CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

BIOMASS GASIFICATION BASED POWER GENERATION

BY

BEACH MINERALS COMPANY PRIVATE LIMITED

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Biomass Gasification based Power Generation by Beach Minerals Company Private Limited

Version: 01

Date : 26/11/2007

A.2. Description of the small-scale project activity:

Purpose of the project activity:

Beach Minerals Company Private Limited (BMCPL) established a 1.44 MW biomass gasification power project located in Kuttam, Tirunelveli district, Tamilnadu.BMCPL is the first high capacity biomass gasification and 100 % producer gas based captive power project in India[1]. Prosopis Juliflora is the major fuel for this project activity which is available abundant in this region. The biomass supplied to the two numbers of gasifier with a capacity of 900 kg/hr .The producer gas generated in the gasifier is then supplied to the six numbers of 240 kW producer gas engine. The generated electricity is supplied to BMCPL's in house consumption. BMCPL started its power generation from January 2007 with 100% producer gas engine.

The following are the main purpose of the project activity:

Contribute to the Sustainable Development through the effective utilization of surplus biomass residues available in the project region for Power generation, thereby enhancing additional income through rural employment opportunities in the region. Climate Change mitigation through the generation of eco-friendly power and reduce the dependence on fossil fuel based conventional power.

In addition to the above, following are other purposes of the project:

Enhanced income for the local populace involved in growing, harvesting, handling and selling of biomass.

Contribution of the Project activity to Sustainable Developments:

Social well being

- The fuel for this power plant is locally available biomass residue like Prosopis Juliflora .The economy of the local people is improved by selling biomass residue for the power plant.

- Since the project is located in a village it will assist in alleviation of poverty to certain extent by generating both direct and indirect employment in the area of skilled/unskilled jobs for regular operation and maintenance of the power plant.

Economic well being

- The biomass gasification process is a alternative to fossil fuel based power plants and the decentralised power generation through biomass gasification will reduce the transmission and distribution losses
- The project shall create new rural income resulting from the sales of biomass fuel like Prosopis Juliflora. Increased income levels shall contribute to the economic security and empowerment of the most vulnerable sections of the society.

Environmental Well being

- The project is using biomass for power generation. There is no GHG emission from this project activity. Combustion of biomass in the proposed project does not result in net increase in GHG emissions of CO2, CH4 and NOx.
- There is no fly ash from this biomass gasification process.

Technology Well being

- The possibility of using the gasifier for internal combustion engine makes it a potential competitor for decentralized power generation. The advantage of decentralised power generation is reduction in transmission and distribution losses.
- The biomass gasification is a cleaner technology there is no Green House Gas (GHG) emission.
- The recent development in the gas cooling and cleaning system provides dry producer gas with the tar and particulate level in the range of ppb levels.

In view of the above, the project participant considers that the project activity profoundly contribute to the sustainable development for the local region as well as to the nation.

A.3. Project participants:

Name of 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
India (host)	Beach Minerals Company Private Limited(BMCPL) BMC House, 32-2 Halls Road, Egmore,Chennai-600 008, Tamil Nadu ,India	No

A.4. Technical description of the small-scale project activity:

The combustion, Gasification & propulsion laboratory at Indian Institute of Science (IISc), Bangalore is the technology provider for this project activity. The specifications of the gasifiers is drawn up by IISc and manufactured to drawings provided by them. The gasification technology designed and developed by the IISc, Bangalore is the state-of-the-art Technology.

Gasification Technology:

Gasification is a process that converts carbonaceous materials into combustible gases. The resulting gas is called producer gas. Gasification relies on chemical processes at elevated temperatures >700^{O}C. The substance of a solid fuel is usually composed of the elements carbon, hydrogen and oxygen. In the gasifiers the biomass is heated by combustion.

Four different processes can be distinguished in gasification:

- Drying
- Pyrolysis
- Oxidation
- Reduction

Drying:

The first stage of gasification is drying. Usually air-dried biomass contains moisture in the range of 13-15 % .The moisture content of biomass in the upper most layers is removed by evaporation using the radiation heat from oxidation zone .The temperature in this zone remains less than 120 °C.

Pyrolysis:

The process by which biomass looses all its volatiles in the presence of air and gets converted to char is called pyrolysis. At temperature above 200°C, biomass starts loosing its volatiles. Liberation of volatiles continues as the biomass travels almost until it reaches the oxidation zone. Once the temperature of the biomass reaches 400°C, a self-sustained exothermic reaction takes place in which the natural structure of the wood breaks down. The products of pyrolysis process are char, water vapour, Methanol, Acetic acid and considerable quantity of heavy hydrocarbon tars.

Oxidation:

The moisture vaporised in the drying zone and the volatiles released in the pyrolysis zone travels down towards oxidation zone. In this zone a calculated quantity of air drawn through the nozzles provided for the purpose. The pyrolysis gases, char and the water vapour all have to pass through this zone and combustion similar to normal stove /furnace takes place. A portion of the pyrolysis gases and char bums here and the temperature rises to about 900 – 1200°C. The main product of oxidation process is CO_2.

Reduction:

The product of oxidation zone then passes through the reduction zone. Reduction zone is packed with a bed of charcoal. This charcoal is initially supplied from external sources. Later it is in the continuous process of being consumed by the reduction reaction and being simultaneously replenished by the char produced in the pyrolysis zone .The temperature in this zone is maintained at 900 – 600° C.

The biomass gasification power plant consists of the following:

(A) Gasification System.

(B) Power System

(C) Auxiliaries

(A) Gasification system.

i) Biomass gasifier:

The biomass gasifier is an open top down draft twin air entry type with technology drawn up from IISc. It consists of two reactor of each 900 kg/hr capacity. Each reactor consists of a steel casing internally lined with 2 layers of hot and cold face insulating bricks & inner layer of high temperature resistant Alumina tiles/ Bauxite bricks /High temperature resistance castable refractory. Air nozzles

with water seal and view glass arrangement, shall be fitted in the reactor at designated locations shall be of SS 316 or other suitable material.The producer gas generated from the gasifier is passed through the hot cyclone where the particulate are stripped off from the gas due to centrifugal separation. The gas beyond this goes to cooling and scrubbing systems

ii) Gas Cooling and Cleaning System:

The gas cooling and cleaning consists of

- Multi Cyclone – Twin-cyclone separator for the retention and recovery of energy from for drying application
- Direct cooler – Consist of spray nozzles for ensuring proper water envelope over the incoming gas and water sealing dump to prevent gas escape.
- Chilled water scrubber – Consist of special nozzles for efficient removal of suspended particles
- Mist eliminators – Cyclone type separator for removal of entrained water after gas scrubbing
- Fabric Filter – for the retention and recovery of energy from for drying application
- Absorption chiller – Consist of Li-Br based Vapour Absorption Heat Pump to provide chilled water at 6°C for chilled water scrubber.

(B) Power System

The power system consists of the following:

i) Gas Engines – the project activity consist of seven number of gas engine. Out of the seven gas engine, six engines are connected with biomass gasifier for power generation and remaining one gas engine is available for standby. All the gas engines are modified spark ignited natural gas engines model GTA-1710-G, supplied by M/s.Cummins India Limited slated to deliver power in producer gas mode.

ii) Alternator – The gas engines are fitted with matching Stamford alternators.

iii) Control System- Complete set of controls to measure and monitor all engine parameters for producer gas operation.

(C) Auxiliaries

The Auxiliaries provided for this power plant are Biomass preparation and conveying system, Water Treatment system, Instrumentation & control and safety system.

A.4.1. Location of the small-scale project activity:

A.4.1.1.	Host Party(ies):

India

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

Tamil Nadu

A.4.1.3.	City/Town/Community etc:

Village : Kuttam

Taluka : Radhapuram

District : Tirunelveli

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project is located at Kuttam Village, Radhapuram Taluka of Tirunelveli District, Tamilnadu. The nearest Railway Station is in Tirunelveli about 60 kms from site .The nearest air port and Sea Port is at Tuticorin about 75 kms from site.

A.4.2. Type and category (ies) and technology/measure of the small-scale project activity:

This project falls under the UNFCCC small-scale CDM project activity categories under **Type-I** with project activity being renewable electricity generation for a system.

Type : I - Renewable Energy project

Category : I. D Grid Connected Renewable Electricity Generation.

Version : 12

Date : 10th August 2007

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

S.No	Crediting Period	Annual estimation of emission reduction in tons of CO_2 e
1	2008	7,088
2	2009	7,747
3	2010	7,747
4	2011	7,747
5	2012	7,747
6	2013	7,747
7	2014	7,747
Total estimated reductions (tonnes of CO_2)		53,570
Total number of crediting years		7
Annual average over the crediting period of estimated reductions (tons of CO_2/year)		7,652

A.4.4. Public funding of the small-scale project activity:

There is no public funding involved in this project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

The proposed project activity is a small-scale project activity and it is not a debundled component of a larger scale 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 small-scale project activity:

The methodology applied for this project activity is

Type : I - Renewable Energy project

Category : I. D Grid Connected Renewable Electricity Generation.

Version : 12

Date : 10th August 2007

B.2 Justification of the choice of the project category:

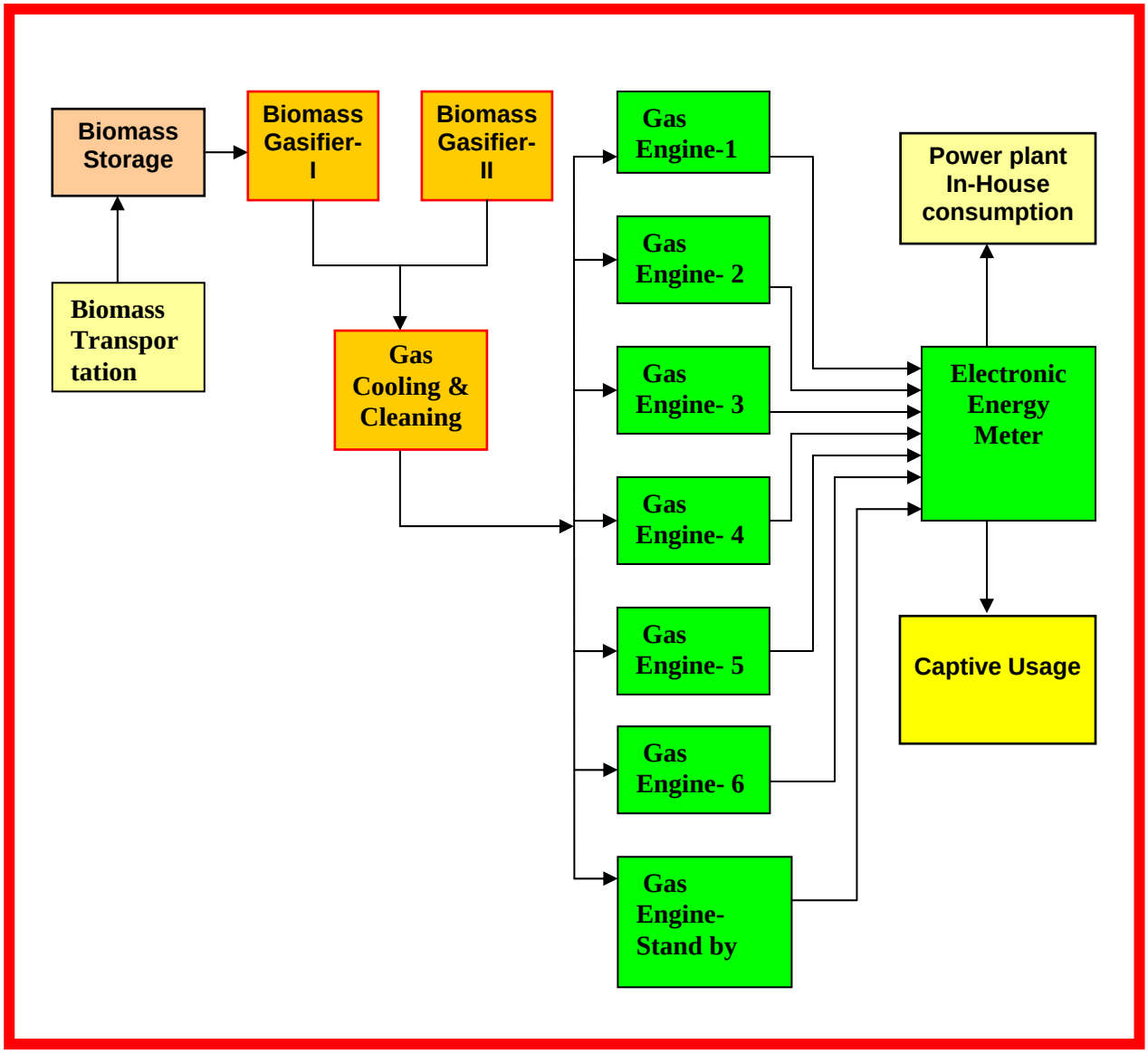
The Justification of the choice of the project category is explained below:

As per the Methodology	As per the Project Activity
This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	This is a biomass based power project which generates electricity to displace electricity from the southern regional grid.
If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel1, the capacity of the entire unit shall not exceed the limit of 15MW.	The total capacity of the project activity is 1.44 MW it is less than 15 MW.There is no fossil fuel co-fired with this project activity.
Combined heat and power (co-generation) systems are not eligible under this category.	This is a biomass power generation project
In the case of project activities that involve the	This is a new biomass power generation project and

addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	there is no existing renewable power generation project.
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	This is a new biomass power generation project.

B.3. Description of the project boundary:

The flow chart of the project and its boundaries is shown in the figure below. The project boundary encompasses the physical, geographical site of the gasification plant including auxiliary electricity use of the plant. Auxiliary consumption refers to the small portion of the generated electricity that is consumed for own use.



Project Boundary

B.4. Description of baseline and its development:

As per the point no. 9 of baseline methodology Type I. D. of Annex B of the simplified modalities and procedures for small scale CDM project activities, states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2equ/kWh) calculated as under:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002.

(OR)

b) The weighted average emissions (in kgCO_2equ/kWh) of current generation mix.The data of the year in which project generation occurs must be used. Calculations must be based on data from an official source (where available) and made publicly available.

The project activity is located in the state of TamilNadu and the electricity generated by this project displaces the electricity from southern regional grid. Due to the displacement of electricity the project activity would have impact on the southern grid, serving the four southern states and one union territory namely Pondicherry. Hence the project also has an impact on all the generation facilities in the southern grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. For the baseline calculation a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) is used. The southern grid is also connected with other regional grids, however, the net exchange of energy within the regional grids is very small and negligible and hence other regional grids are not included in the boundary for estimation of baseline emissions.

Baseline emission factor calculation:

As described in ACM0002, the emission factor EF_y of the southern grid is represented as a combination of the Operating Margin and the Build Margin. The emission factor of the associated method is given by:

$$EF_y = w_{OM} * EF\_OM_y + w_{BM} * EF\_BM_y$$

Where

EF_OM_y - emission factor of Operating Margin

EF_BM_y - emission factor of Build Margin

w_{OM} - weight factors of Operating Margin

w_{BM} - weight factors of Build Margin

with respective weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$), and by default, are weighted equally ($w_{OM} = w_{BM} = 0.5$).

Operating Margin emission factor(s) (EF_{OM})

In the southern regional the power generation is dominated by fossil fuel based power plants and the power generation by low cost/must run resources constitute less than 50% of total grid generation, so simple operating margin method is used for operating margin emission factor calculation. The Operating Margin emission factor *EF_OMy* is defined as the generation-weighted average emissions per electricity unit (tCO2 / MWh) of all generating sources serving the system, excluding zero- or low-operating cost power plants (hydro, geothermal, wind, low-cost biomass, nuclear and solar generation), based on the latest three year statistics data (year of 2003-04,2004-05,2005-06) and are derived from the following equation:

$$EF\_OMy = \frac{TEM_y}{TGEN_y} = \frac{\sum_i F_{i,y} * CO EF_i}{\sum_j GEN_{j,y}}$$

Where:

TEMy - Total GHG emissions

TGENy – Total electricity generation supplied to the grid excluding zero- or low-operating cost sources.

Fi,y & *COEFi* - *F*uel consumption and associated carbon coefficient of the fossil fuel *i* consumed in the grid.

GENj,y - *E*lectricity generation at the plant *j* connected to the grid excluding zero- or low-operating cost sources.

Year	2003-04	2004-05	2005-06	Average
Operating Margin Emission Factor (tCO_2 / MWh)	1.00	1.00	1.01	1.00

Source: Central Electricity Authority: CO2 Baseline Database.

Vesion: 2, Dated 21/06/2007

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Build Margin emission factor (EF_{BM})

The Build Margin emission factor *EF_BMy* is given as the generation-weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most 20% of the generating units built (summation is over such plants specified by *k*).The most 20% of the generating units built recently is used for build margin emission factor calculation.

$$EF\_BM_y = \frac{\sum_i F_{i,y} * COEF_i}{\sum_k GEN_{k,y}}$$

The summation over *i* and *k* is for the fuels and electricity generation of the plants mentioned above. The selection of plants group should be corresponding with methodology ACM0002 .Hence, the set that comprises the larger annual generation is selected.

The Build Margin emission factor will be

EF_{BM} **=0.71** tCO_2/MWh

Source: Central Electricity Authority: CO2 Baseline Database.

Version: 2, Dated 21/06/2007

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Calculate the baseline emission factor (EF)

The baseline emission factor *EF* is calculated as combination of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}):

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$$EF = w_{OM} * EF_{OM} + w_{BM} * EF_{BM}$$

Where

The weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$), and by default, are weighted equally ($w_{OM} = w_{BM} = 0.5$).

EF_{OM} - 1.00 tCO_2/MWh

w_{OM} - 0.5

EF_{BM} - 0.71 tCO2/MWh

w_{BM} - 0.5

EF = 0.5*1.00 + 0.5*0.71

Baseline emission factor will be (EF) = **0.86** tCO2/MWh

Year	**2003-04**	**2004-05**	**2005-06**	**Average**
Operating Margin Emission Factor (tCO_2 / MWh)	1.00	1.00	1.01	1.00
Build Margin (tCO_2 / MWh)			0.71	0.71
Combined Margin (tCO_2 / MWh)	0.86	0.85	0.86	0.86

Source: Central Electricity Authority: CO2 Baseline Database.

Version: 2, Dated 21/06/2007

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

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 small-scale CDM project activity:

Among the barriers suggested in the Attachment A to Appendix B of the simplified modalities and procedures for Small Scale CDM project activities, the following barriers have been identified for demonstrating the additionally of this grid connected biomass power project.

a . Technological barrier

b. Barrier due to prevailing practice

c. Other Barriers

a Technological barrier

As per the attachment A to appendix B the less technologically advanced alternative to this project activity is fossil fuel based power generation. The barrier faced by the new biomass based gasification technology is explained below

- The technology used in this project activity is down draft gasification. The biomass used for the project activity is Prosopis Juliflora and coconut shell. The major barrier for this technology is tar formation due to the pyrolysis of biomass. The increase in moisture content of the biomass would increase the tar formation. If the moisture is less than 15 % the tar content will be in the range of 50-250 mg/Nm^3 and the increase in moisture level will increase the tar content to 700 mg/Nm^3.Compared to up draft gasification the tar formation level is very low in down draft gasifier, even though it requires fine cooling and cleaning system to reduce the quantity of tar, particulate matter and moisture in the gas before supplied to the engine[1]. The cooling and cleaning of producer gas is the major barrier for this technology.

  [1] Source: http://www.ias.ac.in/currsci/oct102004/908.pdf

- There is always a constriction at the level of the oxidation zone to force the pyrolysis products through a concentrated high temperature zone to achieve complete decomposition. This concentrated oxidation zone can cause sintering or slagging of ash resulting in clinker formation and consequent blocking of the constricted area and /or channel formation. Continuous rotating ash grates or other mechanical shaking may be required to avoid this problem.

- Handling of producer gas in large quantities is very dangerous owing to the large inflammability limit of carbon monoxide ranging from 5% to 74%. Gas tight solid handling, continuous feeding is very difficult in gasification system and needs more operator attention.

b Barrier due to prevailing practice :

BMCPL are generating electricity for their captive usage by using biomass gasification technology. The gasification plant consists of two gasifiers of capacity 900 kg/hr and 6 gas engines of each 240 kW (1440 kW) capacity, located in Kuttam village, Radhapuram taluka, Tiruelveli district of Tamilnadu. The biomass gasification systems installed in BMCPL is a new technology that displaces fossil fuel based electricity generation in TNEB grid. The biomass gasification technology is not in prevailing practice. An advantage of displacing grid power by biomass will result in major reductions of GHG emissions. The gasifier technology has good potential to displace fossil fuel based power in grid, but small and medium scale industries hesitate to invest in new technologies such as gasification due to the risks involved in installation, operation and maintenance of the gasifier system[2]. According to the Policy Note 2005-2006 of Tamilnadu Energy Development agency, gasifiers (thermal) of total capacity of 3400 Kwe and gasifiers (electrical) of total capacity of 1686 Kwe were installed as on 31.12.2004. Further thermal (450 Kwe) systems and electrical (2357 Kwe) systems sanctioned by MNES are under implementation[3]. Arashi Hi-Tech Bio power (1.25MW)[4] is the first project running with 100 % producer gas. This is already applied for CDM benefits. The biomass gasification based power plant installed by BMCPL is second project running with 100 % producer gas project in Tamilnadu. The company is required to train the people to operate the biomass gasifier.The above statement clearly states that implementation biomass based gasifier is not a common practice in Tamil nadu.

[2] www.teriin.org/opet/reports/smecau.pdf

[3] www.tn.gov.in/policynotes/archives/policy2005-06/**energy**.htm

[4] Biomass Gasification based Power Generation by Arashi Hi-Tech Bio-Power Private Limited
http://cdm.unfccc.int/Projects/Validation/DB/HG44C70CA9UZSYG4VJQ08I7USR48C1/view.html

c) Other Barriers

- Escalation in the price of biomass has always been historically high due to the perception of the farmers on its demand. Erratic increase in the price of biomass is obvious, even in case of pre-signed contracts biomass suppliers for a fixed price over a period of time. The project has already witnessed hike in the price of biomass by over 30 % since its inception. One of the other reasons

for an increase in the biomass price is also attributed to the expected increase in price of biomass transportation cost due to increase in diesel price.

- The man power and area required per MW level biomass gasification power project is relatively high compared to other thermal power projects.
- The producer gas generated in the gasifier having high inflammability range, if there is any leakage in the gasifier will lead to the higher operational risk.

Conclusions

Thus the barrier analysis as carried out above clearly indicates that in the absence of the CDM project activity the baseline scenario would have been implementation of GHG emissions intensive thermal power plants and hence the proposed grid connected biomass power plant is additional to the baseline scenario. Further the CDM revenues are critical since such revenues will be used to mitigate various risks as mentioned above.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Since the electricity generated by this project displaces the electricity from southern regional grid, the emission reduction quantity depends on the units displaced by the project (in kWh) and the baseline emission of the southern grid. The methodology covers the monitoring of units displaced from the grid, auxiliary consumption and CO_2 emissions. The project fires biomass and hence the methodology includes monitoring the quantum of biomass. The net emission reductions will result from the units of power displaced from the southern grid.

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

Data / Parameter:	EF_{OM}
Data unit:	tCO_2eq/MWh
Description:	Operating Margin emission factor of the Southern grid
Source of data used:	Central Electricity Authority (CEA) CO_2 Baseline Database values have been

	used for calculation. *Source:* http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	1.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by Central Electricity Authority (CEA)
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	tCO_2eq/MWh
Description:	Build Margin emission factor of the Southern grid
Source of data used:	Central Electricity Authority (CEA) CO_2 Baseline Database values have been used for calculation. *Source:* http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	0.71
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by Central Electricity Authority (CEA)
Any comment:	

Data / Parameter:	$EF_{electricity}$
Data unit:	tCO_2eq/MWh
Description:	Combined Margin emission factor of the Southern grid
Source of data used:	Central Electricity Authority (CEA) CO_2 Baseline Database values have been used for calculation. *Source:* http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	0.86

Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by Central Electricity Authority (CEA)
Any comment:	

Data / Parameter:	$EF_{km/CO2}$
Data unit:	T CO_2 /km
Description:	Average CO_2 emission factor for transportation of biomass with trucks ($EF_{km/CO2}$)
Source of data to be used:	IPCC default values are used.
Value of data	0.0004246
Description of measurement methods and procedures to be applied:	Default values from the 2006 IPCC be used for this calculation
QA/QC procedures to be applied:	-
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

The formula for emission reduction is

Formula used to calculate the net emission reduction for the project activity is

ER = $BE_{electricity}$ – PE - L …… (i)

Where,

ER - Net Emission Reduction in tCO2/year

$BE_{electricity}$ - Baseline Emission due to displacement of electricity in tCO2/year

PE - Project emissions in tCO2/year

L - Emissions due to leakage in tCO2/year

Project emissions (*PE*)*Calculation:*

There is no fossil fuel co fired in this project activity. Hence there is no project emission within the project boundary.

PE = 0 …… (ii)

Emissions due to leakage (L):

The leakage activity identified, which contributes GHG emissions outside the project boundary is CO_2 emission due to biomass transportation

CO_2 emission due to biomass transportation:

The main feedstock is Prosopis Juliflora sourced from local people directly and through agents.

▪ Total biomass consumed by the project	**:**	15137 MT per year	
▪ Truck capacity	**:**	10	MT
▪ Total Return trip distance travelled between project site and biomass collection centres	**:**	100	km
▪ Number of return trips	**:**	1513	per year
▪ Total Distance travelled between project site and biomass collection centres	**:**	**151370**	km/year
▪ CO2 Emission factor for Diesel	**:**	0.0004246	t CO2/km
▪ CO_2 emission per annum	**:**	**64.27** t CO2/ year	

Total estimated leakage due to project (L) = 64 tons of CO_2/year …… (iii)

Baseline Emission due to displacement of electricity ($BE_{electricity,}$):

Baseline Emission is calculated by multiplying the net quantity of power export to grid by this project activity (P_{net}) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{electricity,}$) as follows:

$$\mathbf{BE_{electricity} = P_{net} * EF_{electricity}} \quad \textbf{……(iv)}$$

Where: $\mathbf{EF_{electricity}}$ = Baseline emission factor

= 0.86 tCO_2/MWh

P_{net} = Gross Power generation (P_{Gross}) – Auxiliary Power consumption(P_{Aux})

= 10091 - 1009

P_{net} = 9082 MWh/Year

P_{net} and EF in formula (iv)

$\mathbf{BE_{electricity}}$ = 9082*0.86

= 7811 tCO_2/year

BE, PE and L in formula (i)

ER = BE $_{electricity,}$ – PE - L

= 7811 – 0 – 64

Net Emission Reduction (ER) =7747 tCO_2/year

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

S.No	Year	Net electricity MWh/year	Base line Emission tCO_2/year	Project emission tCO_2 /year	Emission reduction tCO_2/year
1	2008	8311	7147	59	7088
2	2009	9082	7811	64	7747
3	2010	9082	7811	64	7747
4	2011	9082	7811	64	7747
5	2012	9082	7811	64	7747
6	2013	9082	7811	64	7747
7	2014	9082	7811	64	7747
Total		**62803**	**54013**	**443**	**53570**

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	P_{Gross}
Data unit:	MWh/Year
Description:	Gross Electricity generated
Source of data to be used:	Monthly Report
Value of data	10,091
Description of measurement methods and procedures to be	Measured by the Energy meter. Shift engineer will measure the data in every shift. Every shift data log sheet is submitted to the plant manager and these log sheets

applied:	are cross verified. The plant manager maintains all the records in the paper mode. The Plant manager submits a monthly report to the management, which will be documented and stored in the project office.
QA/QC procedures to be applied:	Energy meter is regularly calibrated.
Any comment:	-

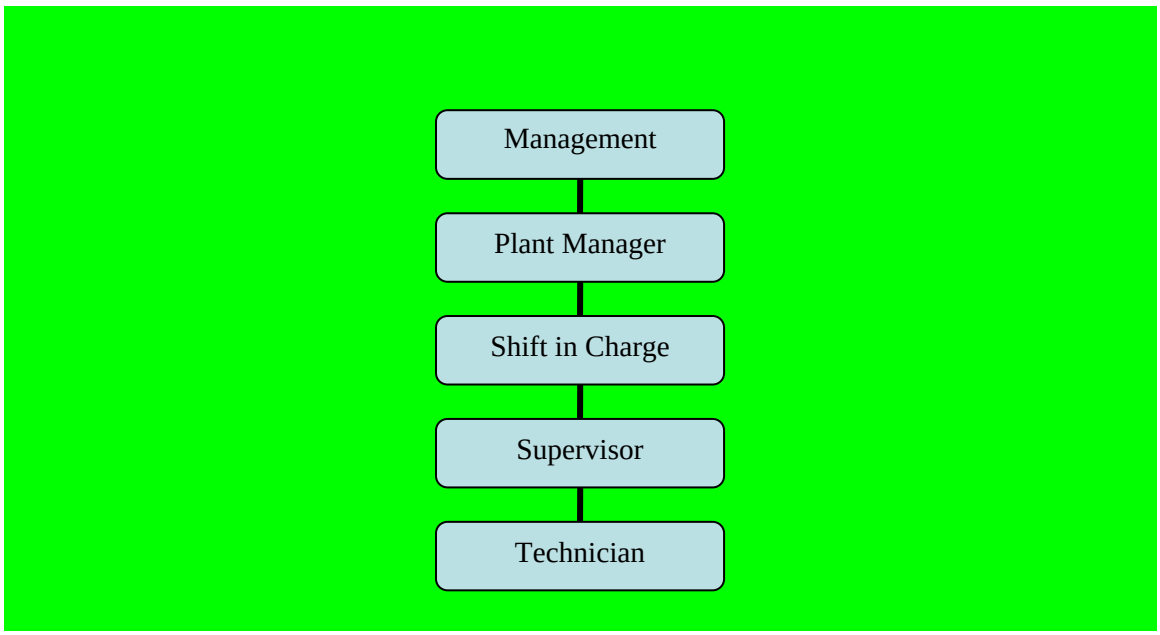
Data / Parameter:	P_{Aux}
Data unit:	MWh/Year
Description:	Auxiliary power consumed by the project activity.
Source of data to be used:	Monthly Report
Value of data	1,009
Description of measurement methods and procedures to be applied:	Measured by the energy meter. Shift engineer measure the data in every shift. Every shift data log sheet is submitted to the plant manager and these log sheets are cross verified. The plant manager maintains all the records in the paper mode. The Plant manager submits a monthly report to the management, which will be documented and stored in the project office.
QA/QC procedures to be applied:	Energy meter is regularly calibrated.
Any comment:	-

Data / Parameter:	P_{NET}
Data unit:	MWh/Year
Description:	Net electricity generated
Source of data to be used:	Monthly Reports
Value of data	9,082
Description of measurement methods and procedures to be applied:	Calculated from gross power generated and auxiliary power consumed by the project activity.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	Biomass Consumption
Data unit:	*MT/year*
Description:	Quantity of biomass type *i* combusted in the project activity during the year *y*
Source of data to be used:	Biomass Log Sheet
Value of data	15,137
Description of measurement methods	Biomass is measured by weigh machine. Shift engineer measure the data in every shift. Every shift data log sheet is submitted to the plant manager and these log

and procedures to be applied:	sheets are cross verified. The plant manager maintains all the records in the paper mode. The Plant manager submits a monthly report to the management, which will be documented and stored in the project office.
QA/QC procedures to be applied:	The data is cross checked with weigh bridge receipt.
Any comment:	

B.7.2 Description of the monitoring plan:



All the measurements taken by the Shift Enginner and supervisor are recorded in the log sheets and these log sheets are verified by the shift in charge. Every shift data log sheet is submitted to the plant manager and these log sheets are cross verified. The plant manager maintains all the records in the paper mode. The Plant manager submits a monthly report to the management, which will be documented and stored in the project office. By this operational structure, the management can monitor the project activity and make amendments immediately, if needed. Hence there is no chance for data loss.

To address all O&M issues, though the overall authority and responsibility belongs the management, it has formed a team of Technician and Supervisors headed by a General Manager to effectively control and monitor the complete process of fuel procurement, quality issues, and the handling and storage of material in the plant area.

S.No	**Monitoring Equipment**	**Functions**	**Calibration of the Equipments**
1	Energy meter	Measurement of electricity generated.	The energy meter is calibrated as per the supplier schedule.

2	Weigh Machine	Measurement of biomass quantity	Calibration is done at regular intervals as per the supplier schedule.

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

Date of Completion of the base line study: 05/09/2007

Mr. M.N.Venkatasubramanian,

Project Head-Titanium

BMC GROUP

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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:

19.01.2006

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

The operational life of the project is 25 years

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:

From the starting date of registration

C.2.1.2. Length of the first crediting period:

7 Years

C.2.2. Fixed crediting period:

N/A

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

According to Indian regulation, the implementation of small scale biomass plants does not require an Environmental Impact Assessment (EIA). The Ministry of Environment and Forests (MOEF), Government of India notification dated June 13, 2002 regarding the requirement of EIA studies as per the Environment Protection Rule, 1986 (MOEF, 2002) states that any project developer in India needs to file an application to the Ministry of Environment and Forests (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Thermal Power Plants with an investment of less than Rs. 1 billion (US$ 21.7 million) are excluded from this list. This project is one of the most environment friendly of its kind. It envisage a virtuous circle of generating electricity from by products of agro- industrial processing and the investment of this proposed biomass project (being a Thermal Power Plant) is less than Rs. 1 billion (US$ 21.7 million), an EIA is not required (neither is a public hearing).

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:

This project activity is a small scale project activity. There is no significant an environmental impact due to this project activity hence environmental impacts assessment is not required for this project activity.

SECTION E. Stakeholders' comments

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

Beach Minerals Company Pvt.Ltd. (BMCPL) has conducted a stakeholder meeting on 14th September 2007.The local population and regulatory authorities participated in that meeting. The local population welcome the project due to various benefits, such as development of infrastructure in the area, increase of income due to the supply of biomass and improvement in their standards for living.

In the meeting BMCPL had explained about the Biomass Gasification technology in detail and employment opportunities. The Social benefits due to the implementation of power plant and the arrangements made in the project to protect environment had been discussed.

The BMCPL explained the various benefit from the plant like this biomass gasification process is a suitable alternative to fossil fuel based power plants and the decentralised power generation through biomass gasification will reduce the transmission and distribution losses and CO_2 emission from the fossil fuel based grid power. This project activity creates a new rural income resulting from the sales of biomass fuels such as Prosopis Juliflora etc.

The doubts of local people had been cleared by BMCPL and the people expressed their consent. They told this unit would lead to social and economical development. In that meeting project promoter distributed the questionnaire to all participants and there is no negative comment received from the stakeholders.

The project proponent has already established good relationship with local people who ensure co-operation for the successful and continuous operation of the power plant.

E.2. Summary of the comments received:

BMCPL has already received the major necessary approvals and consents from various authorities, required for project implementation. BMCPL also received a positive response from the local people.

The following Statutory bodies have examined and studied about all the aspects of the project and have issued necessary clearances to establish the project:

The local village administrator has issued No Objection Certificate (NOC) for supplying surface water by M/s Gangatharan Water Suppliers to BMCPL - NOC-dated -10.10.2006
The Assistant Director for Rural Development has issued no objection certificate for land utilization – NOC No.1977/2006 dated 26.10.2006

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

Local people are very much interested in this project due to employment generation by this project activity and there is no negative comment received from the stakeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Beach Minerals Company Private Limited.
Street/P.O.Box:	32-2 Halls Road, Egmore
Building:	BMC House,
City:	Chennai
State/Region:	Tamil Nadu
Postfix/ZIP:	600 008
Country:	India.
Telephone:	(91) 44 42147537
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E-Mail:	
URL:	www.bmcindia.net
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	Mr. M.N.Venkatasubramanian,
First Name:	
Department:	Project Head-Titanium
Mobile:	(91) 9444383316
Direct FAX:	(91) 4442146000
Direct tel:	(91) 44 42147537
Personal E-Mail:	venkatasuban@bmcindia.net

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in this project activity.

Annex 3
BASELINE INFORMATION

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**2.0**
DATE	**21 June 2007**
BASELINE METHODOLOGY	**ACM0002 / Ver 06**
EMISSION FACTORS	

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.72	0.73	0.74	0.71	0.71	0.71
East	1.09	1.06	1.11	1.10	1.08	1.08
South	0.73	0.75	0.82	0.84	0.78	0.74
West	0.90	0.92	0.90	0.90	0.92	0.87
North-East	0.42	0.41	0.40	0.43	0.32	0.33
India	0.82	0.83	0.85	0.85	0.84	0.82

Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.97	0.99
East	1.22	1.22	1.20	1.23	1.20	1.16
South	1.02	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.71	0.70
India	1.02	1.02	1.02	1.03	1.03	1.02

Build Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.53	0.60
East					0.90	0.97
South					0.71	0.71
West					0.77	0.63
North-East					0.15	0.15
India					0.70	0.68

Combined Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.06	1.05	1.07	1.05	1.06
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.43	0.42
India	0.86	0.86	0.86	0.86	0.86	0.85

Source: **http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm**

Annex 4

MONITORING INFORMATION

Monitoring plan already discussed in section B.7.

Appendix A
Abbreviations

BMCPL	Beach Minerals Company Private Limited
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CO_2	Carbon Di oxide
DPR	Detailed Project Report
GHG	Greenhouse Gas
IPCC	Intra governmental Panel for Climate Change
kCal	Kilo Calories
UNFCCC	United Nations Framework Convention on Climate Change
kg	Kilogram
Km	Kilometre
KP	Kyoto Protocol
kW	Kilowatt
kWh	Kilowatt hour
MNES	Ministry of Non-Conventional Energy Sources
MT	Metric Tons
MU	Million Units
MW	Megawatt
NGO	Non Government Organizations
PDD	Project Design Document
PLF	Plant Load Factor
OM	Operating Margin
BM	Build Margin
CM	Combined Margin
EF	Emission Factor
MOEF	Ministry of Environmental and Forest
PPA	Power Purchase Agreement
QA	Quality Assurance
QC	Quality Control
TEDA	TamilNadu Energy Development Agency
TNEB	TamilNadu Electricity Board
IISc.	Indian Institute of science

Appendix B
References

1	Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)
2	Website of United Nations Framework Convention on Climate Change, **http://unfccc.int**
3	UNFCCC decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol
4	UNFCCC, Clean Development Mechanism, Project Design Document (CDM-PDD) AMS1D
5	UNFCCC document: Annex B to attachment 3, Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories
6	Detailed project report of 1.44MW Biomass based gasification project – Beach Minerals Company Private Limited
7	Central Electricity Authority (CEA) CO2 Baseline Database . **http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm**
8	Website of Central Electric Authority (CEA), Ministry of Power, Govt. of India- **www.cea.nic.in**
9	Website of Ministry Non-Conventional Energy Sources (MNES), Government of India, **www.mnes.nic.in**
10	Website of TamilNadu Electricity Board **www.tneb.org**