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

CONTENTS

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 Arashi Hi-Tech Bio-Power Private Limited

Version: 02

Date : 23/05/2007

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

Purpose of the project activity:

Arashi Hi-Tech Bio-Power Private Limited (AHBPPL) established a 1.25 MW biomass gasification power project located in coimbatore district, Tamilnadu.AHBPPL is the first grid connected biomass gasification power project in India[1]. Coconut residues are the major fuel for this project activity which is available abundant in this region. The biomass supplied to the two 500 kW gasifier is converted into producer gas ,then the generated producer gas is supplied to the five numbers of 250 kW producer gas engine. The generated electricity is exported to Tamilnadu Electricity Board (TNEB) grid and consumed by its sister company by wheeling. AHBPPL started its power generation from January 2005 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. Improve the availability of power in the region leading to enhanced and appreciable development in agricultural and industrial activities.

[1] The Ministry of Non-Conventional Energy Sources has issued a letter stating that the establishment biomass gasification based electricity generation project by AHBPPL is the first of its kind in India. D.O.No.Adv/BE/1/2006. dated 01/02/2006.

Contribution of the Project activity to Sustainable Developments:

Social well being

- The fuel for this power plant is locally available biomass residue like coconut shell .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 coconut shells. 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 or solid waste 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 and the prospect of rural electrification- a major concern for India.
- 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.

- The combined heat and power generation via biomass gasification techniques connected to gas-fired engines or gas turbines can achieve significantly higher electrical efficiencies between 22 % and 37 % compared to biomass combustion technologies with steam generation and steam turbine (15 % to 18 %).

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)	ACCLAIM TECHNOLOGY SERVICES (ATS) 6/1 Sriraman Enclave, Third Main Road, Raja Annamalai Puram, Chennai 600 028.	No

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

The combustion, Gasification & propulsion laboratory at 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 products 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 Plant.

(B) Power Package

(C) Auxiliaries

(A) Gasification Plant.

The system consists of two gasification reactor of each 500 kW capacity. 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, where tar and particulate matter are removed. For further removal of tar the gas will be passed through the chilled water scrubber and bag filters.

(B) Power Package

The power package system consists of Gas Engine with Alternator and grid synchronizing unit.

(C) Auxiliaries

The Auxiliaries provided for this power plant are Biomass Sizing System, Biomass Transportation System, Biomass Conveying System, Water Treatment plant, Cooling Tower, Char Extraction Unit.

The temperature of gas coming out of generator is normally between 300-500 ^{0}C. This gas has to be cooled in order to raise its energy density. Various types of cooling equipment have been used to achieve this end. Most coolers are gas to air heat exchangers where the cooling is done by free convection of air on the outside surface of heat exchanger. Since the gas also contains moisture and tar, some heat exchangers provide partial scrubbing of gas .Thus ideally the gas going to an internal combustion engine should be cooled to nearly ambient temperature.

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.:

Tamilnadu

A.4.1.3. City/Town/Community etc:

Village	:	Varapatti
Taluka	:	Palladam
District	:	Coimbatore

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

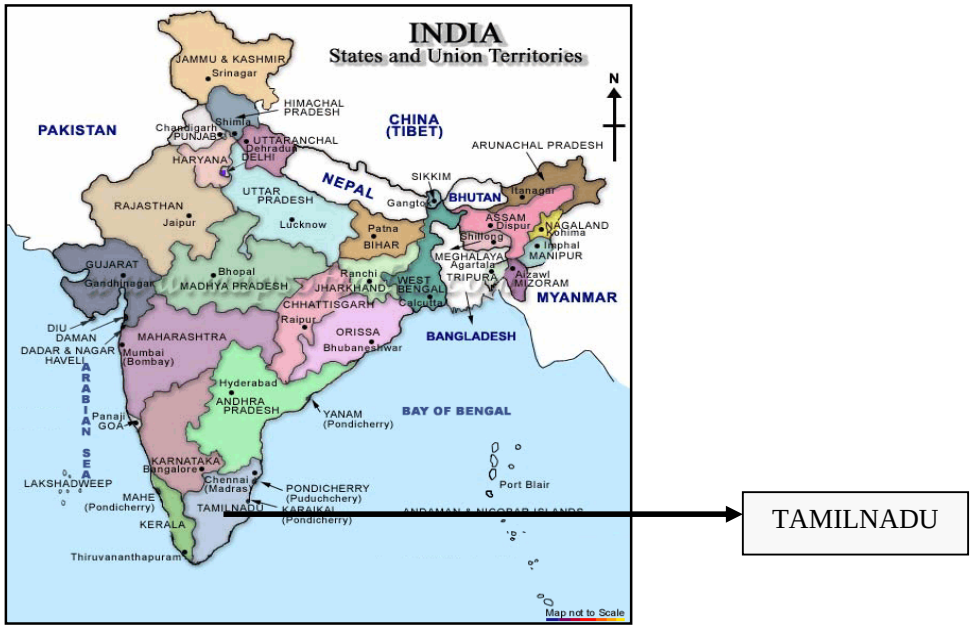
The project is located at Palladam Taluka of Coimbatore District, Tamilnadu. The varappatti village is 25 kms to southwest of Palladam Taluka. The nearest Railway Station is in Tirupur about 30 kms from site and the nearest air port is at Coimbatore about 40 kms from site and seaport is at Cochin about 175 kms

from site. The project site is located within 10 ° 10’ to 11 ° 30’N latitude and 76 ° 40’ to 77 ° 30’E longitude respectively

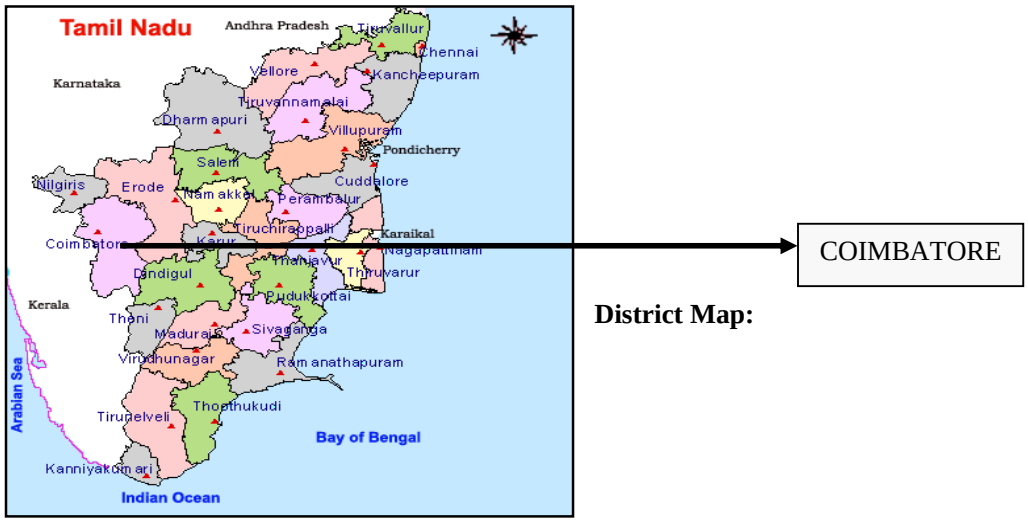
The location of the project activity is given in the following maps:

- Country map
- State map
- District Maps

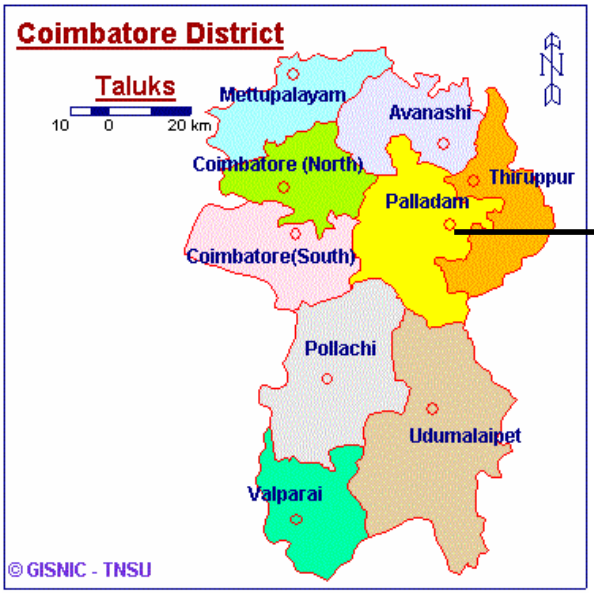
Country Map :



State Map:



District Map:



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 : 10

Date : 23 December 2006

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	2007	3390
2	2008	6724
3	2009	6724
4	2010	6724
5	2011	6724
6	2012	6724
7	2013	6724
Total estimated reductions (tonnes of CO_2)		43734

Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tons of CO_2/year)	6248

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 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 : 10

Date : 23 December 2006

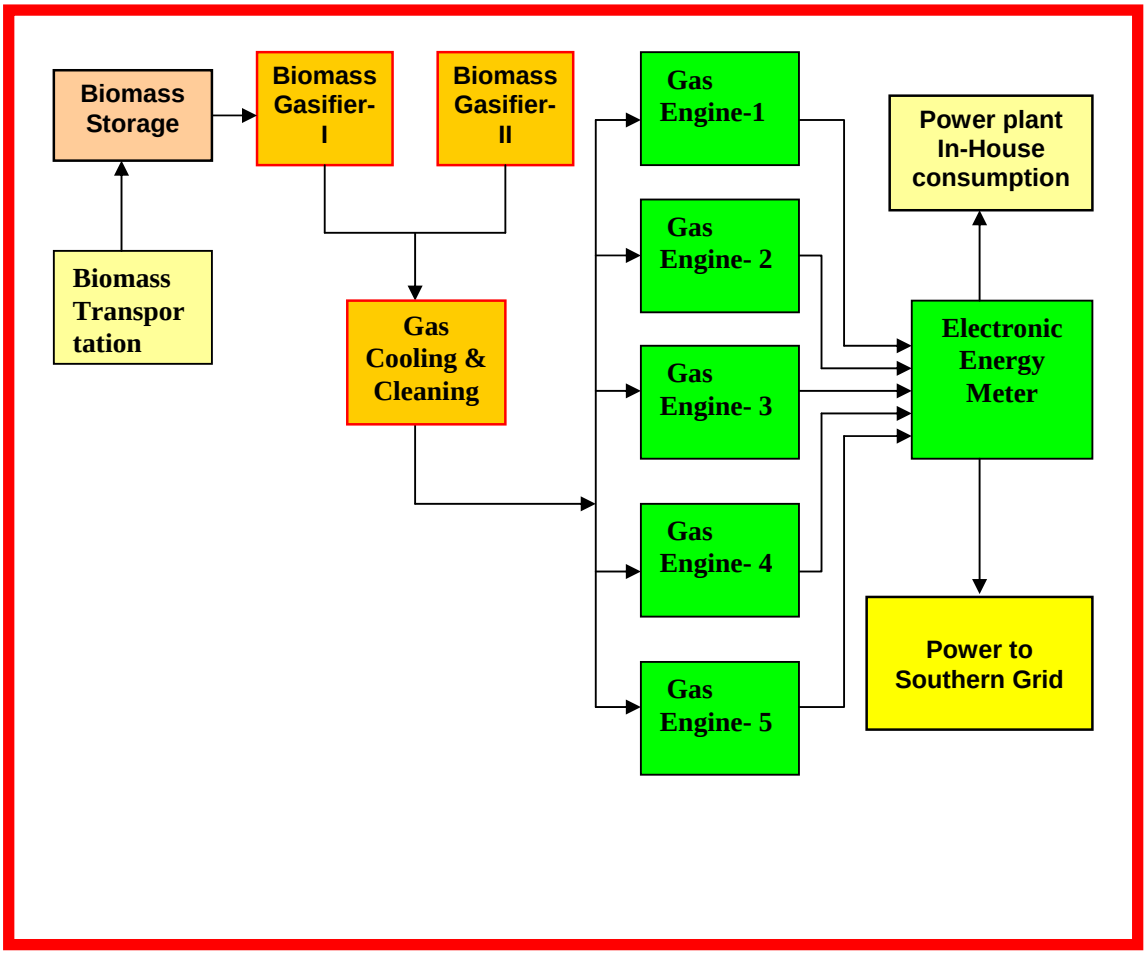
B.2 Justification of the choice of the project category:

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

As per the Methodology	As per the Project Activity
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 grid connected biomass power project hence applicable for this methodology.
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 fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	The total capacity of the project activity is 1.25 MW it is less than 15 MW.There is no fossil fuel co-fires with this project activity.
The sum of all forms of energy output shall not exceed 45 $MW_{thermal}$. E.g., for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 $MW_{thermal}$.	Not applicable

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 proposed project is located in the state of Tamil Nadu and will be feeding the electricity in the southern regional grid serving the four southern states and one union territory namely Pondicherry. Hence the proposed project would have 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.

For the baseline calculation a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) has been used. The combined margin has been estimated by the Central Electricity Authority of India and the same has been used for estimating the baseline emissions for this project activity.

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 2002-03,2003-04,2004-05) and are derived from the following equation:

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

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 - Electricity generation at the plant *j* connected to the grid excluding zero- or low-operating cost sources.

Year	**2002-03**	**2003-04**	**2004-05**	**Average**
Operating Margin Emission Factor (tCO_2 / MWh)	1.00	1.01	1.00	1.00

Source: Central Electricity Authority: CO2 Baseline Database.

Vesion:1.1,Dated 21/12/2006

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} **=0.72** tCO_2/MWh

Source: Central Electricity Authority: CO2 Baseline Database.

Vesion:1.1,Dated 21/12/2006

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}):

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

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} - 0.72 tCO2/MWh

w_{BM} - 0.5

EF = 0.5*1.00 + 0.5*0.72

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

Year	**2002-03**	**2003-04**	**2004-05**	**Average**
Operating Margin Emission Factor (tCO_2 / MWh)	1.00	1.01	1.00	1.00
Build Margin (tCO_2 / MWh)			0.72	0.72
Combined Margin (tCO_2 / MWh)	0.86	0.86	0.86	0.86

Source: Central Electricity Authority: CO2 Baseline Database.

Vesion:1.1,Dated 21/12/2006

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 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 :

AHBPPL started power generation on August 2003 at that time there was no 100% producer gas engine available in India. Hence the project promoter purchased the dual fuel engine and modified for 90 % producer gas. From August 2003 to December 2004 AHBPPL operated their plant by this dual fuel engine. After December 2004 the project promoter purchased the 100 % producer gas engine and started their power generation. Due to this replacement of dual fuel engine by producer gas engine the cost of the project activity is increased. Because of the high capital cost, non availability of 100 % producer gas engine, problem associated with engine feeding, producer gas cooling & cleaning discourage the private sector investment in the biomass gasification project. The AHBPPL project activity is connected with southern regional grid and this is the **first 1.25 MW grid connected biomass gasification power project in India**. The above statement states that generating power from biomass gasification is not a common practice in India.

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 gasifier operates under negative pressure and the feeding of biomass to the closed system is very difficult.
- 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 project is a grid connected renewable energy project, emission reduction quantity depends on the units of energy exported to the grid (in kWh) and the baseline emission of the southern grid. The methodology covers the monitoring of units exported, 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 export to the 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:	0.72
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:	

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 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 coconut shells sourced from local coconut farms directly and through agents.

Biomass available in 50 KM Radius from the project site

S.No	Biomass	Available in Tons/year
1.	Coconut shell	120,000

- Total biomass consumed by the project : 13140 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 : 1314 per year
- Total Distance travelled between project site and biomass collection centres : **131400** km/year
- CO2 Emission factor for Diesel : 0.0004246 t CO2/km
- CO_2 emission per annum : **55.79** t CO2/ year

Total estimated leakage due to project (L) = 56 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:

$$BE_{electricity} = P_{net} * EF_{electricity} \quad \text{.....(iv)}$$

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

= 0.86 tCO_2/MWh

Year	2002-03	2003-04	2004-05	Average
Operating Margin Emission Factor (tCO_2 / MWh)	1.00	1.01	1.00	1.00
Build Margin (tCO_2 / MWh)			0.72	0.72
Combined Margin (tCO_2 / MWh)	0.86	0.86	0.86	0.86

Source: Central Electricity Authority: CO2 Baseline Database.

Vesion:1.1,Dated 21/12/2006

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

P_{net} =Power export to Grid (P_{export}) – Power Import from grid (P_{import})

= 7884 - 0

P_{net} = 7884 MWh/Year

P_{net} and EF in formula (iv)

$BE_{electricity}$ = 7884*0.86

= 6780 tCO_2/year

BE, PE and L in formula (i)

ER = $BE_{electricity,}$ – PE - L

= 6780 – 0 – 56

Net Emission Reduction (ER) = 6724 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	2007	3974	3418	28	3390
2	2008	7884	6780	56	6724
3	2009	7884	6780	56	6724
4	2010	7884	6780	56	6724
5	2011	7884	6780	56	6724

6	2012	7884	6780	56	6724
7	2013	7884	6780	56	6724
Total		**51278**	**44098**	**364**	**43734**

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_{export}
Data unit:	MWh/Year
Description:	Electricity exported to the grid
Source of data to be used:	TNEB meter reading
Value of data	7884
Description of measurement methods and procedures to be applied:	Measured by the TNEB Main meter.
QA/QC procedures to be applied:	TNEB main meter reading is cross checked with the check meter reading.
Any comment:	-

Data / Parameter:	P_{Import}
Data unit:	MWh/Year
Description:	Import of electricity from the grid
Source of data to be used:	Monthly Report
Value of data	0
Description of measurement methods and procedures to be applied:	Measured by the energy meter.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	P_{NET}
Data unit:	MWh/Year
Description:	Net electricity exported to the grid
Source of data to be	Monthly Report

used:	
Value of data	7884
Description of measurement methods and procedures to be applied:	Calculated from power export to the grid and imported from the grid
QA/QC procedures to be applied:	-
Any comment:	-

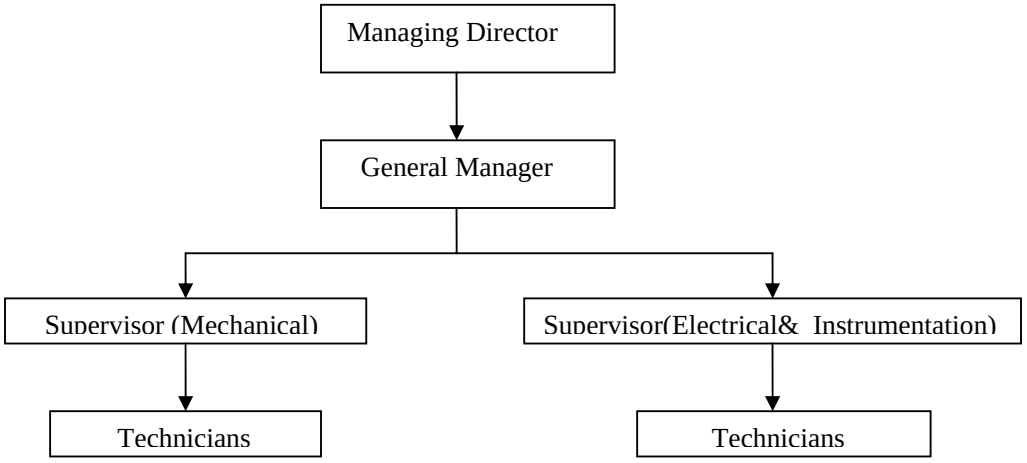
Data / Parameter:	EF
Data unit:	tCO_2eq/MWh
Description:	GHG emission factor of the Southern grid
Source of data to be used:	Central Electricity Authority (CEA) CO_2 Baseline Database values are used for calculation. *Source:* http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value of data	0.86
Description of measurement methods and procedures to be applied:	Calculated by CEA
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:	Weigh bridge Receipt
Value of data	13140
Description of measurement methods and procedures to be applied:	Calculated from weigh bridge receipt
QA/QC procedures to be applied:	The data is cross checked with biomass log sheet.
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 IPCC be used for this calculation
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:



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	Quality of Data
1	TNEB Main meter	Measurement of electricity exported to grid.	Main meter is calibrated as per the supplier schedule. The calibration will be done on yearly basis.	The measurement of electricity is cross checked with the check meter reading.
2	Weighbridge	Measurement of biomass quantity	Calibration is done at regular intervals as per the supplier schedule.	The biomass quantity is cross checked with the invoice from the supplier and the entry record.

All the measurements taken by the Technician are recorded in the log sheets and these log sheets are verified by the supervisor. Every shift data log sheet is submitted to the General Manager and these log sheets are cross verified. The General Manager maintains all the records in electronic and paper mode. The General Manager submits a weekly 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.

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: 18/01/2007

Mr. V.Chandra Mohan, Director
Acclaim Technology Services
6/1 Sriraman Enclave, Third Main Road,
Raja Annamalai Puram, Chennai 600 028,
Tamil Nadu ,India.
acclaim_tech@rediffmail.com
Mobile: (91) 94440 19321
Telefax: (91) 44 5203 0966

Tel: (91) 44 5216 9190

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:

28/03/2003

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 these 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:

Arasi Bio Power Private Ltd (ABPPL) has conducted a stakeholder meeting on 17th November 2005.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 ABPPL 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 ABPPL 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 create a new rural income resulting from the sales of biomass fuels such as coconut fronds, Coconut shell, coconut husk etc.

The doubts of local people had been cleared by ABPPL 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:

AHBPPL has already received the major necessary approvals and consents from various authorities, required for project implementation. AHBPPL 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:

State Government of TamilNadu:

Tamil Nadu Energy Development Agency (TEDA), the promotion and policy implementation body in respect of renewable energy projects in TamilNadu has issued its sanction letter to the project. Lr No.BE/2648/TEDA/2003 dated: 5.7.2004

TamilNadu Electricity Board (TNEB), the monopoly state power utility has issued the consent for establishment of the biomass gasification plant, vide Letter No: CE/NCES/EE/C/A4/F.Arashi/D2310/2001. Dated 24.2.2001.

The project proponent has already signed Agreement with the TNEB dated on 28th October 2004.

The Ministry of Non-Conventional Energy Sources has issued a letter stating that the establishment biomass gasification based electricity generation project by AHBPPL is the first of its kind in the country. D.O.No.Adv/BE/1/2006. dated 01/02/2006.

The performance of the project activity has been certified by IISc. Bangalore, Anna university, Chennai. TEDA, Chennai.

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

Project Entity

Organization:	Acclaim Technology Services
Street/P.O.Box:	6/1 Sriraman Enclave, Third Main Road,
Building:	Raja Annamalai Puram,
City:	Chennai
State/Region:	Tamil Nadu
Postfix/ZIP:	600 028
Country:	India
Telephone:	91-44-5216 9190
FAX:	91-44-5203 0967
E-Mail:	acclaim_tech@rediffmail.com
URL:	
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	V.Chandramohan
Department:	
Mobile:	+91 94440 19321
Direct Fax:	91-44-5203 0967
Direct Tel:	91-44-5216 9190
Personal E-Mail:	acclaim_tech@rediffmail.com

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			**1.1**		
DATE			**21 Dec 2006**		
BASELINE METHODOLOGY			**ACM0002 / Ver 06**		
Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)					
	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.72	0.73	0.74	0.71	0.72
East	1.09	1.03	1.09	1.08	1.05
South	0.74	0.75	0.82	0.85	0.79
West	0.90	0.92	0.90	0.90	0.92
North-East	0.39	0.38	0.37	0.36	0.46
India	0.82	0.83	0.85	0.85	0.84
Simple Operating Margin (tCO2/MWh) (incl. Imports)					
	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.98	0.98	1.00	0.99	0.98
East	1.22	1.19	1.17	1.20	1.17
South	1.03	1.00	1.00	1.01	1.00
West	0.98	1.01	0.98	0.99	1.01
North-East	0.67	0.66	0.68	0.62	0.81
India	1.01	1.02	1.01	1.02	1.02
Build Margin (tCO2/MWh) (not adjusted for imports)					
	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.72
West					0.78
North-East					0.10
India					0.70
Combined Margin in tCO2/MWh (incl. Imports)					
	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.76	0.76	0.77	0.76	0.75
East	1.06	1.05	1.04	1.05	1.04
South	0.87	0.86	0.86	0.86	0.86
West	0.88	0.89	0.88	0.88	0.89
North-East	0.39	0.38	0.39	0.36	0.45
India	0.86	0.86	0.86	0.86	0.86

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

AHBPPL	Arashi Hi-tech Bio Power 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 MW Biomass based gasification project – Arasi Bio Power 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**