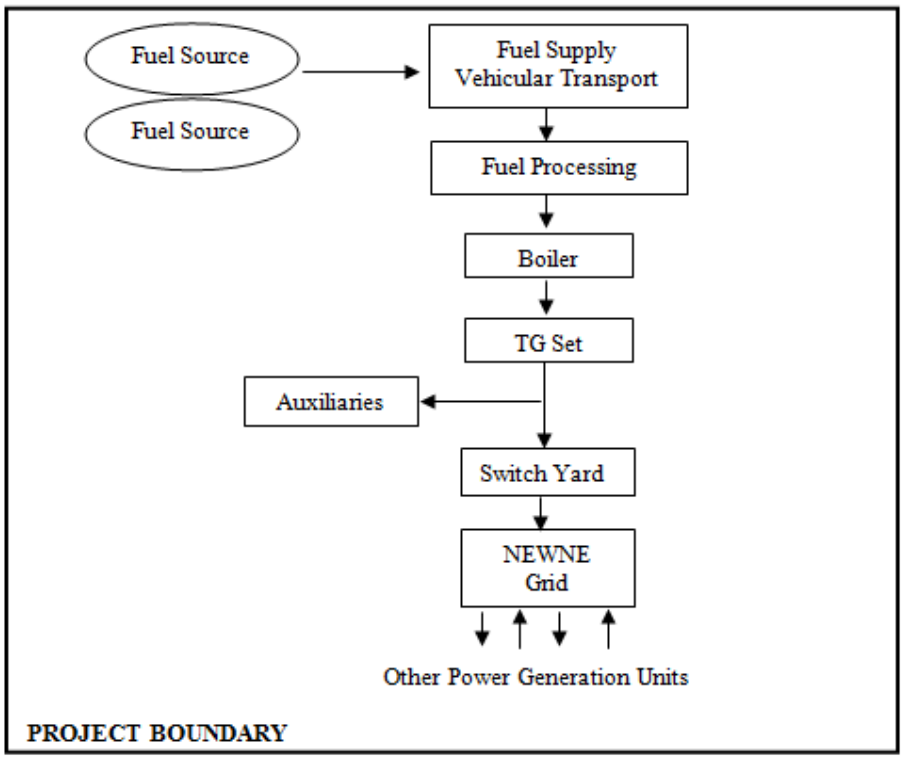
- *For each power plant that would be installed in the absence of the project activity: the type and capacity of the power plant and the types and quantities of fuels which would be used.*

As the proposed project activity is Greenfield power only plant to generate electricity to export to grid by using off-site biomass residues and there is no production process envisaged at project site. In the absence of the project activity the electricity would be generated in the grid which is dominated by fossil fuel based power plants. There is no other power plant expected at the project site in the absence of the project activity. The technical details i.e., type and capacity of the project activity are presented in section A.4.3 and the type and quantities of the fuels which are planned to be used are presented in section B.4.

Geographical boundary:

The geographical boundary considered for the project activity is 100 km radius from project plant site. The geographical boundary (100 km) is the maximum possible distance for collection of biomass residues for power generation.

The project boundary is depicted in the following diagram:



Gases and sources

As per the above baseline grid and project boundaries, the greenhouse gases generated and gases considered within the project boundary are given in the following table. Some of them are negligible and some are CO_2 neutral. The gases and sources related to both baseline and project activities are summarised below.

Table-4: Overview on emissions sources included in or excluded from the project boundary

	Source	Gas		Justification / Explanation
Baseline	Electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Included	B1, and/or B3 has been identified as the most likely baseline scenario
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources
Project Activity	On-site fossil fuel consumption	CO_2	Included	May be an important emission source as the boiler can be cofired with fossil fuel (coal) along with biomass residues.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small

	Source	Gas		Justification / Explanation
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Off-site transportation of biomass residues	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Combustion of biomass residues for electricity	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Included	This emission source included as CH_4 emissions from uncontrolled burning or decay of biomass residues in the baseline scenario are included
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small
	Storage of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small
		N_2O	Excluded	Excluded for simplification. This emissions source is assumed to be very small
	Wastewater from the treatment of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	This emission source is excluded as the waste water is not treated even partly under anaerobic conditions
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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According to the description in the approved methodology ACM0018, "Combined tool to identify the baseline scenario and demonstrate additionality" should be used to identify the baseline scenario. The selection of the baseline scenario and demonstration of additionality has been demonstrated by applying the following steps:

Step 1: Identification of alternative scenarios

Step 1a: Define alternative scenarios to the proposed CDM project activity

According to the 'Baseline Methodology' of ACM0018 version 01.3.0, the alternative scenarios for electric power are furnished below:

Alternative	Description of alternative	Comments
P1	The proposed project activity not undertaken as a CDM project activity	This alternative is a credible baseline alternative because without the

		registration of the project as a CDM project it would not occur due to the investment barrier faced by the project activity and the same is demonstrated in Section B.5.
P2	The continuation of power generation in existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The existing power-only plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the project activity	Proposed project activity is a green field power project and there is no existing power plant at the site. This scenario is not the possible alternative.
P3	The continuation of power generation in existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The existing power-only plants would operate with different conditions from those observed in the most recent three years prior to the project activity	Being an independent Greenfield power project this alternative is not applicable for the project activity. Hence, this scenario is not the possible alternative.
P4	The retrofitting of existing power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site. The retrofitting may or may not include a change in fuel mix;	The project activity is a new Greenfield biomass power project and hence this alternative is not plausible.
P5	The generation of power in the grid	This alternative is considered as credible and realistic alternative to the project activity and the generated power would be exported to grid system, which is dominated by fossil fuel based power generation plants.
P6	The installation of new power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using the same amount or less biomass residues than under scenario P1.	The common practice in the state is uncontrolled burning or dumping of biomass. The project is proposed to use efficient BFBC boiler for generation of high pressure (89 kg/cm^2 (a)) steam at high temperature (520 ^oC) for power generation, which require less biomass fuels for the same amount of electricity generation and hence this alternative is same as P1.
P7	The installation of new power-only plants fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using more biomass	Installation of new power only plant fired with biomass residues, or fossil fuels, or a combination of both, at the project site, using more biomass

	residues than under scenario P1.	residues than under scenario P1, leads to lower efficiency plant. Generation of power with a lower efficiency is not economical due to high cost of generation. Therefore this is not a plausible alternative.

Based on the above, the alternatives P1 and P5 are the most credible and realistic alternatives to the project activity. Further, as per the step 1a of baseline methodology of ACM0018 version 01.3.0, *if the project activity is the establishment of a green field power plant and supplies electricity only to the grid, then the alternatives considered for power generation should include only the scenarios P1 and P5*. As the project activity is establishment of a green field power plant and supplies electricity only to the grid, the alternatives considered for power generation include only the scenarios P1 and P5.

As per the methodology, the baseline scenario of the biomass residues are analysed below:

Baseline scenario	Description of alternative	Comments
B1	The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields	The common practice of surplus biomass residues to be dumped or left to decay. The envisaged agricultural crop residues are paddy stalks, wheat husk, gram stalks, maize stalks, rice husk and juliflora twigs are currently dumped or left to decay under mainly aerobic conditions and burned in an uncontrolled manner on fields. In the absence of this project a huge amount of biomass residues will be left unused (dumped or left to decay under mainly aerobic conditions) around the project site, therefore, B1 is a realistic baseline alternative for the project activity.
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields	Land filling and other planned dumping of biomass residues in anaerobic conditions in rural area is not practiced and hence this alternative is not realistic.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	Considerable quantities of paddy stalks are utilized as fodder and balance is mostly burnt in the fields. Other biomass residues such as wheat husk, gram stalks, maize stalks and juliflora twigs are burnt in an uncontrolled manner on fields. Rice husk would be utilized in hotels and brick manufacturing units and the surplus quantities are left to decay or burnt in an uncontrolled manner. Hence, this alternative is identified as a baseline scenario.

B4	The biomass residues are used for electricity generation in power-only plant configuration at the project site in new and/or existing power plants	There is neither existing nor proposed new power plant at the project site other than this project activity. This is not an alternative for this project.
B5	The biomass residues are used for power and/or heat generation in other existing or new power plants at other sites	According to Biomass assessment report, there is no other biomass based heat or power generating plants in the project region. In the absence of project activity biomass residues will not be utilized at other sites for heat and/or electricity generation purposes. Hence, this is not a realistic baseline alternative for this project.
B6	The biomass residues are used for other energy purposes, such as the generation of bio-fuels;	As there are no other projects those use biomass residues for other energy purpose. Therefore, this alternative is not a realistic baseline alternative for unused biomass.
B7	The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry).	Prior to this project, some quantities of biomass residues are used for feedstock and domestic purpose and the balance residues are dumped to decay or burned uncontrolled manner. So, the biomass consumption of this project is from the local surplus biomass residues in the project region and will not be utilized these residues for non-energy purposes in absence of this project and hence, this is not a realistic alternative for the project.
B8	The primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.	The primary sources of the biomass residues are agricultural fields and rice mills which are located in the project region. According to the biomass assessment report, the surplus biomass residues are left to decay or burnt in an uncontrolled manner. Hence, this is not a realistic alternative for the project.

It is evident that the scenarios B1 and B3 are the plausible baseline alternative for biomass residues for the proposed project activity.

In accordance with methodology ACM0018, the biomass residues that have been proposed to be used by the project activity are categorized below Table.

Table-5: Biomass residues categories

Biomass residues category (*k*)	Biomass residues type	Biomass residues source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (tonnes)
1	Rice husk	Off-site from identified rice mills	Dumped (B1)	Electricity generation on-site	86,157
2	Paddy stalks	Off-site from an agricultural fields	Dumped or burnt in the fields (B1 or B3)	Electricity generation on site	17,181
3	Til Stalks	Off-site from an agricultural land	Dumped or burnt in the fields (B1 or B3)	Electricity generation on-site	3,436
4	Red Gram Stalks	Off-site from an agricultural land	Dumped or burnt in the fields (B1 or B3)	Electricity generation on-site	1,718
5	Mung Stalks	Off-site from an agricultural land	Dumped or burnt in the fields (B1 or B3)	Electricity generation on-site	6,872
6	Maize Cobs & Stalks	Off-site from an agricultural land	Dumped or burnt in the fields (B1 or B3)	Electricity generation on-site	13,745
7	Ground nut shell	Off-site from an agricultural land	Dumped or burnt in the fields (B1 or B3)	Electricity generation on-site	7,832
8	Woody Biomass (Juliflora & casuarina twigs)	Off-site from an agricultural / waste lands	Dumped or burnt (B1 or B3)	Electricity generation on-site	8,590

As per the methodology, surplus of the type of biomass residue in the project is demonstrated below:

A detailed biomass assessment study has been conducted in the region for a radius of 100 km around the project activity prior to the project conceptualization, which confirms the surplus biomass residues available in the region and assures the continuous availability of surplus biomass for the project. As per the biomass assessment study conducted by M/s Environment and Energy management Group, Bhopal, the surplus of each type of biomass residue in the region of the project activity for the year 2008 - 09 is as given below.

Table-6: Biomass Residue Generation, consumption & surplus

Type of Residues	Generation	Consumption		Surplus	% of Surplus
		Project Activity (SGEL)	Others		
Rice husk	838,600	86,157	385,757	366,686	77.7%
Paddy stalks	111,814	17,181	46,960	47,673	74.3%
Til stalks	28,436	3,436	7,962	17,038	149.5%
Mung stalks	52,445	6,872	16,750	28,823	122.0%

Red gram stalks	15,583	1,718	7,800	6,065	63.7%
Maize cobs & stalks	129,759	13,745	55,000	61,014	88.8%
Groundnut shell	20,559	7,832	5,140	7,587	58.5%
Woody Biomass (Juliflora & casuarina twigs	71,955	8,590	26,450	36,915	105.3%
Total Residues	**1,269,151**	**145,532**	**551,819**	**571,800**	**82.0%**

From the above table it is evident that the availability of each type of biomass residue proposed to use as fuel by the project activity in the project region is more than 25% larger than the quantity of biomass residues of that type which is utilized in the region including the project plant.

Based on the above analysis, the baseline scenario that would apply to the proposed project activity is a combination of

Scenario 1	P1: The proposed project activity not undertaken as a CDM project activity	B1: The biomass residues are dumped or left to decay mainly under aerobic conditions, and B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes
Scenario 2	P5: The generation of power in the grid	B1: The biomass residues are dumped or left to decay mainly under aerobic conditions, and B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes

Table-7: Data sources for the baseline calculations

Key Parameter	Description	Data Source	Website
$EF_{grid,CM,y}$	Combined Margin CO_2 emission factor for grid connected power generation in year *y*	CEA published CO_2 Database baseline for NEWNE region grid stated in Version 5 dated Nov 2009.	www.cea.nic.in
$EG_{PJ,y}$	Net quantity of electricity generated in the project plant year y	From Plant and OPTCL Records. Ex post determination.	------
GWP_{CH4}	Global warming potential for CH_4	IPCC 2006 default values	http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
$EF_{CO2,i}$	CO_2 Emission factors of fossil fuels	India's initial national communication (INC) and 2006 IPCC values, ex-ante determination.	www.cdm.unfccc.int www.ipcc.ch/
$EF_{km,y}$	Average CO_2 emission factor for the trucks	India Road transport efficiency study published by world bank South Asia	www.worldbank.org

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

In accordance with the methodology demonstration and assessment of additionality is being done using latest approved version 05.2 of the "Tool for the demonstration and assessment of additionality", and is presented as under:

Step 1: Identification of alternative scenarios

Step 1a: Define alternative scenarios to the proposed CDM project activity

As per methodology ACM0018, Version 1.3.0, the realistic and credible baseline alternatives regarding power and use of biomass residues are demonstrated in section B.4 of this document. The following alternatives are identified as the realistic and credible alternative(s) to the project activity for both power and use of biomass residues.

Alternatives for Power:

P1: The proposed project activity not undertaken as a CDM project activity

P5: The generation of power in the grid.

Alternatives for use of Biomass residues:

B1: The biomass residues are dumped or left to decay mainly under aerobic conditions.

B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.

***Outcome of step 1a*:**

For Power Generation

P1: The proposed project activity not undertaken as a CDM project activity

P5: The generation of power in the grid.

And for the use of Biomass Residues

The scenarios B1 & B3

Therefore, the project activity passes Step 1a.

Sub-step 1b. Consistency with mandatory applicable laws and regulations

The above alternatives are in compliance with all mandatory applicable legal and regulatory requirements of the State Pollution Control Board and Environmental clearance from MOEF, New Delhi and nodal agency of state and state utilities of Orissa and Designated National Authority (DNA). There are no regulatory changes expected that would make the above alternatives non-compliant. Hence, it passes Step 1b.

Since, the project activity is not the only alternative and the identified alternatives are in compliance with all mandatory laws and regulations taking into account the enforcement in the region or country, step 1 is passed.

Step 2: Barrier analysis.

Sub-step 2a. Identify barriers that would prevent the implementation of alternative scenarios:

The project activity proposes to employ Rankine cycle technology, where the biomass is combusted directly in the boiler to generate steam and the adopted technology is environmentally safe and sound. Hence, the PP has not identified any barriers other than lower returns, which would prevent the implementation of the alternative scenario 1 & 2, The power generation in grid is not controlled by PP and as per the five year plans of the Govt. of India, the power generation in the grid is increasing which concludes there are no barriers for the alternative scenario P5 to occur.

Sub-step 2b*: *Eliminate alternative scenarios which are prevented by the identified barriers:

Based on the outcome of Step 2a, neither of the two alternative scenarios is eliminated.

Outcome of Step 2b:
For Power Generation

P1: The proposed project activity not undertaken as a CDM project activity
P5: The generation of power in the grid.

And for the use of Biomass Residues

B1: The biomass residues are dumped or left to decay mainly under aerobic conditions.
B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.

Outcome of Step 2: There are two alternative scenarios remaining, including the proposed project activity undertaken without being registered as a CDM project activity. Therefore, according to the methodology it proceeds to Step 3 (Investment analysis).

Step 3: Investment analysis.

In the alternative scenario P5 "Power generation in the grid" the project participants do not undertake any investment. As per the methodology ACM0018 version 01.3.0, *"If one of the alternative scenarios remaining after Step 2 corresponds to the situation where the project participants do not undertake any investment, then use either the NPV or the IRR as financial indicator in the analysis".* Hence IRR is chosen as financial indicator for the purpose of investment analysis.

Determine appropriate analysis method
As per "Tool for the demonstration and assessment of additionality" Version 5.2.0, for financial evaluation of the project the following options can be applied:

I. Simple cost analysis,
II. Investment comparison analysis, and
III. Benchmark analysis.

The simple cost analysis is not applicable as the project activity will result into financial return from the sale of the electricity apart from CDM revenue. Since the methodology defines the baseline as the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources, same is not to be considered as investment. Therefore, the investment comparison analysis is not applicable.

Option III: Benchmark analysis has been selected for investment analysis by the project proponent.

Suitability of Benchmark:
As per CDM EB 62 meeting report (Annex 5 Guidelines on the assessment of investment analysis Selection and validation of appropriate benchmarks) "*In case where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average cost of capital (WACC) are appropriate benchmarks for a project IRR*".

Benchmark for the project IRR analysis has been considered as 13%, which was the average value of Prime Lending Rate (PLR) of Reserve Bank of India (RBI) at the time of investment decision (21/11/2007) and the same is a publicly available data[4]. Normally the Financial Institutions would be funding/charge the interest rate of -0.25 % to +2.5% per year over and above their BPLR which was announced by respective banks by adding the operational expenses, a minimum margin to cover regulatory requirements of provisioning and capital charge, and profit margin[5] on published PLR by RBI. The Term loan sanction letters of UCO Bank & IDBI Bank confirm the same and the derived weighted average interest rate is 15%, which is higher than the selected bench mark. Copies of term loan sanction letters have been provided to DOE.

Further, The PP also computed project specific Weighted Average of Capital Cost (WACC) based on cost of equity (11.75% from '*Guidelines on the assessment of investment analysis*", *version 05, EB 62)*, Inflation Forecast for India published by RBI for the next ten years (2008 to 20017) is 5.0%[6]. Based on these parameters, the estimated WACC is 16.75% (sum of cost of equity, 11.75% and Expected inflation rate, 5%) and it is higher than the selected PLR i.e. 13.0%. Thus the considered benchmark i.e. 13% for the purpose of comparison the estimated project IRR is reasonable and this approach is in conformity with the above Guidance EB 62, Annex 5.

The IRR analysis has been computed for a period of 20 years and arrived IRR has been compared with Benckmark. For the purpose of IRR analysis the following input parameters are considered from DPR, consents, PPA and other publicly available data. Copies of said documents are provided to DOE.

Table-8: Financial parameters and assumptions at the time investment decision

Parameter	Assumption	Source
Plant capacity, MW	20	DPR and In-principle letter for set up Biomass power project issued by OREDA
PLF	70% First year 80% Second year onwards	DPR
Annual operating days	365	DPR
Auxiliary consumption	10%	DPR
SHR (kcal/kWh)	3,800	Considered from CSERC Tariff order 11/11/2005
Fuel GCV (kcal/kg)	Rice husk : 3,400 Paddy stalks : 3,100 Groundnut shells : 3,400 Other crop residues : 3,100 Woody biomass : 3,100	DPR
Biomass Fuel Price (INR per MT)	Rice husk : 1,450 Paddy stalks : 1,260 Groundnut shell : 1,450 Other crop residues : 1,260 Woody biomass : 1,260	DPR Biomass price quotations. The weighted average value (INR 1384) is lower than the price specified (INR 1785) in the OERC order dated Sept 2010. Hence the considered fuel prices

[4] http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/86104.pdf

[5] Section 2,11 of RBI Report vide web link http://rbi.org.in/scripts/PublicationReportDetails.aspx?UrlPage=&ID=565

[6] http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/88112.pdf

Fossil fuel GCV (kcal/kg)	3,384	are reasonable.
Fossil fuel price	Coal – INR 1,500 per MT	
Fuel Price Escalation	5%	DPR & CSERC Order dated 11/11/2005
Tariff	INR. 3.61 /kWh for first three years with 5% escalation for every three years*	Power Purchase Agreement
Project cost	INR 905.38 million	DPR
Debt Equity ratio	70:30	DPR & Term loan sanction letters
O& M Expenses	4% of capital cost	DPR
O & M Expenses escalation	5%	DPR
Interest rate on term loan	13.25%	DPR
Interest rate for working capital	13%	DPR
Loan repayment period (including Moratorium)	10 years	DPR
Depreciation rate (WDV) Civil works Plant & machinery Misc. Fixed assets	 10% 80% 15%	Income Tax Act[7]
Income Tax (2007-08) MAT Regular tax	 11.33% 33.99% (including cess)	As per Income Tax Act, Govt. of India
Residual value of land	100%	CERC norms vide Page No. 19/72 of CERC Order dated 26 Mar 2004[8]
Salvage value	10%	
Subsidy (INR, million)	13.85	MNRE Guidelines[9]
Tax holiday	10 Years	

* The tariff for first three years has been fixed in the PPA with M/s. Tata Power Trading Company Limited (TPTCL) in September 2007. And the tariff would be reviewed once in every three years.

At the time of investment decision, no tariff order for biomass based projects was available in the state of Orissa. The PP has analyzed the project viability based on input parameters considered in the Detailed project report (DPR) wherein the annual tariff rates reflected from Power purchase agreement with TATA Power Trading Company Ltd. (TPTCL) and took the decision to implement the project with CDM revenue on 01/09/2007. Further, the prevailing power tariff rates in neighboring states have been analyzed and the results are furnished below:

	MERC		**MPERC**		**CSERC**		**SGEL (Project Activity)**	
Order Date	**8th August 2005**		**7th August 2007**		**15th January 2008**			
Year	**Tariff INR/ kWh**	**Annual Escalation**	**Tariff INR/ kWh**	**Annual Escalation**	**Tariff INR/ kWh**	**Annual Escalation**	**Tariff INR/ kWh**	**Escalation**

[7] http://www.scribd.com/doc/24559879/Depreciation-Rates-as-Per-Income-Tax-Act

[8] http://cercind.gov.in/13042007/Terms_and_conditions_of_tariff.pdf

[9] http://www.mnre.gov.in/prog-biomasspower.htm

1st	3.04		3.33		3.05		3.61	
2nd	3.08	1.32%	3.36	0.90%	3.09	1.31%	3.61	
3rd	3.11	0.97%	3.39	0.89%	3.13	1.29%	3.61	
4th	3.14	0.96%	3.43	1.18%	3.15	0.64%	3.79	5%
5th	3.17	0.96%	3.48	1.46%	3.18	0.95%	3.79	
6th	3.20	0.95%	3.53	1.44%	3.20	0.63%	3.79	
7th	3.23	0.94%	3.59	1.70%	3.24	1.25%	3.98	5%
8th	3.26	0.93%	3.65	1.67%	3.27	0.93%	3.98	
9th	3.30	1.23%	3.71	1.64%			3.98	
10th	3.33	0.91%	3.79	2.16%			4.18	5%
11th	3.36	0.90%	3.51	-7.39%			4.18	
12th	3.40	1.19%	3.65	3.99%			4.18	
13th	3.43	0.88%	3.81	4.38%			4.39	5%
14th			3.97	4.20%			4.39	
15th			4.15	4.53%			4.39	
16th			4.33	4.34%			4.61	5%
17th			4.52	4.39%			4.61	
18th			4.71	4.20%			4.61	
19th			4.92	4.46%			4.84	5%
20th			5.14	4.47%			4.84	
Average annual escalation		**1.01%**		**2.35%**		**1.00%**		**1.55%**
Fuel		**5%**		**5%**		**5%**		**5%**
O&M		**5%**		**5%**		**5%**		**5%**

Though the annual escalation on fuel price and O&M cost remain the same, the annual tariff escalation for the subsequent years varies in all the tariff orders. The annual tariff rates considered for investment analysis are higher than the above state ERC tariff orders except 18th to 20th year in MPERC order. The SGEL has to pay open access charges which are not applicable on the above tariff rates announced by the state ERCs. The open access charges are not considered for investment analysis for simplification. Hence, the considered 5% tariff escalation for every three years is reasonable and stands conservative.

Based on the above in put parameters, the financial analysis for IRR has been carried out and the project IRR in baseline scenario is worked out to be 9.79% which is far below the benchmark IRR.

In context to the review comment raised by CDM EB, the financial indicator i.e. project IRR has been computed on pre-tax basis without changing any input parameters considered in the investment analysis and it works out to 10.62% which is also less than the selected PLR (13%).. The relevant pre-tax project IRR calculations have been provided to DOE.

A sensitivity analysis has also been made for the project activity considering the following probable scenarios and the resultant IRR without CDM revenues are depicted below.

Table-9: Sensitivity analysis

Sensitivity parameters	(-)10%	Base Line Scenario %	(+)10%
PLF	6.87%	9.79%	12.35%
Project Cost	12.57%	9.79%	7.21%
Fuel Cost	13.81%	9.79%	1.65%
Tariff	-	9.79%	15.90%
O & M Cost	10.55%	9.79%	8.96%

The IRR improves to 17.79% with the CDM revenues.

The project IRR reaches bench mark in the following scenarios:

- PLF increase by 12.68**%,** i.e., at PLF of 92.68%
- Project cost reduces by 11.48% (or)
- Fuel cost reduction by 7.70% (or)
- Tariff increase by 4.78%
- O&M cost reduces by 47.30%

At the time of investment decision there was no tariff order for Biomass based power projects in the state of Orissa. The plant load factor of a biomass power plant is 80% with 365 days operation as per the CEA, CSERC and other state regulatory commissions. At the time of investment decision as there was no biomass order from OERC, as per the other ERCs, i.e., as per the MERC "The PLF is an important performance parameter for any power plant installation and is dependent on factors such as continuous availability of reliable quality fuel supply, plant availability and unconstrained off-take (high load factor). The Commission notes that APERC, in its Order dated July 5, 2004 (R.P.No.3/2004 and R.P.No.4/2004) has referred to the submission made by NEDCAP that PLF of an average of 80% is achievable for the life of such projects. Further it is understood that APERC has reviewed the PLFs achieved by the biomass power plants during the past 2-3 years, and considered a threshold PLF of 80% for the purpose of determination of Tariff for such projects in Andhra Pradesh". Hence the PLF reaching 92.68% for 365 days of operation in a year is impossible.

Project Cost: The project is still under construction and there has been increase in the construction material as well as plant & machinery since commencement of the project activity. In fact, the price of construction materials such as cement, steel and labour cost has been escalating every year. As per the Whole sale Price Index (WPI) and Consumer Price Index (CPI), the cement, steel and labour cost has escalated annually for the last 10 years at the average rate of 4%, 7%[10], 5.9%[11] respectively. Further, the company has incurred INR 907.55 million as on 25 Feb 2011 towards project implementation, which is more than the estimated project cost in the DPR. A copy of CA certificate has been provided to DOE for validation. Hence, the question of project cost of 11.48% coming down is also not a realistic assumption .

A steep increase in the price of biomass fuels during the operational stage from the experience of other biomass plant developers in the adjoining states, there is no possibility in price reduction for biomass fuels. Further, if it observed in the state of Maharashtra state the biomass average biomass price has increased by more than 100% from the financial year 2005-2006 to the last financial year 2009-2010 at a whopping rate of 25% as against anticipated 5% per annum. Similarly the APERC also noted biomass price rise by 100% from year 2003- 04 to 2008-09. Hence the scenario of biomass price reduction by 7.70% is highly remote.

[10] http://eaindustry.nic.in/ - 10 years average

[11] http://labourbureau.nic.in/indtab.pdf - 10 years average

The PP has entered into a Power Purchase Agreement (PPA) with TPTCL for electricity supply for 10 years, wherein the tariff is fixed for the first three years and the tariff would be revised for every three years. In accordance with Electricity Regulatory Commission (ERC) of Maharashtra, Chhattisgarh, Madhya Pradesh and Andhra Pradesh, the tariff structure was two components i.e. variable and fixed cost. The variable cost component would be escalated with 3% for every year and fixed cost component would be reduced annually by 2%. An average annual escalation of 1% of Tariff is given by various ERCs. Hence conservatively the tariff has given an escalation of 5% for every three years which keeps the tariff slightly higher of the tariff fixed by ERCs. As the tariff fixed by the ERCs forms the basis for the private entities while fixing the tariff, the tariff increase by 4.78% additional to the considered escalation of 5% is remote.

As per PPA executed with TPTCL, the plant has to commission within three years from the date of agreement or otherwise it will be terminated. The state ERC i.e. Orissa Electricity Regulatory Commission (OERC) has issued tariff orders in the months of Sep 2010 and Sep 2011 for biomass based power projects. Due to delay in project implementation and advice of state nodal agency (OREDA), the PP has entered into new PPA with GRIDCO Ltd. which is state govt. owned transmission company. In view of this, the project IRR has been analysed in line with latest OERC order tariff i.e. Sep 2011 in which the annual tariff rates are available for 13 Years i.e. up to the year 2023-24. The applicable tariff and fuel price for the year 2011-12 are INR 4.87 per kWh and INR 2316 per MT respectively. After 13th year of operation the fixed cost component of tariff is not considered and 5% annual escalation has been applied to variable cost component of the tariff for conservative estimation. Based on latest OERC order, which is applicable to the project activity, the project IRR works out to 11.54% before taxes and 8.92% after taxes, which are less than the selected benchmark i.e. 13%.

The foregoing analysis proves beyond doubt that the project is additional and would continue to remain additional, thus the project justifies the need of CDM benefits for the project activity, which will help in improving the project competitiveness and financial sustainability. It is only with CDM benefits, that the project crosses the benchmark.

Step 4: Common practice analysis.

In India, the total installed generation capacity as on 31-12-2009 was 156092.23 MW[12] of which the installed capacity of Biomass power generation was only 834.50 MW[13] and it is equivalent to 0.53% of the total installed generation capacity in India. The potential of biomass power through agro residues in India has been estimated to be 16881 MW[14], it can be concluded that biomass power has not been exploited completely.

As per Annex–10 of EB 39, "Tool for demonstration and assessment of additionality" Version 05.2, the common practice analysis is demonstrated as follows:

Sub-step 4a: Analysis of other activities similar to the proposed project activity:

In accordance with the above tool the PP has considered the following criteria to identify the similar technology and scale of plant operations in the region.

Geographical area / region	As there is no biomass based power plants in regulatory environment i.e. state of Orissa, the PP has considered the biomass power projects established in host country (India).

12 http://www.cea.nic.in/archives/exec_summary/dec09.pdf

13 http://www.agora.mfa.gr/agora/images/docs/rad1BD86RENEWABLES-Investment.Opportunites.pdf

14 http://www.agora.mfa.gr/agora/images/docs/rad1BD86RENEWABLES-Investment.Opportunites.pdf

Technology	Direct biomass combustion with Rankine cycle based grid connected power only plant
Scale of plant operation	Grid connected biomass power plants of capacity from 10 MW to 30 MW.

In host country (India), there are multiple ways to produce power from biomass. The primary routes for biomass to power production are Direct combustion and Gasification.

Direct combustion – Biomass is used to produce steam that runs a turbine. In fact, most plants are regular rankine cycle route for biomass based power production in India as well as in many other parts of the world. This technology is quite efficient and cost effective for the capacity 5 MW and above[15].

Gasification - The biomass is first gasified and this producer gas consisting of Carbon monoxide (CO), Hydrogen (H_2) & traces of Methane (CH_4). Producer gas can be used to run internal combustion engines (both compression and spark ignition) for power production.

Gasifiers can work at low scales as low as 20 kW and works well up to 2 MW beyond which multiple engines can be used with current technology. Currently, less than 125 MW of cumulative installed capacity in India (less than 15%[16] of total biomass power, excluding biomass cogeneration).

The most of power production systems in India using biomass gasification are off-grid and have been for captive consumption for an industry or for a community. The same confirms the list of installed Biomass Gasification Plants in India stated in the Table vide web link http://www.eai.in/ref/ae/bio/csbg/list_of_installation.html

In view of the above, Direct biomass combustion with rankine cycle route is most appropriate for identification of power projects, which have been commissioned as on 11/07/2008 (Start date of the project activity).

The PP has used the official web sources of state nodal agencies, which are responsible & monitoring of renewable power in respective states, data available with CDM consultant and other public domains for identification of similar and operational projects in the region that deliver the power output in the range of 10 to 30 MW. The identified project details are listed below:

S.No.	Project	Capacity, MW	Date of Commissioning #	CDM status
1	Clarion Power Corpn. Ltd, Andhra Pradesh	12	Feb-2004	Regd. on 06-Aug-05, (Ref. 0075)
2	KVK Bio-Energy Pvt. Ltd., Champa, Chattisgarh[17]	15	Dec-2005	Under validation
3	Rukmini Power and Steel Ltd.(RPSL), Raigarh, Chattisgah[18]	10	Dec-2006	Regd. on 29-Sep-06, (Ref. 0532)
4	R.K.Powergen Private Limited, Karnataka	20	Jan-2004	Regd. on 24-Dec-06, (Ref. 0694)
5	Bhagyanagar Solvents and Extractions Private Ltd.,	11	Sep-2003	Under validation

[15] http://www.eai.in/ref/ae/bio/bppm/com/combustion.html

[16] http://www.eai.in/ref/ae/bio/bppm/gas/gasification.html

[17] http://www.credacg.org/bpg_projects_commissioned.htm

[18] http://www.credacg.org/bpg_projects_commissioned.htm

	Karnataka[19]			
6	Saradambika Power Plant Private Limited, Maharashtra[20]	10	Jul-2008	Registered, Ref. 1541
7	Shalivahana Green Energy limited, Wani, Maharashtra[21]	10	Jan-2008	Registered, Ref. 1473
8	Rake power limited, Maharashtra[22]	10	Jun-2008	Registered, Ref. 4319
9	Ind-Bharat Energies (Maharashtra) Limited, Maharashtra[23]	20	May-2006	Registered, Ref. 3083
10	Jalkheri power pvt ltd., Jalkheri, Punjab	10	Jul-2002	Regd. on 8-Sep-06, ,(Ref. 0524)
11	Raghu Rama Renewable Energy Ltd., Tamilnadu	18	Oct-2004	Regd, on 24-Dec-05, (Ref. 0111)
12	Empee Distilleries Ltd.,	10		Regd. on 14-Apr-08, (Ref. 1548)
13	20 MW Biomass Power Project in Tamilnadu	20	Ju-2006	Registered, Ref. 2920
14	Aurobindo Energy Pvt. Ltd., Sivagangai, Tamilnadu	15	Sep-2006	Under validation
15	Prathyusha Power Pvt. Ltd., Tirunelveli, Tamilnadu	10	Aug-2007	Under validation

[#] *Plant commissioning dates were identified from respective CDM PDD or Monitoring reports or state nodal agencies.*

From the above table it is evident that there is no biomass power plant of similar technology within selected scale of plant capacity (10 to 30 MW) operating without availing or considering CDM benefits. Hence it is concluded that similar project activities have not diffused in the considered geographical region, India.

Therefore sub-step 4a is passed.

Sub-step 4b: Discuss any similar activities that are occurring:

No similar activities are observed and commonly carried out.

Therefore sub-step 4b is passed.

Sub steps 4a and 4b are satisfied, i.e, no similar projects have been observed. Hence the proposed project activity is additional.

Prior consideration of the CDM

[19] http://www.kredltest.in/Bioreport.aspx

[20] http://www.mahaurja.com/PDF/Biomass_Proj_StatusC.pdf

[21] http://www.mahaurja.com/PDF/Biomass_Proj_StatusC.pdf

[22] http://www.mahaurja.com/PDF/Biomass_Proj_StatusC.pdf

[23] http://www.mahaurja.com/PDF/Biomass_Proj_StatusC.pdf

The PP was aware of CDM benefits and the Directors of SGEL have developed the four biomass based power projects as CDM activity in the states of Andhra Pradesh, Karnataka & Maharashtra. With the experience of these projects, the Board of Directors have discussed the uncertainties of the proposed biomass power project and consider additional revenues through sale of CERs to make the project for better impact on financially attractive.

The project proponent has decided to register the project as a Clean Development Mechanism (CDM) activity right at the planning stage of the project activity and towards this end passed a resolution in the meeting of the Board of Directors held on 21 Nov 2007. A copy of Board resolution for investment decision is submitted to the DOE for validation.

The project proponent has initiated various steps for obtaining licenses / permissions for starting of the project activity and also required for project validation under CDM activity. The list of events performed to get the project registered as CDM activity in parallel with the implementation of the project activity is given below:

Table-10: Chronology of events

Date	Description
11/01/2006	Board resolution to start a renewable energy based power project with CDM benifits
29/06/2007	In principal clearance from OREDA for setting up 20MW biomass power plant in Dhenkanal district.
30/06/2007	Board resolution to start biomass based power project with CDM benefits
03/07/2007	OREDA clearance for setting up 20 MW power plant in Dhenkanal Dist
15/08/2007	NOC from Gram panchayat
01/09/2007	Detailed Project report
13/09/2007	PPA with TATA power
28/09/2007	Board resolution on Social responsibility
21/11/2007	Board resolution for **investment decision**
09/01/2008	Board resolution to start the project activity and follow the CDM procedures
01/07/2008	Environmental clearance from Environmental Dept. Of State Govt
11/07/2008	LOI for Boiler (**Start date of the project activity**)
16/08/2008	Loan approval from UCO bank
27/09/2008	Loan approval from IDBI bank
17/11/2008	Intimation to UNFCCC about project activity
27/01/2009	Board resolution to start the CDM registration process
01/02/2009	Agreement for availing CDM consulting services
04/02/2009	Stake holders meetings for CDM project
01/06/2009	OPCB consent
09/01/2009	Grid connectivity
31/01/2009	P.O. of Boiler
31/03/2009	Order for turbine and generator
12/10/2009	Final Agreement with OREDA
09/12/2009	Climate change agreement with DNV
05/05/2010	Permission from Water resource dept.
11/01/2010	Documents submission for obtaining HCA
31/03/2010	NCDMA meeting for HCA
18/08/2010	Host country approval from MoEF, Govt. of India
27/10/2010	PDD web-hosted for GSC
30/12/2010	Power purchase agreement with GRIDCO

The PP has taken investment decision on 21/11/2007 considering project is financially viable only with CDM benefit. After getting positive response from the Bankers an LOI has been released for boiler on 11/07/2008. Further the UNFCCC has been intimated on 17/11/2008 which is within 6 months from start date of project activity (11/07/2008) and the same has been acknowledged by UNFCCC on the same day. Hence it is evident that the PP has considered the CDM right at the planning stage of the project activity and in the decision to implement the project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Emission Reductions

The project activity mainly reduces CO_2 emissions through substitution of power generation with fossil fuels by power generation with biomass residues. The emission reductions by project activity are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emissions reductions during year *y* (tCO_2)
BE_y = Baseline emissions during year *y* (tCO_2)
PE_y = Project emissions during year *y* (tCO_2)
LE_y = Leakage emissions during year *y* (tCO_2)

Baseline Emissions

Baseline emissions are calculated as follows:

$$BE_y = BE_{EL,y} + BE_{BR,y}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2e)
$BE_{EL,y}$ = Baseline emissions due to generation of electricity in year *y* (tCO_2)
$BE_{BR,y}$ = Baseline emissions due to uncontrolled burning or decay of biomass residues in year *y* (tCO_2e)

Baseline emissions are determined through the following steps:

Step 1: Determination of $BE_{EL,y}$

Baseline emissions from electricity generation are calculated as follows:

$$BE_{EL,y} = EG_{PJ,y} \cdot EF_{BL,EL,y}$$

Where:

$BE_{EL,y}$ = Baseline emissions due to generation of electricity in year *y* (tCO_2)
$EG_{PJ,y}$ = Net quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y* (MWh)
$EF_{BL,EL,y}$ = Emission factor for electricity generation in the baseline in year *y* (tCO_2/MWh)

Step 1.1: Determination of $EG_{PJ,y}$

The net quantity of electricity generated at the project site ($EG_{PJ,y}$) is calculated as the difference between the gross electricity generation at the project site ($EG_{PJ,gross,y}$) and the auxiliary electricity consumption required for the operation of the power plant at the project site ($EG_{PJ,aux,y}$), as follows:

$$EG_{PJ,y} = EG_{PJ,gross,y} - EG_{PJ,aux,y}$$

Where:

$EG_{PJ,y}$ = Net quantity of electricity generated at the project site in year *y* (MWh)

$EG_{PJ,gross,y}$ = Gross quantity of electricity generated at the project site in year *y* (MWh)

$EG_{PJ,aux,y}$ = Total auxiliary electricity consumption required for the operation of the power plant at the project site (MWh)

$EG_{PJ,aux,y}$ includes all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of power plant which are located at the project site (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.).

Step 1.2: Determination of $EF_{BL,EL,y}$

$$EF_{BL,EL,y} = \frac{EG_{BL,FF,y} \cdot EF_{BL,FF,y} + EG_{BL,grid,y} \cdot EF_{grid,CM,y} + EG_{BL,FF/grid,y} \cdot MIN\left(EF_{BL,FF,y}; EF_{grid,CM,y}\right)}{EG_{BL,BR,y} + EG_{BL,FF,y} + EG_{BL,grid,y} + EG_{BL,FF/grid,y}}$$

Where:

$EF_{BL,EL,y}$ = Emission factor for electricity generation in the baseline in year *y* (tCO_2/MWh).

$EG_{BL,BR,y}$ = Amount of electricity that would be generated with biomass residues in power-only plant operated at the project site in the baseline in year *y* (MWh)

$EG_{BL,FF,y}$ = Minimum amount of electricity that would be generated with fossil fuels at the project site in the baseline in year *y* (MWh)

$EG_{BL,grid,y}$ = Minimum amount of electricity that would be generated by power plant in the electricity grid in the baseline in year *y* (MWh)

$EG_{BL,FF/grid,y}$ = Amount of electricity that could be generated in the baseline either by power plant in the electricity grid in year *y* (MWh)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid-connected electricity generation in year *y* (tCO_2/MWh)

$EF_{BL,FF,y}$ = CO_2 emission factor for electricity generation with fossil fuels in power plant(s) at the project site in the baseline in year *y* (tCO_2/MWh)

From the results of step 1.3, 1.4, 1.5 and 1.6

$$EF_{BL,EL,y} = \frac{0 \cdot EF_{BL,FF,y} + EG_{PJ,y} \cdot EF_{grid,CM,y} + 0 \cdot MIN\left(EF_{BL,FF,y}; EF_{grid,CM,y}\right)}{0 + 0 + EG_{PJ,y} + 0}$$

Hence $EF_{BL,EL,y} = EF_{grid,CM,y}$

Step 1.3: Determination of $EG_{BL,BR,y}$

As the biomass base line for the project activity is B1 and/or B3, and not B4,

$$EG_{BL,BR,y} = 0$$

Step 1.4: Determination of $EG_{BL,FF,y}$

Since project activity is a grid connected new greenfield power plant and the baseline scenario is the construction of new power plant at the project site which is (co-)fired with fossil fuels the applicable case is case no. 4: **Grid connection, no historical use of fossil fuels, and construction of a new power plant(co-)fired with fossil fuels in the baseline scenario**.

As in the baseline scenario in the absence of the proposed project the equivalent amount of electricity would be generated in the grid which is dominated by fossil fuel based power plants and which do not use any biomass residues. And also there is technical constraint to use a minimum amount of fossil fuel by the project activity and also the PP do not wish to determine a minimum amount of fossil fuel usage. Hence,

$$EG_{BL,FF,y} = 0$$

Step 1.5: Determination of $EG_{BL,grid,y}$

There would be no power plants operated at the project site in the baseline, hence all electricity generated by the project displaces grid electricity. The applicable case is case no. 2: **No electricity generation at the project site in the baseline.** Hence

$$EG_{BL,grid,y} = EG_{PJ,y}$$

Step 1.6: Determination of $EG_{BL,FF/grid,y}$

$EG_{BL,FF/grid,y}$ represents the amount of electricity that could be generated in the baseline in the grid or at the project site using fossil fuels. $EG_{BL,FF/grid,y}$ is calculated as follows:

$$EG_{BL,FF/grid,y} = EG_{PJ,y} - EG_{BL,BR,y} - EG_{BL,FF,y} - EG_{BL,grid,y}$$

Where:

$EG_{BL,FF/grid,y}$ = Amount of electricity that could be generated in the baseline either by power plants in the electricity grid or by power plants at the project site using fossil fuels in year *y* (MWh)

$EG_{PJ,y}$ = Electricity generated in power plants included in the project boundary in year *y* (MWh)

$EG_{BL,BR,y}$ = Amount of electricity that would be generated with biomass residues in power-only plants operated at the project site in the baseline in year *y* (MWh)

$EG_{BL,FF,y}$ = Minimum amount of electricity that would be generated with fossil fuels at the project site in the baseline in year *y* (MWh)

$EG_{BL,grid,y}$ = Minimum amount of electricity that would be generated by power plants in the electricity grid in the baseline in year *y* (MWh)

From the results of step 1.3, 1.4 and 1.5

$$EG_{BL,FF/grid,y} = EG_{PJ,y} - 0 - 0 - EG_{PJ,y}$$

Hence $EG_{BL,FF/grid,y} = 0$

Step 1.7: Determination of $EF_{BL,FF,y}$

If fossil fuel power plants were operated at the project site prior to the implementation of the project activity, either Option A or Option B can be used to determine $EF_{BL,FF,y}$. For new power plants that would be constructed at the project site in the baseline scenario, Option B has been considered for computing $EF_{BL,FF,y}$.

Option B: *Determine a default emission factor for $EF_{BL,FF,y}$ based on a default efficiency of the power plant that would be operated at the project site in the baseline and a default CO_2 emission factor for the fossil fuel types that would be used, as follows:*

$$EF_{BL,FF,y} = 3.6 \cdot \frac{EF_{BL,CO2,FF}}{\eta_{BL,FF}}$$

Where:

$EF_{BL,FF,y}$ = CO_2 emission factor for electricity generation with fossil fuels in power plant(s) at the project site in the baseline in year *y* (t CO_2 / MWh)

$EF_{BL,CO2,FF}$ = CO_2 emission factor of the fossil fuel type that would be used for power generation at the project site in the baseline (t CO_2 / GJ)

$\eta_{BL,FF}$ = Efficiency of the fossil fuel power plant(s) at the project site in the baseline

Step 1.8: Determination of $EF_{grid,CM,y}$

The combined margin CO_2 emission factor for grid connected power generation in year *y*, calculated using the latest approved version of the "Tool to calculate the emission factor for an electricity system" . A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM). Project proponent chose to use the data of NEWNE grid from Central Electricity Authority (CEA) of Government of India, which is being published for every year in its "CO_2 Baseline Database version 5 dated Nov 2009" according to the guidelines of CDM UNFCCC website. The details are furnished below:

The Central Electricity Authority (CEA) CO_2 Baseline database Version 5 Nov 2009 is used and the it is available vide web link
http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Simple Operating Margin (tCO_2/GWh) (Incl. Imports) for NEWNE Grid is derived as follows:

Most recent three years	2006-07	2007-08	2008-09
Operating Margin (OM) in t CO_2 / MWh	1.0085	0.9999	1.0066
Total net generation in MWh	465,361,323.5	496,119,033.5	509,775,578.2
Average of 3 years	**1.0049** tCO_2 / MWh		

Build Margin (tCO_2/GWh) (incl. Imports) for NEWNE Grid (FY 2008-09)

Build Margin (BM)	**0.6752**	tCO_2 / MWh

Combined margin (CM):

The combined margin emission factor is calculated as

$$EF_{grid\ CM\ y} = EF_{grid\ OM\ y} \times w_{OM} + EF_{grid\ BM\ y} \times w_{BM}$$

Where

$EF_{grid\ OM\ y}$ = Operating margin CO_2 emissions factor in year y (tCO_2/MWh)
$EF_{grid\ BM\ y}$ = Build margin CO_2 emissions factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (50%)
w_{BM} = Weighting of build margin emissions factor (50%)

Combined Margin (CM)	**0.840**	tCO_2 / MWh

Step 2: Determination of baseline emissions due to uncontrolled burning or decay of biomass residues ($BE_{BR,y}$)

$$BE_{BR,y} = BE_{BR,B1/B3,y} + BE_{BR,B2,y}$$

Where:

$BE_{BR,y}$ = Baseline emissions due to uncontrolled burning or decay of biomass residues in year *y* (tCO_2)
$BE_{BR,B1/B3,y}$ = Baseline emissions due to aerobic decay or uncontrolled burning of biomass residues in year *y* (tCO_2)
$BE_{BR,B2,y}$ = Baseline emissions due to anearobic decay of biomass residues in year *y* (tCO_2)

As the baseline scenario for the project activity does not include B2, $BE_{BR,B2,} = 0$.

$$Hence\ BE_{BR,y} = BE_{BR,B1/B3,y}$$

As per the result of step 2.1

$$BE_{BR,B1/B3,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot 0.001971$$

$$Hence\ BE_{BR,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot 0.001971$$

Step 2.1: Determination of $BE_{BR,B1/B3,y}$

Baseline emissions are calculated by multiplying the quantity of biomass residues with the net calorific value and an appropriate emission factor, as follows:

$$BE_{BR,B1/B3,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot NCV_{n,y} \cdot EF_{BR,n,y}$$

Where:

$BE_{BR,B1/B3,y}$ = Baseline emissions due to uncontrolled burning or anaerobic decay of biomass residues in year *y* (tCO_2)
GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4)

$BR_{n,B1/B3,y}$	=	Amount of biomass residues category n used in the project plant(s) included in the project boundary in year *y* for which B1 or B3 has been identified as the most plausible baseline scenario (tonnes on dry-basis)
$NCV_{n,y}$	=	Net calorific value of the biomass residues category n in year y (GJ/tonnes on dry-basis)
$EF_{BR,n,y}$	=	CH_4 emission factor for uncontrolled burning of the biomass residues category n during the year *y* (tCH_4/GJ)
N	=	Categories of biomass residues

In the absence of more accurate information, it is proposed to use 0.0027 t CH_4 per ton of biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$ and lower value (0.73) of Conservativeness factor at 150% uncertainty band for ex-ante emission calculations.

$$BE_{BR,B1/B3,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot 0.001971$$

Hence the Baseline emissions as per the procedure followed in the methodology of ACM0018, version 01.3.0, are calculated as below.

$$BE_y = BE_{EL,y} + BE_{BR,y}$$

Where

$$BE_{EL,y} = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

$$EG_{PJ,y} = EG_{PJ,gross,y} - EG_{PJ,aux,y}$$

$$BE_{BR,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot 0.01971$$

Project emissions

Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{EL,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{EC,y}$$

Where:

PE_y	=	Project emissions during year *y* (tCO_2e)
$PE_{FF,y}$	=	Emissions during the year *y* due to fossil fuel consumption (tCO_2)
$PE_{EL,y}$	=	Emissions during the year *y* due to electricity use off-site for the processing of biomass residues (tCO_2)
$PE_{TR,y}$	=	Emissions during the year *y* due to transport of the biomass residues to the project plant (tCO_2)
$PE_{BR,y}$	=	Emissions from the combustion of biomass residues during the year *y* (tCO_2e)
$PE_{WW,y}$	=	Emissions from wastewater generated from the treatment of biomass residues in year *y* (tCO_2e)
$PE_{EC,y}$	=	Emissions from electricity consumption in year *y* (tCO_2e)

The project does not use electricity off site for the processing of biomass residues and the project activity is not involved in the waste water generation for treatment of biomass residues and hence the project emissions for the project will be

$$PE_y = PE_{FF,y} + PE_{TR,y} + PE_{BR,y} + PE_{EC,y}$$

Project Emissions due to on-site fossil fuel consumption (PE_{FFy}):

The following emission sources should be included in determining $PE_{FF,y}$:

- Emissions from on-site fossil fuels consumption in boiler for the generation of electric power; and
- Emissions from on-site fossil fuel consumption of auxiliary equipment and systems related to the generation of electric power. This includes fossil fuels required for the operation of auxiliary equipment related to the power plants (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.) which are not accounted in the above.

As per the EB 41, annex 11, "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC.j.y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,,,,i\,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr);

$FC_{i,j,y}$ = Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);

$COEF_{i,y}$ = CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

i = Fuel types combusted in process j during the year y

The CO_2 emission coefficient $COEF_{i,y}$ is calculated using Option B by using the following formula

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)

i = Are the fuel types combusted in process *j* during the year *y*

The expected fossil fuels consumption at project site are coal in the boiler for the generation of electric power and diesel for DG sets and transportation and preparation of biomass onsite. Hence

$$PE_{FC.j.y} = FC_{coal,j,y} \times COEF_{coal,y} + FC_{diesel,j,y} \times COEF_{diesel,y}$$

Where

$FC_{coal,j,y}$ = Is the quantity of fuel coal combusted in process j during the year y (mass or Volume unit/yr);

$COEF_{coal,y}$ = Is the CO_2 emission coefficient of fuel coal in year y (tCO_2/mass or volume unit)

Where $\mathbf{COEF}_{coal,y} = NCV_{coal,y} \times EF_{CO2,coal,y}$

$FC_{diesel,j,y}$ = Is the quantity of fuel diesel combusted in process j during the year y (mass or Volume unit/yr);

$COEF_{diesel,y}$ = Is the CO_2 emission coefficient of fuel diesel in year y (tCO_2/mass or volume unit)

Where $\mathbf{COEF}_{diesel,y} = NCV_{diesel,y} \times EF_{CO2,diesel,y}$

Project Emissions due to transport of biomass residues to project plant ($PE_{TR,y}$)

PP has chosen the following approach (Option 1) to determine emissions:

$$PE_{TR,y} = \frac{BR_{TR,y}}{TL_y} \cdot AVD_y \cdot EF_{km,y}$$

Where:

$PE_{TR,y}$	=	CO_2 emissions during the year *y* due to transport of the biomass residues to the project plant (tCO_2)
AVD_y	=	Average round trip distance (from and to) between the biomass residues fuel supply sites and the site of the project plant during the year *y* (km)
$EF_{km,y}$	=	Average CO_2 emission factor for the trucks measured during the year *y* (tCO_2/km)
$BR_{TR,y}$	=	Quantity of biomass residues that has been transported to the project site during the year *y* (tonnes of dry matter)
TL_y	=	Average truck load of the trucks used (tonnes) during the year *y*

Project Emissions from the combustion of biomass residues ($PE_{BR,y}$)

As per the methodology ACM0018, version 01.3.0,

$$PE_{BR,y} = GWP_{CH4} \cdot EF_{CH4,BR} \cdot \sum_n BR_{PJ,n,y} \cdot NCV_{n,y}$$

Where:

$PE_{BR,y}$	=	Emissions from the combustion of biomass residues during the year *y* (tCO_2)
GWP_{CH4}	=	Global Warming Potential for methane valid for the relevant commitment period (21 tCO_2/tCH_4)
$EF_{CH4,BR}$	=	CH_4 emission factor for the combustion of biomass residues in the project plant (0.0000411 tCH_4/GJ)
$BR_{PJ,n,y}$	=	Quantity of biomass residues of category *n* used in power plants which are located at the project site and included in the project boundary in year *y* (tonnes on dry-basis/yr)
$NCV_{n,y}$	=	Net calorific value of the biomass residues category *n* in year *y* (GJ/tonnes on dry-basis)

In the absence of measured values, CH_4 emission factor for biomass residues is computed from the IPCC default value for solid biomass residues 30 kg CH_4/TJ and lower value (1.37) of Conservativeness factor at 150% uncertainty band for ex-ante emission calculations.

Project Emissions from electricity consumption ($PE_{EC,y}$):

The project activity would provide energy meter to measure electricity import from grid system. Since, the project activity is a power generation plant; the project would import the electricity from grid system only during start-up and emergency situations. However, the amount of electricity imports from the grid system would be minimal and are not accurately predictable during implementation stage. Hence, for the purpose of calculating ex-ante project emissions due to electricity consumptions, imports from the grid system are considered zero for simplification of ex-ante emission reduction calculations. The corresponding amount of emissions from the grid electricity consumption will be calculated every year during the crediting period and accounted for project emissions. The default value of $TDL_{j,y}$ is considered as 20% for the project electricity consumption sources as defined in "Tool to calculate baseline , project and/or leakage emissions from electricity consumption" (Version 01).

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

$PE_{BC,,y}$	=	Project emissions from electricity consumption in year *y* (tCO_2/yr)
$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)
$EF_{EJ,j,y}$	=	Emission factor for electricity generation for source j in year y (tCO_2/MWh) $EF_{EJ,j,y} = EF_{grid,CM,y}$
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source j in year *y*
j	=	Sources of electricity consumption in the project

Leakage

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity.

Since the baseline scenarios of the biomass residues for the proposed project activity are B1 & B3, leakage emissions are not relevant. However, in the event that during any of the crediting years leakage is applicable, the following formula as prescribed by the methodology will be applied:

$$LE_y = EF_{CO2,LE} \cdot \sum_n BR_{PJ,n,y} \cdot NCV_{n,y}$$

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2/yr)
$EF_{CO2,LE}$	=	CO_2 emission factor of the most carbon intensive fossil fuel used in the country (tCO_2/GJ)
$BR_{PJ,n,y}$	=	Quantity of biomass residues of category n used in power plants which are located at the project site and included in the project boundary in year *y* (tonnes on dry-basis/year)
NCVn,y matter)	=	Net calorific value of the biomass residues category *n* in year *y* (GJ/ton of dry
n	=	Categories of biomass residues for which B5:, B6:, B7: or B8: has been identified as the baseline scenario

B.6.2. Data and parameters that are available at validation:

The following are not monitored data and parameters

Data / Parameter:	**$EF_{grid,CM,y}$**
Data unit:	tCO_2/MWh
Description:	Combined Margin CO_2 emission factor for grid connected power generation in year *y*
Source of data used:	CO_2 Baseline Database for the Indian Power Sector , User Guide ,Version 5.0 - Nov 2009 issued by Central Electricity Authority(CEA) http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver6.pdf
Value applied	0.84
Justification of the choice of data or	Central Electricity Authority (CEA) has issued a publication on CO_2 Baseline Database for the Indian Power Sector and the Combine Margin

description of measurement methods and procedures actually applied :	Grid Emission factor will be used for the entire crediting period.
Any comment:	Fixed as ex-ante. This value is applied for estimation of baseline emissions during the crediting period.

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH_4
Source of data used:	IPCC http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
Value applied	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	21 for the first commitment period. The value would be updated according to any future COP/MOP decisions
Any comment:	-

Data / Parameter:	**$EF_{CO2,Coal}$**
Data unit:	tCO_2/TJ
Description:	CO_2 Emission factor of coal
Source of data used :	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Energy http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied	99.7
Justification of the choice of data or description of measurement methods and procedures actually applied	The IPCC 95% confidence interval upper value of Other Bituminous Coal has been taken for this parameter.
Any comment:	IPCC 2006 values have been used for coal and any future revision of the IPCC Guidelines should be taken into account and review the appropriateness of the data annually

Data / Parameter:	**$EF_{CO2,Diesel}$**
Data unit:	tCO_2/GJ
Description:	CO_2 Emission factor of Diesel
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Energy http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied	0.0748
Justification of the choice of data or description of measurement methods	The IPCC 95% confidence interval upper value of Diesel has been taken for this parameter.

and procedures actually applied	
Any comment:	IPCC 2006 values have been used for diesel and any future revision of the IPCC Guidelines should be taken into account and review the appropriateness of the data annually

Data / Parameter:	**NCV_{Diesel}**
Data unit:	GJ/ton
Description:	Net calorific value of diesel
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Energy http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied	43.3
Justification of the choice of data or description of measurement methods and procedures actually applied:	Net calorific value of diesel has been considered from the IPCC's Default Net calorific values, upper limits of the 95% confidence Intervals
Any comment:	-

Data / Parameter:	**$TDL_{j,y}$**
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data used:	As defined in "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".
Value applied	20
Justification of the choice of data or description of measurement methods and procedures actually applied:	It is default value as prescribed in tool as the Scenario A applies for the project activity. The distribution losses can be based on references from utilities, network operators or other official documentation. Here a default value is used
Any comment:	---

Data / Parameter:	**ρ_{Diesel}**
Data unit:	kg/Litre
Description:	Density of Diesel
Source of data used:	Society of Indian Automobile Manufacturers http://www.siamindia.com/scripts/Diesel.aspx
Value applied	0.845
Justification of the choice of data or description of measurement methods and procedures actually applied:	The upper most value has been considered from the Society of Indian Automobile Manufacturers
Any comment:	---

Data / Parameter:	Biomass residues categories and quantities used for the selection of the baseline scenario selection and assessment of additionality
Data unit:	Please refer Table 5: biomass residues categories and quantities
Description:	Explained and documented transparently in the CDM-PDD, using a table similar to Table 2, of ACM0018 version 01.3.0 which quantities of which biomass residues categories are used in which installation(s) under the project activity and what is their baseline scenario.
Source of data used:	On-site assessment of biomass residues categories and quantities
Value applied	--
Justification of the choice of data or description of measurement methods and procedures actually applied :	---
Any comment:	This parameter is related to the procedure for the selection of the baseline scenario selection and assessment of additionality

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline emissions:

Baseline emissions due to generation of power:

Baseline emissions due to generation of electricity by the power plant for year y are the product of net electricity exported (gross electricity generation deduced by auxiliary electricity consumption) to the grid by the power plant in year y and the CO_2 emission factor of the grid NEWNE.

$$BE_{EL,y} = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

$$EG_{PJ,y} = EG_{PJ,gross,y} - EG_{PJ,aux,y}$$

Where

$BE_{EL,y}$ = Baseline emissions due to generation of electricity in year *y* (tCO_2)
$EG_{PJ,y}$ = Net quantity of electricity generated in the power plant year y (MWh)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid-connected electricity generation in year *y* (tCO_2/MWh)

Sample calculations for 1st year are as follows

$$EG_{PJ,y} = EG_{PJ,gross,y} - EG_{PJ,aux,y}$$
$$= 122,640 - 12,264 = 110,376 \text{ MWh}$$
$$BE_{EL,y} = EG_{PJ,y} \cdot EF_{grid,CM,y}$$
$$= 110,376 \times 0.84 = 92,716 \text{ } tCO_2$$

Table-11: Baseline emissions due to generation

Year	Gross Generation	Auxiliary consumption	Net Electricity export to Grid	Combined margin CO_2	Baseline Emissions

				Emission Factor	$BE_{EL,y}$
	MWh	MWh	MWh	tCO_2/MWh	tCO_2e
1	122,640	12,264	110,376	0.84	92,716
2	140,160	14,016	126,144	0.84	105,961
3	140,160	14,016	126,144	0.84	105,961
4	140,160	14,016	126,144	0.84	105,961
5	140,160	14,016	126,144	0.84	105,961
6	140,160	14,016	126,144	0.84	105,961
7	140,160	14,016	126,144	0.84	105,961
8	140,160	14,016	126,144	0.84	105,961
9	140,160	14,016	126,144	0.84	105,961
10	140,160	14,016	126,144	0.84	105,961
	1,384,080	**138,408**	**1,245,672**		**1,046,365**

Baseline emissions due to uncontrolled burning or decay of biomass residues under aerobic conditions:

$$BE_{BR,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot 0.001971$$

$BE_{BR,y}$ = Baseline emissions due to uncontrolled burning or decay of biomass residues in year *y* (tCO_2)

GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4)

$BR_{n,B1/B3,y}$ = Amount of biomass residues category n used in the project plant(s) included in the project boundary in year *y* for which B1 or B3 has been identified as the most plausible baseline scenario (tonnes on dry-basis)

Sample calculations for 1st year are as follows

$$BE_{BR,y} = GWP_{CH4} \cdot \sum_{n} BR_{n,B1/B3,y} \cdot 0.001971$$

$$= 21 * 127{,}341 * 0.001971 = 5{,}270\ tCO_2$$

Since the biomass baseline for the project activity is B_1 or B_3, $\sum_{n} BR_{n,B1/B3,y}$ is the total amount of biomass residues used in the project plant in year y.

Table-12: Baseline emissions due uncontrolled burning or decay of biomass

Year	Amount biomass residues used	Global Warming Potential of methane	Baseline Emissions $BE_{BR,y}$
	tonnes	tCO_2/tCH_4	tCO_2
1	127,341	21	5,270
2	145,532	21	6,023
3	145,532	21	6,023
4	145,532	21	6,023
5	145,532	21	6,023
6	145,532	21	6,023
7	145,532	21	6,023
8	145,532	21	6,023

9	145,532	21	6,023
10	145,532	21	6,023
	1,437,132		**59,477**

The baseline emissions for the project activity are

$$BE_y = BE_{EL,y} + BE_{BR,y}$$

Table-13: Baseline emissions

Year	$BE_{EL,y}$	$BE_{BR,y}$	Baseline Emissions
	tCO_2	tCO_2	tCO_2
1	92,716	5,270	97,986
2	105,961	6,023	111,984
3	105,961	6,023	111,984
4	105,961	6,023	111,984
5	105,961	6,023	111,984
6	105,961	6,023	111,984
7	105,961	6,023	111,984
8	105,961	6,023	111,984
9	105,961	6,023	111,984
10	105,961	6,023	111,984
	1,046,365	**59,477**	**1,105,842**

Project emissions

The Project Emissions for the project activity are

$$\mathbf{PE_y = PE_{FF,Y} + PE_{TR,y} + PE_{BR,y} + PE_{EC,y}}$$

Emissions due to use of fossil fuel combustion:

Project emissions due to use of coal combustion in the Boiler and diesel combustion in DG set at the project site are calculated by using the following formula.

$$PE_{FF,y} = FC_{coal,,y} \times COEF_{coal,y} + FC_{diesel,y} \times COEF_{diesel,y}$$

Where

$PE_{FF,y}$ = Project emissions during the year y due to fossil fuel combustion in the project plant

$FC_{coal,y}$ = Quantity of fuel coal combusted in process j during the year y (mass or volume unit/yr);

$COEF_{coal,y}$ = CO_2 emission coefficient of fuel coal in year y (tCO_2/mass or volume unit)

Where $COEF_{coal,y} = NCV_{coal,y} \times EF_{CO2,coal,y}$

$COEF_{coal,y} = 13.46$ (GJ/ton) x 0.0997 (tCO_2/GJ)

$FC_{diesel,y}$ = Quantity of fuel diesel combusted in process j during the year y (mass or volume unit/yr);

$COEF_{diesel,y}$ = CO_2 emission coefficient of fuel diesel in year y (tCO_2/mass or volume unit)

Where $COEF_{diesel,y} = NCV_{diesel,y} \times EF_{CO2,diesel,y}$

$COEF_{diesel,y} = 43.3$ (GJ/ton) x 0.0748 (tCO_2/GJ)

The emission factors for fossil fuels Coal, Diesel and NCV of Diesel has been considered from 2006 IPCC Guidelines, Volume 2 -Energy

Project emissions due to use of coal combustion at the project site are calculated assuming 10% of coal (on energy basis) would be used in the plant.

Sample Calculations of Project emissions due to coal for 1st year are as follows

$$PE_{FF,coaly} = FC_{coal,,y} \times NCV_{coal,y} \times EF_{CO2,coal,y}$$
$$= 13{,}772 \text{ (tons)} \times 13.460 \text{ (GJ/ton)} \times 0.0997 \text{ (tCO}_2\text{/GJ)}$$
$$= 18{,}481 \text{ tCO}_2$$

Table-14: Project emissions due to fossil fuel (coal) combustion

Year	Coal Consumption	GCV for Coal	NCV of coal	Emission factor coal	Project Emissions coal
	tonnes	kcal/kg	GJ/ton	tCO_2/GJ	tCO_2
1	13,772	3,384	13.460	0.0997	18,481
2	15,739	3,384	13.460	0.0997	21,121
3	15,739	3,384	13.460	0.0997	21,121
4	15,739	3,384	13.460	0.0997	21,121
5	15,739	3,384	13.460	0.0997	21,121
6	15,739	3,384	13.460	0.0997	21,121
7	15,739	3,384	13.460	0.0997	21,121
8	15,739	3,384	13.460	0.0997	21,121
9	15,739	3,384	13.460	0.0997	21,121
10	15,739	3,384	13.460	0.0997	21,121
Total	**1,55,423**				**208,570**

Sample Calculations of Project emissions due to Diesel for 1st year are as follows

$$PE_{FFdiesel,y} = FC_{diesel,,y} \times NCV_{diesel\ ,y} \times EF_{CO2,diesel\ ,y}$$
$$= 0 \text{ (tons)} * 43.3 \text{ (GJ/ton)} \times 0.0748 \text{ (tCO}_2\text{/GJ)}$$
$$= 0 \text{ tCO}_2$$

Table-15: Project emissions due to fossil fuel (diesel) combustion

Year	Diesel consumption	Diesel consumption	NCV of diesel	Emission factor diesel	Project Emissions diesel
	litres	kg	GJ/ton	tCO_2/GJ	tCO_2
1	0	0	43.3	0.0748	0
2	0	0	43.3	0.0748	0
3	0	0	43.3	0.0748	0
4	0	0	43.3	0.0748	0
5	0	0	43.3	0.0748	0
6	0	0	43.3	0.0748	0
7	0	0	43.3	0.0748	0

8	0	0	43.3	0.0748	0
9	0	0	43.3	0.0748	0
10	0	0	43.3	0.0748	0
Total					0

Sample Calculations of Project emissions due to coal & Diesel for 1st year are as follows

$$PE_{FF,Y} = PE_{FF,coaly} + PE_{FFdiesel,y}$$
$$= 18,481 + 0 = 18,481\ tCO_2$$

Table-16: Project emissions due to fossil fuel combustion

Year	Project Emissions coal	Project Emissions diesel	Project Emissions $PE_{FF,y}$
	tCO_2	tCO_2	tonnes
1	18,481	0	18,481
2	21,121	0	21,121
3	21,121	0	21,121
4	21,121	0	21,121
5	21,121	0	21,121
6	21,121	0	21,121
7	21,121	0	21,121
8	21,121	0	21,121
9	21,121	0	21,121
10	21,121	0	21,121
TOTAL	**208,570**	**0**	**208,570**

Project emissions in year y due to transport of biomass residues to project plant ($PE_{TR,y}$)

$$PE_{TR,y} = \frac{BR_{TR,y}}{TL_y} \cdot AVD_y \cdot EF_{km,y}$$

Sample calculations of project emissions due to biomass transportation for 1st year are as follows

$$= (127,341 * 200 * 0.00060818)/10$$

$$= 1,549\ tCO_2$$

Table-17: Project emissions due to biomass residues transportation

Year	Quantity of Biomass residues transported	Average round trip distance	Average truck load	Emission factor for trucks	Off-site transport Emissions $PE_{TR,y}$
	tonnes	km	tons	tCO_2/km	tCO_2
1	127,341	200	10	0.00060818	1,549
2	145,532	200	10	0.00060818	1,771
3	145,532	200	10	0.00060818	1,771
4	145,532	200	10	0.00060818	1,771

5	145,532	200	10	0.00060818	1,771
6	145,532	200	10	0.00060818	1,771
7	145,532	200	10	0.00060818	1,771
8	145,532	200	10	0.00060818	1,771
9	145,532	200	10	0.00060818	1,771
10	145,532	200	10	0.00060818	1,771
Total					**17,488**

Project emissions from the combustion of biomass residues ($PE_{BR,y}$)

$$PE_{BR,y} = GWP_{CH4} \cdot EF_{CH4,BR} \cdot \sum_{n} BR_{PJ,n,y} \cdot NCV_{n,y}$$

CH_4 emission factor for combustion of biomass residues in the project plant would be determined based on stack gas analysis using calibrated analyzers. In the absence of such data default values are used for ex-ante calculations.

Sample calculations of project emissions due to combustion of biomass residues for 1st year are as follows

$$= 21*0.0000411*127,341*13.101 = 1,440\ tCO_2$$

Table-18: Project emissions from combustion of biomass residues

Year	Amount biomass residues used	Global Warming Potential of methane	CH_4 emission factor for combustion biomass	Average NCV of biomass	Project Emissions $PE_{br,y}$
	tonnes	tCO_2/tCH_4	tCH_4/GJ	GJ/ton	tCO_2
1	127,341	21	0.0000411	13.102	1,440
2	145,532	21	0.0000411	13.102	1,646
3	145,532	21	0.0000411	13.102	1,646
4	145,532	21	0.0000411	13.102	1,646
5	145,532	21	0.0000411	13.102	1,646
6	145,532	21	0.0000411	13.102	1,646
7	145,532	21	0.0000411	13.102	1,646
8	145,532	21	0.0000411	13.102	1,646
9	145,532	21	0.0000411	13.102	1,646
10	145,532	21	0.0000411	13.102	1,646
	1,437,132				**16,254**

Project Emissions from electricity consumption ($PE_{EC,y}$):

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

For 1st Year, $PE_{EC,y}$ = 0 x 0.84 x (1 + 20%) = 0 tCO_2

Table-19: Project emissions from electricity consumption

Year	Quantity of electricity consumed (Import)	Grid CO_2 Emission factor	Average T&D Losses	Project Emissions $PE_{EC,y}$
	MWh	tCO_2/MWh	%	tCO_2
1	0	0.84	20	0
2	0	0.84	20	0
3	0	0.84	20	0
4	0	0.84	20	0
5	0	0.84	20	0
6	0	0.84	20	0
7	0	0.84	20	0
8	0	0.84	20	0
9	0	0.84	20	0
10	0	0.84	20	0
	Total			**0**

Total project emissions are

$$PE_y = PE_{FF,y} + PE_{TR,y} + PE_{BR,y} + PE_{EC,y}$$

Sample calculations of project emissions for 1st year are as follows

= 18,481 + 1,549 + 1,440 + 0 = 21,470

Table-20: Total Project Emissions

Year	$PE_{FF,y}$	$PE_{TR,y}$	$PE_{BR,y}$	$PE_{EC,y}$	Project Emissions PE_y
	tCO_2	tCO_2	tCO_2	tCO_2	tCO_2
1	18,481	1,549	1,440	0	21,470
2	21,121	1,771	1,646	0	24,538
3	21,121	1,771	1,646	0	24,538

4	21,121	1,771	1,646	0	24,538
5	21,121	1,771	1,646	0	24,538
6	21,121	1,771	1,646	0	24,538
7	21,121	1,771	1,646	0	24,538
8	21,121	1,771	1,646	0	24,538
9	21,121	1,771	1,646	0	24,538
10	21,121	1,771	1,646	0	24,538
Total	**208,570**	**17,488**	**16,254**	**0**	**242,312**

Leakage

The project activity is generating electricity using surplus biomass residues; hence, according to Indicative simplified baseline and monitoring methodologies for selected CDM project activity categories: "General guidance on leakage in biomass project activities"(Version 03), the leakage source applicable is 'Competing use of biomass'. This is accomplished by the biomass survey report furnished to DOE and explained in section B.4 of this report.

From the Table-6, the surplus availability of each type of biomass residue in the project region is in the range of 69.2% to 149.5% larger than the quantity of biomass residues of that type which is utilized in the region including the project plant. Hence, the leakage of the project activity is zero.

$$LE_y = 0$$

Emission Reductions
The emission reductions by project activity are as follows:

$$ER_y = BE_y - PE_y - LE_y$$

For 1st Year, ER_y = 97,986 - 21,470 - 0 = 76,516 tCO_2e
For 2nd Year, ER_y = 111,984 - 24,538 - 0 = 87,446 tCO_2e

B.6.4 Summary of the ex-ante estimation of emission reductions:

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Summary of the ex-ante emission reductions are presented below table.

Table-21: Summary of the ex-ante emission reductions

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of Overall emission reductions (tCO_2e)
1st year *	21,470	97,986	0	76,516
2nd year	24,538	111,984	0	87,446
3rd year	24,538	111,984	0	87,446
4th year	24,538	111,984	0	87,446

5th year	24,538	111,984	0	87,446
6th year	24,538	111,984	0	87,446
7th year	24,538	111,984	0	87,446
8th year	24,538	111,984	0	87,446
9th year	24,538	111,984	0	87,446
10th year	24,538	111,984	0	87,446
Total	**242,312**	**1,105,842**	**0**	**863,530**

* 1st year corresponds to the period starting from 01/04/2012 to 31/03/2013 or from the date of registration of the project activity. Similar interpretation shall apply for the subsequent years.

Project activity achieves on an average 86,353 tCO_2 emission reductions annually.

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**Biomass residues categories and quantities used in the project activity**
Data unit:	- Type (i.e. paddy stalks, groundnut shells, rice husk, stalks of red gram, til, mung, maize, woody biomass, etc.); - Source (e.g. produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc.); - Fate in the absence of the project activity (scenario B); - Use in the project scenario (scenario P); - Quantity (tonnes on dry-basis).
Description:	Along the crediting period, if new categories of biomass residues (i.e. new types, new sources, with different fate) are used in the project activity if these new categories are of the type B1:, B2: or B3:, the baseline scenario for those types of biomass residues would be assessed using the procedures outlined in the guidance provided in the procedure for the selection of the baseline scenario and demonstration of additionality.
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please see Table-5 of this report
Description of measurement methods and procedures to be applied:	The quantity of each type of biomass residues will be measured continuously using weighbridge, which is installed at the plant. The trucks carrying biomass residues weighted by a calibrated weighbridge twice upon entry and exit to arrive net quantity of fuel procured. Accuracy : ±10 kg Monitoring frequency: Data monitored continuously, recorded daily and

	aggregated monthly
QA/QC procedures to be applied:	The weighbridge will be calibrated annually as per Weights & Measurement Act by Weight & Measurement Controller Department of Orissa. Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	---

Data / Parameter:	**$BR_{n,B1/B3,y}$**
Data unit:	Tonnes on dry-basis
Description:	Amount of biomass residues category n used in the project plant(s) included in the project boundary in year *y* for which B1 or B3 has been identified as the most plausible baseline scenario.
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please see Table-5 of this report
Description of measurement methods and procedures to be applied:	The quantity of each type of biomass residues will be measured continuously using weighbridge, which is installed at the plant. The trucks carrying biomass residues weighted by a calibrated weighbridge twice upon entry and exit to arrive net quantity of fuel procured. Accuracy = ±10 kg Monitoring frequency: Data monitored continuously recorded daily and aggregated monthly
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes
Any comment:	---

Data / Parameter:	**For biomass residues categories for which scenarios B1; B2; or B3 is deemed a plausible baseline alternative, project participants shall demonstrate that this is a realistic and credible alternative scenario**
Data unit:	Tonnes
Description:	• Quantity of available biomass residues of type n in the region • Quantity of biomass residues of type n that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region • Availability of a surplus of biomass residues type n (which can not be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region
Source of data to be used:	Surveys or statistics from third party biomass assessment report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please see Table-6 of this report
Description of	At the validation stage for biomass residues categories identified *ex-ante*.

measurement methods and procedures to be applied:	And for new biomass residues categories are included during the crediting period, with a biomass assessment survey from a third party, their quantity and fate in the absence of the project activity would be presented.
QA/QC procedures to be applied:	---
Any comment:	---

Data / Parameter:	**$BR_{TR,y}$**
Data unit:	Tonnes on dry-basis
Description:	Quantity of biomass residues that has been transported to the project site during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Please see Table-5 of this report
Description of measurement methods and procedures to be applied:	The quantity of each type of biomass residues will be measured continuously using weighbridge, which is installed at the plant. The trucks carrying biomass residues weighted by a calibrated weighbridge twice upon entry and exit to arrive net quantity of fuel procured. Adjust for the moisture content in order to determine the quantity of dry biomass. Accuracy = ±10 kg Monitoring frequency: Data monitored continuously recorded daily and aggregated monthly
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	---

Data / Parameter:	**$EG_{PJ,gross,y}$**
Data unit:	MWh
Description:	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y*
Source of data to be used:	On-site measurements at plant premises
Value of data applied for the purpose of calculating expected emission reductions in section B.5	122,640 for 1st Year 140,160 from 2nd Year onwards
Description of measurement methods and procedures to be applied:	Use calibrated electricity meters Accuracy : 0.2 class Monitoring frequency: Data monitored continuously, recorded daily and aggregated monthly

QA/QC procedures to be applied:	The meter will be calibrated once in a year as per National Standards. The consistency of metered electricity generation will be cross-checked with receipts from electricity sales, auxiliary (in-house) electricity consumption.
Any comment:	---

Data / Parameter:	**$EG_{PJ,aux,y}$**
Data unit:	MWh
Description:	Total auxiliary electricity consumption required for the operation of the power plant at the project site
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	12,264 for 1st Year 14,016 from 2nd Year onwards
Description of measurement methods and procedures to be applied:	The auxiliary electricity consumption will be measured using calibrated energy meter of accuracy class 0.2 which is installed in the control room/MCC Monitoring frequency: Data monitored continuously, recorded daily and aggregated monthly.
QA/QC procedures to be applied:	Meter will be calibrated once in a year as per National Standards. The consistency of metered auxiliary electricity consumption shall be cross-checked with receipts from electricity sales and the metered gross electricity generation .
Any comment:	$EG_{PJ,aux,y}$ shall include all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of all power plants which are located at the project site and included in the project boundary (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.)

Data / Parameter:	**$EG_{PJ,y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated in the power plant year y
Source of data to be used:	Joint meter readings (JMR) of Main meter & Check meter installed at grid interface of OSEB and Monthly bills
Value of data applied for the purpose of calculating expected emission reductions in section B.5	110,376 for 1st Year 126,144 from 2nd Year onwards
Description of measurement methods and procedures to be applied:	The net quantity of electricity generated readings will be measured using Main meter and Check meter (accuracy class 0.2). Considered conservative value of the measured reading and computed value by difference of Gross generation and Auxiliary electricity consumption.

	Monitoring frequency: Measured continuously using calibrated meters (Main meter and Check meter) by grid officials, recorded monthly and aggregated annually.
QA/QC procedures to be applied:	The meters will be calibrated as per PPA/OSEB norms or at least once in a year as per National standards. The consistency of metered net quantity of electricity generated should be cross-checked with monthly invoices raised to OSEB
Any comment:	--

Data / Parameter:	**$EC_{PJ,j,y}$**
Data unit:	MWh
Description:	Quantity of electricity consumed by the project in year y (Import from grid system)
Source of data to be used:	Joint meter readings (JMR) of Main meter & Check meter installed at grid interface of OSEB and Monthly bills
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 Projected for ex-ante calculations
Description of measurement methods and procedures to be applied:	The electricity import measured using Main meter and Check meter (accuracy class 0.2). Monitoring frequency: Measured continuously using calibrated meters (Main meter and Check meter) by grid officials, recorded monthly and aggregated annually.
QA/QC procedures to be applied:	The meters will be calibrated as per PPA/OSEB norms or at least once in a year as per National standards.
Any comment:	--

Data / Parameter:	**$NCV_{n,y}$**
Data unit:	kcal/kg
Description:	Net calorific value of biomass residues of category n in year *y*
Source of data to be used:	Periodic fuel calorific value test reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,129 NCV of biomass = 95% of GCV = 3,294 x 95% = 3,129 kcal/kg
Description of measurement methods and procedures to be applied:	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Monitoring frequency: At least every six months, taking at least three samples for each measurement

QA/QC procedures to be applied:	Consistency of the measurements shall be checked by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass
Any comment:	---

Data / Parameter:	**$EF_{BR,n,y}$**
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for uncontrolled burning of the biomass residues category *n* during the year *y*
Source of data to be used:	Conduct measurements or use reference default values
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0000411
Description of measurement methods and procedures to be applied:	To determine the CH_4 emission factor, project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH_4 per ton of biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$
QA/QC procedures to be applied:	---
Any comment:	---

Data / Parameter:	**Moisture content of the biomass residues**
Data unit:	% Water content
Description:	Moisture content of each biomass residues type *k*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	---
Description of measurement methods and procedures to be applied:	Moisture content of biomass would be analysed by using drying pan and weighing scale. Monitoring frequency: The moisture content shall be monitored for each batch of biomass of homogeneous quality. The weighted average shall be calculated for each monitoring period and used in the calculations
QA/QC procedures to be applied:	---
Any comment:	---

Data / Parameter:	N_y
Data unit:	---
Description:	Number of truck trips for the transportation of biomass
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	12,734
Description of measurement methods and procedures to be applied:	Number of trucks would be monitored continuously, recorded daily and aggregated monthly -
QA/QC procedures to be applied:	Consistency of the number of truck trips shall be checked with the quantity of biomass combusted and biomass purchase receipts.
Any comment:	---

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 to be used:	Records by project participants on the origin of the biomass
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100 + 100
Description of measurement methods and procedures to be applied:	Truck trip distances would be monitored continuously and aggregated monthly.
QA/QC procedures to be applied:	Consistency of distance records provided by the truckers by comparing recorded distances shall be checked with other information from other sources (e.g. maps).
Any comment:	The mean value of km traveled by trucks that supply the biomass plant will be used to estimate CO_2 emissions from transportation.

Data / Parameter:	$EF_{km,y}$
Data unit:	tCO_2/km
Description:	Average CO_2 emission factor for the trucks during the year *y*
Source of data to be used:	IPCC 2006 default values & local data if available
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.00060818
Description of measurement methods and procedures to be applied:	Based on the formulae depicted in above section B.6.1 i.e. $EFkm,,y = (NCV_{Diesel\ y} \times EF_{CO2\ diesel} \times Density_{\ diesel})/$ (Avg. Mileage of truck × 10^6) Values of the data used:

	- NCV of diesel = 43.3 TJ/Gg - IPCC 2006 default CO_2 emission factor of diesel = 74.8 tCO_2/TJ - Fuel consumption for diesel vehicles = 4.5 km/liter. - Density of diesel = 0.845 kg/liter Monitoring frequency: At least annually
QA/QC procedures to be applied:	Cross-check measurement results with emission factors referred to in the literature
Any comment:	---

Data / Parameter:	**TL_y**
Data unit:	Tonnes
Description:	Average truck load of the trucks used for transportation of biomass
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10
Description of measurement methods and procedures to be applied:	Determined by averaging the weights of each truck carrying biomass to the project plant. Monitoring frequency: Data monitored continuously and aggregated monthly
QA/QC procedures to be applied:	---
Any comment:	---

Data / Parameter:	**$FC_{coal,y}$**
Data unit:	Tonnes
Description:	Quantity of coal combusted in boiler during the year *y*
Source of data to be used:	On site measurement at weigh bridge of plant & Plant Records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	13,772 for 1st Year 15,739 from 2nd Year onwards
Description of measurement methods and procedures to be applied:	The quantity of coal will be measured continuously using weighbridge, which is installed at the plant. The trucks carrying coal weighted by a calibrated weighbridge twice upon entry and exit to arrive net quantity of fuel procured. Accuracy = ±10 kg Monitoring frequency: Data monitored continuously recorded daily and aggregated monthly
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	---

Data / Parameter:	**$FC_{diesel,y}$**
Data unit:	Litre

Description:	Quantity of diesel used in the DG set during the year *y*
Source of data to be used:	Plant log book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 Projected for ex-ante calculations
Description of measurement methods and procedures to be applied:	The quantity will be measured and monitored through dedicated log book for diesel consumption in DG set. The log book will have details of total quantity of diesel used in DG set. A dip stick is used for the same purpose. No accuracy level needed as no instrument is involved. Monitoring frequency: The recorded data can be cross checked against the diesel purchase receipts.
QA/QC procedures to be applied:	Considered zero for ex- ante calculations, however the measured values would be used for ex- post project emission calculations.
Any comment:	---

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	kcal/kg
Description:	Net calorific value of the fossil fuel type *i* (i.e., coal and diesel) in year *y*
Source of data to be used:	For coal: measurements are carried out at third party lab. For diesel: IPCC default value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,215 NCV of biomass = 95% of GCV = 3,384 x 95% = 3,215 kcal/kg
Description of measurement methods and procedures to be applied:	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Monitoring frequency: In case of measurements: At least every six months, taking at least three samples for each measurement In case of other data sources: Review the appropriateness of the data annually
QA/QC procedures to be applied:	Check consistency of measurements and local/national data with default values by the IPCC. If the values differ significantly from IPCC default values, possibly collect additional information or conduct measurements
Any comment:	--

Data / Parameter:	**$EF_{CH4,BF}$**
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for the combustion of biomass residues in the project plant
Source of data to be used:	On-site measurements or default values, as provided in **Error! Reference source not found.**
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0000411

Description of measurement methods and procedures to be applied:	The CH_4 emission factor may be determined based on a stack gas analysis using calibrated analyzers. Monitoring frequency: At least quarterly, taking at least three samples per measurement
QA/QC procedures to be applied:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
Any comment:	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary. Note that a conservative factor shall be applied, as specified in the baseline methodology

B.7.2 Description of the monitoring plan:

>>

The PP has designed a monitoring plan which defines hierarchy and corresponding responsibilities This monitoring plan is designed for the 20 MW biomass power project implemented by Shalivahana Green Energy Limited (SGEL), in Dhenkanal, Orissa, India. This monitoring plan, which would be registered with the CDM - EB as a part of the Project Design Document, describes the operation and management structure, responsibilities and institutional arrangements, parameters and variables, monitoring practices, QA and QC procedures, data storage and archiving etc. CDM Internal Audit will be conducted by accredited auditors every half yearly once. SGEL formed a CDM team comprising of persons from relevant departments, which will be responsible for monitoring of all the parameter mentioned in the section. In the CDM team, a special group of operators will be responsible of monitoring of different parameters and record keeping. On periodical basis, the monitoring reports will be checked and discussed.

Operational and management structure

The proposed operational and management structure for the project activity for the purpose of monitoring of emission reductions, leakage effects etc., is shown below (May undergo changes if situation demands):

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
Date of completion of the baseline study and monitoring methodology: 26/11/2009

Name of the entity: GIFTech Solutions

Contact information is provided below.

Organization:	GIFTech Solutions
Street/P.O. Box, Building:	, 1st floor, 1-9-202/E/1/C/3, Ramnagar P.O.Box No. 1854, Musheerabad
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500 020
Country:	India
Telephone:	+91 40 27665373
FAX:	+91 40 27665373
E-Mail:	giftech@gmail.com
URL:	www.giftech.in
Represented by:	
Title:	CEO-Energy & Climate change
Salutation:	Mr.
Last Name:	Nalla
Middle Name:	
First Name:	Krishnudu

Mobile	+91-9490190325
Direct Fax	
Direct Telephone	
Personal E-mail	krishnudun@gmail.com

The project proponent has appointed the above-mentioned as the CDM official contact entity and the same is not the project participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

11/07/2008 Letter of Intent (LOI) issued for the supply of Boiler

C.1.2. Expected operational lifetime of the project activity:

>>

20 years [24]

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

Not chosen

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/04/2012 or from the date of registration of project activity with UNFCCC, whichever is later.

C.2.2.2. Length:

>>

10 Years 0 Months

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

[24] http://www.cercind.gov.in/2010/ORDER/February2010/53-2010_Suo-Motu_RE_Tariff_Order_FY2010-11.pdf of page no 4

As required, the project participants have conducted a Rapid Environmental Impact Assessment (EIA) with the objective to review the environmental status of the plant site and its surrounding areas; the impact of the project on the environment; to plan for environmental management plan meeting the requirements of local pollution control board. However, the rapid environmental impact assessment for the project activity revealed no negative impacts on the environment.

Management during project construction

The impacts during construction phase on the environment were of transient nature and reduced gradually on completion of the construction activities.

Site preparation: Dust generated during construction activity was suppressed by sprinkling water

Water and air quality: Since no process effluents were discharged, there was no possibility of ground water contamination. To protect air quality due to some arising from transport vehicles, the vehicles were also maintained properly to minimize smoke in the exhaust.

Noise: Noise impact was within acceptable limits on the surrounding population. High noise generating equipment was used only during night time to eliminate any discomfort to the nearby population.

Ecological aspects: As the land chosen for the project is a barren land, no tree cutting was involved nor were there any aquatic bodies in the plant site. Therefore there was no effect on the terrestrial ecology.

Storage of hazardous materials: Hazardous material like diesel, petrol, welding gas etc stored and handled as per guidelines specified under Hazardous Wastes Storage, Handling and Storage Rules of EPA, 1989.

Migrant laborers: Safe and secure camping areas should be provided for the migrant laborers and adequate arrangement are made for supply of water, sanitation and cooking gas.

Management during operation

Air quality management: Major pollutants envisaged from the biomass power plant are particulates, sulphur dioxide, oxides of nitrogen and fugitive dust. The project proponent pursues the following methods of abatement for the control of air pollution.

- Particulate matter is being controlled by providing highly efficient electrostatic precipitator.
- Sulphur dioxide emissions is being controlled by line bed and widely dispersed for providing adequate stalk height.
- Emissions of NO_x is being controlled through low NO_x burners
- Green belt is being developed
- Water is sprinkled frequently at all dust generating areas

Stack gas monitoring

- The emissions from the stack would be monitored for exit concentration of SO_x, NO_x and particulate matter.

Water and waste water management:

The water requirement are restricted and conserved by recycling treated water to the maximum extent. Continuous effort is being made to reduce the water consumption and thereby to reduce the waste water generation.

Solid waste management

- The main solid waste generated from the biomass power plant is fly ash and bed ash. The fly ash generated is collected in a dry form from ESP and stored in silos. The dry ash is supplied to potential entrepreneurs free of cost for brick manufacturing and cement.

Green belt development

- Green belt development is being undertaken all-round the factory. Plantations contribute towards environmental improvement so as to prevent spreading of particulate and other atmospheric pollutants in near by areas, providing vegetative cover, increasing the aesthetics and ecological aspects of the surrounding.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

Not applicable, since, no negative environmental impacts are anticipated due to the project activity.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

Requirement of Stakeholder Comments

Before implementing any project, project investors / developers need to identify the stakeholders, prepare necessary documents, approach the identified stakeholders directly and obtain required clearances / approvals. The stakeholders after review of documents and investment profile, would accord approvals / licences or send comments in writing to project investors for further clarifications / corrections. In case they are not satisfied with the project design or they feel that the project affects negatively any of the local environment / social / economical environments, they would not issue clearances / approvals to the project.

The project participants have consulted various stakeholders as listed below for their comments. Stakeholders have been approached directly and invited to provide comments on the project. However, the project participants invited the local populace at plant premises at Nimdha village, Dhenkanal District of Orissa State on 4th February 2009 at 11.00 AM and informed about the project, asked for their comments.

25 people had participated in the meeting out of which 1 was the Sarpanch-Head of the Gram-panchayat, and another was the ex-Head of the village and rest of them was farmers. No negative comments were received and all the members welcomed the establishment of the project since it creates market for crop residues as well as new opportunities for employment. The company was represented by Mr. shyam sunder, Asst Mr. Piyush, S N Routh, present at the stakeholders meeting.

Minutes of the stakeholder meeting held at conference at project site, Survey no Nimdha village, Dhenkanal District of Orissa State is provided to DOE for validation.

Identification of the Stakeholders:

The project participants have consulted various stakeholders as listed below for their comments. Stakeholders have been approached directly and invited to provide comments on the project However, the project participants assembled the local populace, informed them about the project and asked for their comments. No negative comments were received and all have welcomed the project.

The stakeholders identified for the project are the local populace, which is represented by the Village Panchayat. Village Panchayat is an elected body of representatives administering the local area, and it is competent to issue No-Objection Certificate and permission to implement the project. The project proponents also conducted discussions with members of the local population. The local population welcomed the project due to various benefits, such as development of infrastructure in the area, increase of income due to the supply of biomass residues and improvement in their standards of living.

Since the project is a biomass power project, which utilizes only surplus biomass residues available in the region, the project would not cause any negative socio-economic impacts on the local populace and would not result in any scarcity of biomass residues to other users. In addition, the project would not cause displacement of any local populace.

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As the project participants have proposed all measures to mitigate environmental impacts and the project is located away from the habitation, there is no negative impact on stakeholders.

Since the project is located near to the electrical substation for power evacuation and the transmission lines are planned along the road, problems of inconvenience to the populace would not arise. Moreover, the project participants have already discussed with various local populaces concerned in the region before applying for clearance.

The following statutory bodies / stakeholders identified by the Government of Orissa state that have examined and studied all of the above aspects and issued necessary clearances / approvals to implement the project:

- The Orissa Pollution Control Board (OPCB) and the Environment Department of Govt. of Orissa State take care from the environmental angle and prescribe standards and monitor adherence to standards.
- The Orissa Renewable Energy Development Agency (OREDA) is the policy implementation body in respect of biomass power projects in Orissa.
- The Ground water department of the Govt. of Orissa state controls the withdrawal of underground water. The Orissa Power Transmission Corporation Limited (OPTCL) has given clearance for evacuation of power from the project to the grid and would purchase the exported power at a predetermined tariff. This is regulated through Power Purchase Agreement. The project participants had extensive discussions with the Orissa Power Transmission Corporation Limited, which has issued a license to set up the power plant. The project participants have already signed Power Purchase Agreement with Tata Power.

E.2. Summary of the comments received:

>>

All stakeholders have issued their approvals and consents for setting up the project and comments have been received. They expressed their gratitude towards M/s. Shalivahana Green Energy Limited for establishing project which can generate employment for skilled and unskilled manpower.

The village Sarpanch Mr. Srikanta D, has expressed that the formers of Nimdha and neighbouring villages can get additional income from the sale of the biomass residues which are presently either

burnt or left decay in their fields. He also expressed that the unemployed youth can get income by collecting of various biomass residues from fields.

Ms. Nimai Sahu, Private teacher, has expressed that their village would develop without polluting environment, generates additional income to villages by collecting and selling of agro wastes and also expressed that their villagers would get direct and indirect employment opportunities.

Similar views are expressed by other stakeholders appreciating the project activity which helps towards the sustainable development in the region.

E.3. Report on how due account was taken of any comments received:

>>

No adverse comments received; hence, no actions are applicable.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Shalivahana Green Energy Limited.
Street/P.O.Box:	S. D. Road
Building:	7th Floor, Minerva Complex
City:	Secunderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500003
Country:	India
Telephone:	+91 (40) 27846420
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E-Mail:	shalivahanaprojects@yahoo.com
URL:	
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Rajababu
Middle Name:	
First Name:	I
Department:	Technical
Mobile:	+91 9393464000
Direct FAX:	--
Direct tel:	--
Personal E-Mail:	irajababu@yahoo.co.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project activity.

Annex 3

BASELINE INFORMATION

From Carbon Dioxide Baseline Data base, Version 05, November 2009 published by Government of India, Ministry of Power Central Electricity Authority (CEA), Government of India.

Appendix A Assumptions for CO_2 Emission Calculations

BASE PARAMETERS AND ASSUMPTIONS

Fuel Emission Factors (EF) (Source: Coal/Lignite - Initial National Communication, Gas/Oil/Diesel/Naphta - IPCC 2006, Corex - own assumption)

	Unit	Coal	Lignite	Gas	Oil	Diesel	Naphta	Corex
EF based on NCV	gCO2 /MJ	96.8	106.2	54.3	75.5	72.6	69.3	0.0
Delta GCV NCV	%	3.6%	3.6%	10%	5%	5%	5%	n/a
EF based on GCV	gCO2 /MJ	92.5	102.5	49.4	71.9	69.1	66.0	0.0
Oxidation Factor	-	0.98	0.98	1.00	1.00	1.00	1.00	n/a
Fuel Emission Factor	gCO2 /MJ	90.6	100.5	49.4	71.9	69.1	66.0	0.0

n/a = not applicable (i.e. no assumptions were needed)

Assumptions at Station Level (only where data was not provided by station)

	Unit	Coal	Lignite	Gas-CC	Gas-OC	Oil	Diesel-Eng	Diesel-OC	Naphta	Hydro	Nuclear
Auxiliary Power Consumption	%	8.0	10.0	3.0	1.0	3.5	3.5	1.0	3.5	0.5	10.5
Gross Heat Rate	kcal /kWh (gross)	2,500	2,713	2,013	3150	2,117	1,975	3,213	2,117	n/a	n/a
Net Heat Rate	kcal /kWh (net)	2,717	3,014	2,075	3,182	2,193	2,047	3,330	2,193	n/a	n/a
Specific Oil Consumption	ml /kWh (gross)	2.0	3.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
GCV	kcal /kg (or m3)	3,755	n/a	8,800	n/a	10,100	10,500	10,500	11,300	n/a	n/a
Density	1/1,000 lt	n/a	n/a	n/a	n/a	0.95	0.83	0.83	0.70	n/a	n/a
Specific CO2 emissions	tCO2 /MWh	1.04	1.28	0.43	0.66	0.66	0.59	0.96	0.61	n/a	n/a

n/a = not applicable (i.e. no assumptions were needed)

Assumptions at Unit Level (by capacity, only for units in the BM, where data was not provided by station)

Coal	Unit	67.5 MW	120 MW	200-250 MW	300 MW	500 MW
Gross Heat Rate	kcal /kWh	2,750	2,500	2,500	2,350	2,425
Auxiliary Power Consumption	%	12.0	9.0	9.0	9.0	7.5
Net Heat Rate	kcal /kWh	3,125	2,747	2,747	2,582	2,622
Specific Oil Consumption	ml /kWh	2.0	2.0	2.0	2.0	2.0
Specific CO2 Emissions	tCO2 /MWh	1.19	1.05	1.05	0.98	1.00

Lignite	Unit	75 MW	125 MW	210/250 MW
Gross Heat Rate	kcal /kWh	2,750	2,560	2,713
Auxiliary Power Consumption	%	12.0	12.0	10.0
Net Heat Rate	kcal /kWh	3,125	2,909	3,014
Specific Oil Consumption	ml /kWh	3.0	3.0	3.0
Specific CO2 Emissions	tCO2 /MWh	1.32	1.23	1.28

Gas	Unit	0-49.9 MW	50-99.9 MW	>100 MW
Gross Heat Rate	kcal /kWh	1,950	1,910	1,970
Auxiliary Power Consumption	%	3.0	3.0	3.0
Net Heat Rate	kcal /kWh	2,010	1,969	2,031
Specific CO2 Emissions	tCO2 /MWh	0.42	0.41	0.42

Diesel	Unit	0.1-1 MW	1-3 MW	3-10 MW	>10 MW
Gross Heat Rate	kcal /kWh	2,350	2,250	2,100	1,975
Auxiliary Power Consumption	%	3.5	3.5	3.5	3.5
Net Heat Rate	kcal /kWh	2,435	2,332	2,176	2,047
Specific CO2 Emissions	tCO2 /MWh	0.70	0.67	0.63	0.59

Naphta	Unit	All sizes
Increment to Gas Heat Rate	%	2%
Gross Heat Rate	kcal /kWh	2,117
Auxiliary Power Consumption	%	3.5
Net Heat Rate	kcal /kWh	2,193
Specific CO2 Emissions	tCO2 /MWh	0.61

Combined Margin	Unit	
Weight OM	%	50%
Weight BM	%	50%

Conversion Factors	Unit	
Energy	kJ /kcal	4.1868
	MJ /kWh	3.6
Oil		
Specific Emission	gCO2 /ml	2.89

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	5.0
DATE	Nov-09

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports) (2)

	2005-06	2006-07	2007-08	2008-09
NEWNE	0.8387	0.8245	0.8127	0.8347
South	0.7341	0.7163	0.7223	0.7597
India	0.8127	0.7972	0.7902	0.8219

Simple Operating Margin (tCO2/MWh) (incl. Imports) (1) (2)

	2005-06	2006-07	2007-08	2008-09
NEWNE	1.0196	1.0085	0.9999	1.0066
South	1.0057	0.9991	0.9906	0.9729
India	1.0167	1.0064	0.9979	1.0094

Build Margin (tCO2/MWh) (not adjusted for imports)

	2005-06	2006-07	2007-08	2008-09
NEWNE	0.6725	0.6313	0.5977	0.6752
South	0.7067	0.7013	0.7133	0.8179
India	0.6808	0.6485	0.6253	0.7088

Combined Margin in tCO2/MWh (incl. Imports) (1) (2)

	2005-06	2006-07	2007-08	2008-09
NEWNE	0.8461	0.8199	0.7988	0.8409
South	0.8562	0.8502	0.8520	0.8954
India	0.8488	0.8275	0.8116	0.8591

(1) Operating margin is based on "ex post" option of "Tool to Calculate the Emission Factor for an Electricity System", Ver.1.1 (p.4)

(2) Import adjustments are based on approach (c) of "Tool to Calculate the Emission Factor for an Electricity System", Ver.1.1 (p.4)

Annex 4

MONITORING PLAN

This monitoring plan is designed for the 20 MW biomass power project implemented by Shalivahana Green Energy Limited in Orissa, India. This monitoring plan, which would be registered with the CDM - EB as a part of the Project Design Document, describes the parameters and variables, monitoring practices, QA and QC procedures, data storage and archiving etc. Project participants implement this monitoring plan right from the start of the implementation of the project.

MONITORING PARAMETERS:

The following parameters / variables would be monitored in accordance with the approved methodology ACM0018 version 01.3.0: "Consolidated methodology for electricity generation from biomass residues in power plants"..

Project Emissions:

- Quantity of biomass residues (tonnes) that has been transported to the project site
- On-site fossil fuel consumptions such as coal combustion (tonnes) in boiler and diesel combustion (Ltrs.) in DG set
- Net calorific value (kcal/kg) of biomass residues of each category
- Net calorific value (kcal/kg) of coal
- CH_4 emission factor (tCH_4/GJ) for uncontrolled burning of the biomass residues of each category
- Percentage of moisture content of each biomass residues
- Number of truck trips for the transportation of biomass
- Average round trip distance (km) between biomass fuel supply sites and the project site
- Average truck load (tonnes) of the trucks used for transportation of biomass
- Average CO_2 emission factor (tCO_2/km) for the trucks
- CH_4 emission factor (tCH_4/GJ) for the combustion of biomass residues in the project plant
- Quantity of electricity consumed by the project electricity consumption source (grid system)

Baseline Emissions:

- Gross quantity of electricity generated in power plant (MWh)
- Total auxiliary electricity consumption (MWh) required for the operation of the power plant
- Net quantity of electricity generated in project plant (MWh)
- Biomass residues categories and quantities tonnes) used in the project activity

Leakage: The following are the parameters required to be monitored under leakage.

- Surplus availability of each type of biomass residues in case any new biomass type fuel used during the crediting period.

Monitoring Equipments:

- Main Meter, for metering the electricity export to grid and import from grid
- Check Meter, for metering the electricity export to grid and import from grid
- In house Gross electricity generation meter
- Weighbridge to measure the quantity of fuels received / ash disposed by the project plant
- Level guage /Dipstick for measuring diesel consumption

Quantity of biomass purchased

The quantity of biomass fuel purchased would be measured, recorded and monitored from starting point in the project i.e. at the entry of the project premises. The fuel truck details shall also be noted as mentioned in the format. The plant shall have a computerized weighing system through which each truck of the fuel would pass through. No truck with biomass fuel would be able to enter into the plant without weighing the fuel. The weighing system would be calibrated and sealed regularly as per the prevailing practices.

Quantity of fossil fuels purchased

The quantity of fossil fuels procured would be measured, recorded and monitored at the entry point of the project premises. The fuel truck details shall be noted as mentioned monitoring tables. The plant shall have a computerized weighing system through which each truck of the fuel would pass through. No truck with fossil fuels would be able to enter into the plant without weighing the fuel. The weighing system would be calibrated and sealed regularly as per the prevailing practices.

Total electricity generated& Total auxiliary electricity consumption.

The total electricity generated by the plant & total auxiliary electricity consumptions would be measured in the plant premises to the best accuracy and would be recorded, monitored on a continuous basis. All instruments would be calibrated at regular intervals.

Net quantity of electricity generated

The project developers shall install Main meter & Check meter at grid connecting point, where exported power is connected to the grid. This would be recorded and monitored on a continuous basis and certified the Monthly energy meter readings by both State Electricity Board and the project proponents.

$EG_{PJ, gross,y}$	Gross quantity of Electricity generated by the project activity during the year y	kWh/MWh
$EC_{PJ, aux,y}$	Total auxiliary consumption required for the operation of the power plant at project site	kWh/MWh
$EG_{PJ,y}$	Net quantity of electricity generated in the project plant during the year *y*	kWh/MWh
$\mathbf{EC_{PJ,j,.y}}$	Quantity of electricity consumed by the project electricity consumption source (grid system)	kWh/MWh

QA AND QC PROCEDURES

The project employed latest state of art microprocessor based high accuracy monitoring and control equipment that measure, record, report, monitor and control various key parameters like generation by the project, auxiliary consumption net quantity of electricity generated in the project plant and On-site electricity consumption attributable to the project activity. The monitoring and controls would be the part of the Distributed Control System (DCS) of the entire plant. Necessary standby meters or check meters would be installed, to operate in standby mode when the main meters are not working. All meters would be calibrated and sealed as per the industry practices at regular intervals/PPA. Hence, high quality is ensured with the above parameters. Sales records would be used and kept for checking consistency of the recorded data.

The baseline emission factor is taken from CEA published data. Hence, quality control of the data is not under the control of project proponent and no QA/QC procedures are applicable.

MANAGEMENT AUTHORITY & DATA MONITORING PROCEDURES

The management authority of the project is 'Board of directors of the company'. The board is the prime authority for any decision makings and final conclusions on decision with respect to the project. The plant operators basically collect the data for the equipment operated by them. The project maintains standard log sheets and formats to record the monitoring parameters. The persons would be given proper training to maintain the plant records. The parameters to be monitored during the crediting period would be provided in a table format to the monitoring personnel. The data monitoring personnel would be given proper training to record and maintain the data in log sheets, which is the basic data for calculations of emission reductions during the crediting period. The primary data collected by plant operators is initially verified by plant manager. The plant manager takes responsibility for the data collection, monitoring and archiving the collected data. His duty is to cross-check the recorded data with references and basic documents. If the plant manager finds any faulty readings and errors in the recorded data, would take necessary corrective actions immediately by taking assistance from plant operators. The recorded and verified data would be submitted to 'Board of Directors' for their review. The board would verify the data and if board finds any discrepancy, would direct the responsible person to rectify the errors to ensure the quality of the monitored data. The responsible person would take necessary corrective actions in the monitored and recorded data and submit the report on the reason for occurrence of errors and the respective corrective action. Board would once again review the data submitted and if satisfies with corrective action taken would approve the data. The final data verified by board would be archived and kept in a safe storage for any future reference for the maximum period.

DATA STORAGE AND ARCHIVING

All of the above parameters monitored under the monitoring plan would be kept for 2 years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

The monitored data would be presented to the verification agency or DOE to whom verification of emission reductions is assigned.

Necessary formats / tables / log sheets etc. would be developed by the project participants for monitoring and recording of the data and would be made part of the registered monitoring protocol.