Voluntary Carbon Standard Project Description Template

19 November 2007

[Date of VCS PD - 25th September 2009]

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1 Description of Project:

1.1 Project title

"Biomass based steam generation project by Gujarat Ambuja Exports Ltd."
Version: 1.0
Date: 25/09/2009

1.2 Type/Category of the project

The project activity falls under the following guidelines set in the Clean Development Mechanism under the Kyoto Protocol:

- **Type I** : Renewable energy projects
- **Category I C** : Thermal energy production with or without electricity generation
- **Reference** : Thermal energy production with or without electricity AMS-IC, Version: 16, Sectoral Scope: 1, EB 51

The specified project is not a part of a grouped project

1.3 Estimated amount of emission reductions over the crediting period including project size:

The annual emission reductions by the projects are as follows:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2008*-2009	45523
2009-2010	45523
2010-2011	45523
2011-2012	45523
2012-2013	45523
2013-2014	45523
2014-2015	45523
2015-2016	45523
2016-2017	45523
2017-2018	45523
Total estimated reduction (tonnes of CO_2 e)	455230
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	45523

*1st April – 31st March every year

The project activity is neither a micro project nor a mega project, since the emission reductions are neither below 5000 tCO_2e/annum or nor above 1000000 tCO_2e/annum.

1.4 A brief description of the project:

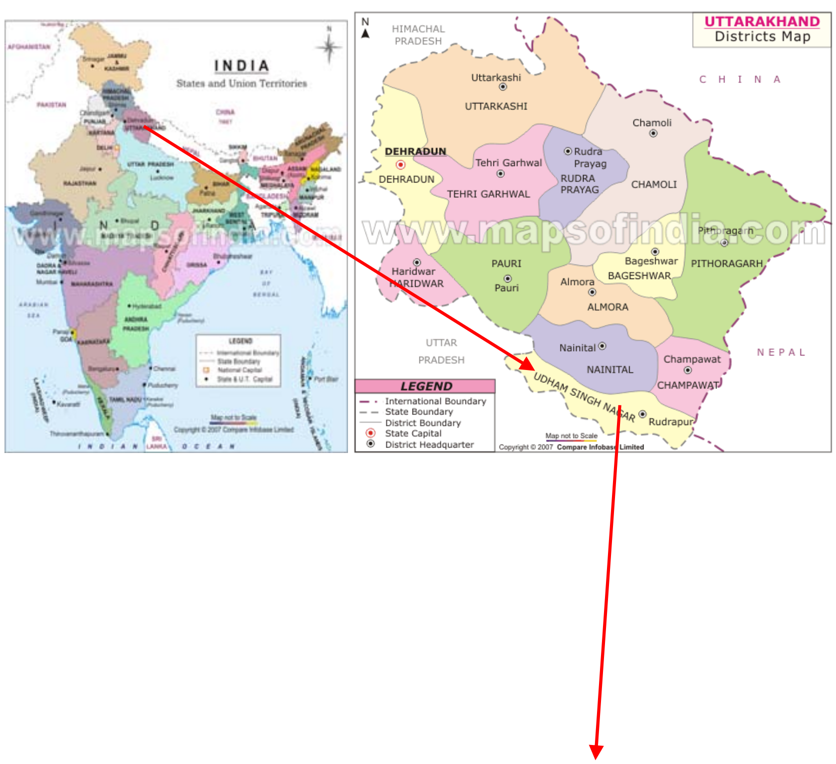
The project proponent, Gujarat Ambuja Exports Limited (GAEL) is principally involved in agro-processing & trading and has focused on exports, competing in the global market.

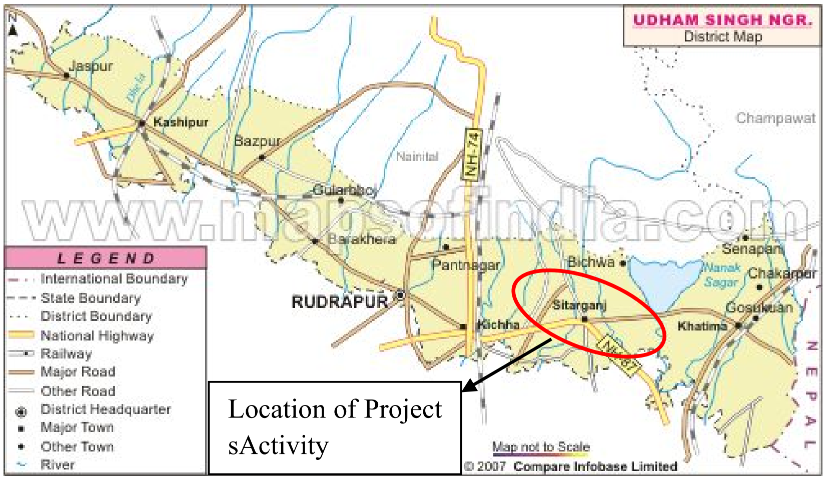
With a humble beginning in 1983 and with just a textile processing unit, the company has grown with the addition of numerous state-of-the-art- plants in the agro-processing sector.

The project activity is installation of 30TPH biomass based boiler in the starch manufacturing unit at ELDECO SIDCUL industrial park at Sitarganj, Udhamsingh Nagar district, Uttarakhand state. Also the project activity utilises biogas as a fuel in the same boiler. This biogas is produced from the anaerobic digestion of wastewater within the plant premises. The purpose of the project activity is to generate steam for process heating. This will generate 30TPH of steam which would be utilized for process heating in the starch manufacturing process.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The project is located in Sitarganj, Udhamsingh Nagar district, Uttarakhand state. The nearest Rail head is at Kathgodam (37km from site) and the airport is at Pantnagar (50km from site). Its exact location of Sitarganj is be given by the Latitude 28º 55´ 43" N and Longitude 79º 42´ 25" E.





1.6 Duration of the project activity/crediting period:

- Project Start date: March 2008 which is the start date of commercial operation of the plant
- Crediting Period start date[1]: 1st April 2008 – 31st March 2018
- Credit Period: 10 years fixed crediting period

1.7 Conditions prior to project initiation:

The project is a renewable energy project which generates steam. It utilizes the locally available surplus biomass. The produced steam is utilized for process heating in the starch production. This starch production plant is a new facility. In the absence of the project activity the steam would have been generated by the operation of fossil fuel based boiler.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The project activity is installation of biomass based boiler for steam generation. Also the project activity utilises the biogas as a fuel in the same boiler. This biogas is produced from the anaerobic digestion of wastewater. The purpose of the project activity is to generate steam using renewable biomass as fuel instead of using fossil fuel. In the absence of the project activity, project proponent would have gone for fossil fuel fired boiler for steam generation resulting in Green House Gas emissions into the atmosphere. Thus the use of biomass, which is biogenic in origin, will help reduce GHG emissions.

1.9 Project technologies, products, services and the expected level of activity:

The project activity is installation of biomass based boiler for steam production. The installed capacity of the project activity is 30TPH or 19.63 $MW_{thermal}$.

<u>Technical specifications of the project activity</u>

[1] As per VCS-2007.1 guidelines

Parameter	Values
Boiler type	Semi-outdoor, Bi-drum, Water tube, AFBC boiler
Capacity	30TPH
Steam Pressure	17.5 kg/cm^2
Steam temperature	Saturated
Fuel	Rice husk/Coal/Bio-gas
Make	Cheema Boilers

1.10 Compliance with relevant local laws and regulations related to the project:

The project activity is not mandated by any local or national laws. The project proponent has obtained all required approvals as given below.

Approval Name	Approval date	Law under which it is applicable
PCB approval	02nd Mar 07	Water (Prevention & Control of Pollution) Act, 1974 & Air (Prevention & Control of Pollution) Act, 1981
Boiler Inspection Certificate	4th Jan 08	Section 9 of "The Indian Boiler Act 1923"

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Sustainable management of biomass:
The success of the project activity is dependent on good crop season in Uttarakhand. Important aspect for sustainable availability of biomass to the project activity is of logistics. Collection and transportation of biomass in such a huge volume to the project site is a big constraint for project's successful operation. This is because of factors like biomass is widely dispersed in small quantities and absence of a formal market for continuous supply of biomass. These factors will not only create availability issues but may also impact the prices of biomass severely. The collection of biomass would be a daunting task as it is involved the setting up of a system for the collection of biomass from large number of sellers, since one single supplier cannot supply the quantity of biomass required for the project activity. Absence of a dependable logistic support for collection and delivery is a big hurdle to the project's successful operation.

Storage of biomass:
The availability of biomass residues are season dependent. To ensure a sustainable supply of biomass to this project activity, adequate storage facilities are required, which in turn occupied lots of space in the plant. Moreover, the characteristics of biomass fuel change quickly within a very short time, mainly the calorific value decreases due to loss of volatiles[2], which adversely affects on the performance of the boiler. Also the project activity does not have the provision for closed biomass storage. Hence there is a high possibility of boiler shut down in case of continuous rain which in turn leads to production loss.

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2 http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,17306&_dad=portal&_schema=PORTAL

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The project activity is installation of biomass based boiler for steam generation. Also the project activity utilises the biogas as a fuel in the same boiler. This biogas is produced from the anaerobic digestion of wastewater. The purpose of the project activity is to generate steam using locally available renewable biomass as fuel instead of fossil fuel. Thus, it is evident that project proponent has initiated this project with an aim to generate steam from biomass residues, and not primarily for creating GHG emissions primarily for the purpose of its subsequent removal.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The project has not created any other form of environmental credit. A supporting letter for the same will be provided from the project proponent.

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1.14 Project rejected under other GHG programs (if applicable):

The project has not been rejected under any other GHG programs.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

The project proponent shall maintain all the monitoring equipment. The proponents shall record the data and shall make the data available to the DOE during validation and verification.

Project Proponent Contact Details:
R.K. Gupta
Sr. General Manager
C-50, ELDECO – SIDCUL Industrial Park
Sitarganj – 262 405
Udham Singh Nagar District
Uttarakhand (India)

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

The project conforms to the sustainable development goals of the country in the following ways:

Socio-Economic well-being:

- ✓ The project activity will create employment opportunities during the project stage and operation and maintenance of the boiler.
- ✓ The project activity will help in conservation of fast depleting natural resources like coal, thereby contributing to the economic well being of country as a whole.

***Environmental well-being*:**

- ✓ Renewable biomass is used as a fuel in the project activity. Uses of renewable fuels will reduce the GHG emission to the environment as compared to non-renewable fuels.
- ✓ The project activity will also reduce the pollution associated with the extraction and transport of the fossil fuel.

***Technological well-being*:**

- ✓ The project activity is expected to increase awareness and interest among the industry players to make investments in similar areas.
- ✓ The project activity is also expected to encourage technology providers in putting more R&D efforts towards new and renewable technology development.

The above benefits due to the project activity would ensure that the project contributes to the sustainable development of the region.

1.17 List of commercially sensitive information (if applicable):

There is no such information which is deemed as commercially sensitive.

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

The VCS methodology applied to the project activity is:

Title: “Type I – Thermal energy production with or without electricity”

Reference: Category I C of Appendix B of the simplified modalities and procedures for small-scale CDM project activities as mentioned on UNFCCC CDM website.
Sectoral Scope: 1, EB 51[3]

3 http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Methodology Criteria	Applicability of Criteria to the Project Activity
This category comprises renewable energy technologies that supply users1 with thermal energy that displaces fossil fuel use. These units include technologies such as solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.	This project activity is installation 0f 30TPH biomass fired boiler that produces steam for process heating.
Biomass-based co-generating systems that produce heat and electricity are included in this category. For the purpose of this methodology "Cogeneration" shall mean the simultaneous generation of thermal energy and electrical and/or mechanical energy in one process. Cogeneration system may supply one of the following: (a) Electricity to a grid; (b) Electricity and/or thermal energy (steam or heat) for on-site consumption or for consumption by other facilities; Combination of (a) and (b).	This is not a co-gen project.
The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal2 (see paragraph 5 for the applicable limits for cogeneration project activities).	The thermal generation capacity of the project activity is only 19.63 $MW_{thermal}$ (refer annex-1).
The following capacity limits apply for biomass cogeneration units: (a) If the project activity includes emission reductions from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to thermal energy (i.e., for renewable project activities, the maximal limit of 15MW(e) is equivalent to 45 MW thermal output of the equipment or the plant). (b) If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e. no emission reductions accrue from electricity component), the total installed thermal energy production capacity of the project	No cogeneration is involved in this project activity. Moreover the project claims emission reduction for thermal energy component only.

equipment of the cogeneration unit shall not exceed 45 MW thermal. (c) If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e. no emission reductions accrue from thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.	
In case electricity and/or steam/heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.	The project activity produces steam which is used to meet the process heating requirements within the facility's premises itself.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

Source		Gas	Include d?	Justification / Explanation
Baseline	Fossil fuel combustion in boilers for heat generation	CO2	Yes	Main source
		CH4	No	Excluded for simplification. This is conservative.
		N2O	No	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of the biomass residues	CH4	No	
Project Activity	On-site fossil fuel and electricity consumption	CO2	Yes	Minor emission source
		CH4	No	Excluded for simplification. This emission source is assumed to be very small.
		N2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Off-site transportation of biomass residues	CO2	Yes	Minor emission source
		CH4	No	Excluded for simplification. This emission source is assumed to be very small.
		N2O	No	Excluded for simplification. This emission source is assumed to be very small.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

Approved methodology AMS IC has been applied to the project activity as it meets applicability criteria outlined in the methodology. Following paragraphs demonstrate selection of baseline scenario out of the various alternatives available to the project proponent.

Identification of alternative baseline scenarios:
The methodology as applied to the project activity involves the identification of alternative baseline scenarios that provide or produce steam for in-house consumption. The possible alternative baseline scenarios are as follows:

Alternative-1: Steam generation using fossil fuel.

Alternative-2: Steam generation using biomass residues without CDM benefit.

Alternative 1:
The project proponent had chosen the following fossil fuels for steam generation.

1. Coal
2. Furnace Oil (FO)
3. Diesel

The decision of fossil fuel that would have been used in the absence of project activity will be based on availability and cost of various fuels options, i.e. fuel cost per unit of energy supplied. The above mentioned fuels are available at the project site and no policy constraints the use of these fuels in steam generation. These fuels hence are compared based on the cost factor. The unit cost of various fuels options available for steam generation based on unit cost of energy generation, are shown below.

Fuel type	Fuel NCV (TJ/ kg)	Fuel price	Cost per unit of energy (Rs./ TJ)	Remarks
Coal	0.000018828[4]	3.40 Rs./kg[5]	180582.10	Coal is the cheapest fuel option available amongst all the fossil fuels.
FO	0.0000404[6]	21.128 Rs./kg[7]	522970.30	2.9 times that of coal
Diesel	0.000043[8]	32.05 Rs./l[9]	908962.00	4.2 times that of coal

It is evident from the above table that coal has the lowest unit cost of energy generation amongst all the fuel options available. Therefore project proponent had chosen coal as a possible baseline amongst all the fossil fuel alternatives that are available to PP in absence of the project activity.

4 Coal supplier information
5 Coal supplier information
6 IPCC default value
7 http://petroleum.nic.in/petstat.pdf (Page 26, Table 28)
8 IPCC default value
9 As per IBP dealer invoice

Based on the analysis above, the remaining plausible alternative baseline scenarios are as follows:

Alternative-1: Steam generation using coal
Alternative-2: Steam generation using biomass residues without CDM benefit

The decision of the plausible baseline for this project activity will be based on the unit cost of energy generation. The fuel option with the least unit cost of energy generation will be taken as baseline option. The detailed explanation for the basis of unit cost analysis is given in section 2.5. The summary of the unit cost analysis has been discussed in the table below.

Parameter	**Unit**	**Alternative-1: Steam generation using coal**	**Alternative-2: Steam generation using biomass residues without VCU benefit**
Unit Cost	Rs./ton of steam	440.91	590.42

As evident from the table above, unit cost of steam generation using biomass residues as fuel is more than that in steam generation using coal and hence it can be concluded that Alternative-1 is the baseline option available to project proponent in the absence of the project activity. Besides this Alternative- 2 faces many barriers (refer section 2.5 of the document for Additionality) and hence cannot be a plausible baseline option for steam generation for the project proponent. Hence Alternative-I is the most plausible baseline scenario for this project activity.

Since the project activity is using coal in the baseline for steam generation, therefore baseline emission is calculated as per para 15 of the small scale methodology AMS I.C version 16.

According to the para 15, the baseline emission is calculated as per the equation below:

$$BE_{Thermal, CO2, y} = (EG_{Thermal, Biomass, y} / \eta_{BL, Thermal})* EF_{FF, CO2}$$

Where,

$BE_{Thermal, CO2, y}$ = The baseline emissions from steam/heat displaced by the project activity during the year y; tCO2e

$EG_{Thermal, Biomass, y}$ = The net quantity of steam/heat supplied by the project activity through biomass during the year y; TJ

$EF_{FF, CO2}$ = The CO2 emission factor of the fossil fuel that would have been used in the baseline plant; tCO2 / TJ, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used

$\eta_{BL, Thermal}$ = The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

$$EG_{Thermal, Biomass, y} = EG_{Thermal, y} - EG_{Biogas, y}$$

$EG_{Thermal, y}$ = Total steam/ heat supplied by the project activity during the year y; TJ

$EG_{Biogas, y}$	= Total steam / heat supplied to project activity through biogas during the year y; TJ

$EG_{Thermal, y}$	=(Enthalpy of steam – Enthalpy of feed water)* Quantity of steam generated

$EG_{Biogas, y}$	= Quantity of Biogas * NCV_{Biogas}

$SEC_{j, PJ, y,}$	= $(\sum FC_{j, PJ, y} * NCV_{j,y}) / EG_{PJ,y}$

Where,

$SEC_{j, PJ, y,}$	=Specific energy consumption of fuel type *j* of the project activity in year y *in /MWh*
$EG_{PJ\,y}$,	=Energy generation in MWh in *y*
$FC_{j\,PJ\,y}$	=Quantity of fuel type *j* combusted in the project activity during the year *y* in volume or mass unit
$NCV_{j,y}$	=Average net calorific value of fuel type *j* combusted during the year in TJ per unit volume or mass unit

Data requirement and sources for baseline emission estimation:

Parameter	Unit	Data source
Net energy output ($EG_{Thermal, Biomass, y}$)	TJ/annum	Plant
Emission factor of coal ($EF_{FF, CO2}$)	tCO_2/TJ	IPCC default value
Boiler efficiency on coal (ηth)	%	Technology supplier details

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The additionality of the project activity is explained on the basis of barrier analysis mentioned in Attachment A to Appendix B of Simplified modalities and procedures for small scale project activities. Attachment A to Appendix B mentions the barriers listed below and at least one of the listed barriers should be explained to show that the project activity could not be undertaken due to the barrier and that the VCS revenue would significantly act as an impetus for the project to survive.

1. Investment barrier
2. Technological barrier
3. Barrier due to prevailing practice
4. Other barriers

As mentioned above the project proponent has two alternatives to generate thermal energy required for the process; however it may be noted that alternative 2 *i.e.* „Use of biomass in the boiler (rice husk and other agricultural residues) as fuel source‟ faced following barriers which are detailed below:

<u>Investment barrier:</u>

The project activity entails the installation of a biomass based boiler for steam generation. The total investment in the project is approximately Rs. 327.84 Lacs[10]. This includes the cost of boiler and its accessories and erection charges. Here the project financial viability is analysed in terms of fuel cost analysis. The fuel cost analysis has been done based on unit cost of energy generation for rice husk and for the baseline scenario i.e. coal based steam generation. In this analysis we have considered the cost of project activity to be same for both the cases. These assumptions considered for the cost comparison are tabulated below:

Financial parameters:

Description	Unit	Details	Remarks
Project cost	Lacs (INR)	327.84	Considered same for both the options
Debt	%	0.00	
Equity	%	100.00%	
Coal cost	Rs/ton	3400	As per Coal invoice
Biomass cost	Rs/ton	2800	As per Biomass invoice

Technical parameters:

Description	Unit	Details	Remarks
Qty of steam generate	TPH	30.00	As per Purchase order
Pr. of steam	kg/cm2	17.50	As per Purchase order
Temp of steam	Deg C	205.00	As per Purchase order
Feed water temperature	Deg C	105.00	As per Purchase order
Eff. Of the boiler with biomass	%	80.00*	As per Purchase order
Eff. of the boiler with Coal	%	88.00**	As per Purchase order
Coal emission factor	tCO2e/TJ	96.10	IPCC default value for coal
Run hrs	hrs per annum	7920.00	
Enthalpy of steam	kJ/kg	2794.70	http://www.efunda.com/materials/water/steamtable_sat.cfm
Enthalpy of feed water	kJ/kg	439.30	Feed Water temp considered as 105 deg C
Coal calorific value – NCV	Kcal/kg	4270.00	As per test report
Biomass calorific value – NCV	Kcal/kg	2930.00	As per test report
PLF	%	100.00	
Qty of biogas used	m3/day	12960.00	Letter to MNRE on 6th February 2009

[10] 1 million = 10 lacs

Biogas calorific value	Kcal/m3	5915.00	As per test report

* As per PO, efficiency lies between 78% and 80%. For a conservative approach 80% is considered for analysis

** As per PO efficiency is between 88% and 90%. For a conservative approach 88% is considered for cost comparison analysis but for emission reduction calculation default value of 100% is considered

Based on the values above, the cost comparison has been carried out for equivalent steam generation for both the options. The comparison is shown below:

Cost of steam generation through Coal

Parameter	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fuel cost	INR(Lacs)	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61
Total Steam generation	TPA	237600	237600	237600	237600	237600	237600	237600	237600	237600	237600
Unit cost (Without CDM benefit)	Rs./t Steam	440.91	440.91	440.91	440.91	440.91	440.91	440.91	440.91	440.91	440.91

Parameter	Unit	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Fuel cost	INR(Lacs)	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61	1047.61
Total Steam generation	TPA	237600	237600	237600	237600	237600	237600	237600	237600	237600	237600
Unit cost (Without CDM benefit)	Rs./t Steam	440.91	440.91	440.91	440.91	440.91	440.91	440.91	440.91	440.91	440.91

Cost of steam generation through Biomass

Parameter	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fuel cost	INR(Lacs)	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84
Total Steam generation	TPA	237600	237600	237600	237600	237600	237600	237600	237600	237600	237600
Unit cost (Without CDM benefit)	Rs./t Steam	590.42	590.42	590.42	590.42	590.42	590.42	590.42	590.42	590.42	590.42

Parameter	Unit	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Fuel cost	INR(Lacs)	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84	1402.84
Total Steam generation	TPA	237600	237600	237600	237600	237600	237600	237600	237600	237600	237600
Unit cost (Without CDM benefit)	Rs./t Steam	590.42	590.42	590.42	590.42	590.42	590.42	590.42	590.42	590.42	590.42

As demonstrated above, the use of coal is the most cost effective option. It is evident from the table above that the unit generation of energy using biomass as fuel is costlier than the coal fired generation. Hence the project activity is not a business-as-usual scenario.

Further sensitivity analysis is carried out to test the robustness of the financial attractiveness of the coal based steam generation as compared to biomass based steam generation.

It has been observed that biomass prices increase significantly because of improper collection mechanism, inconsistency in production, lack of a structured and established market etc. The changes in unit cost of energy production with different fuel price tabulated below:

Parameter	Unit Cost of energy generation on coal (Rs./ton)	Unit cost of energy generation on biomass without CDM benefit (Rs./ton)
Variation in Coal and Biomass price		
Coal Price remains constant, 10% fall in Biomass Price	440.91	531.38
10% fall in Coal Price, Biomass Price remains constant	396.82	590.42

10% hike in Coal Price , Biomass price staying constant	485.01	590.42
Coal Price remains constant, 10% hike in Biomass price	440.91	649.46
10% hike in coal price , 10% fall in biomass price	485.01	531.38

The conclusion of the sensitivity analysis is that the unit cost of steam production is very high through biomass route.

Technological barrier:

High alkali salt content:
The ash generated by burning of biomass residues contains of high percentage of alkali salts. Presence of alkali salts reduces the fusion temperature, which causes clinker formation in the furnace. The alkali, alkaline-earth elements and chlorine contents in biomass residues cause severe particulate deposition when mixed with other gas components[11].

Impurities present in biomass:
The biomass residues are adulterated with impurities such as rock, dust particle, metals, glass etc. The presence of impurities may cause the plugging and mechanical breakdown of boiler equipments. The presence of glass and metal may cause sintering and fouling of boiler equipments[12]. Presence of impurities can also provide incorrect estimates of the biomass requirement for energy generation. In addition to this the effective cost of biomass is also increased affecting project's viability.

Summary:
As discussed in above sections, project activity cannot be considered a natural choice for steam generation. There are a number of barriers for such projects to come up. Besides, it is not the most cost effective way for steam generation. However, CDM benefits accruing from the project activity would support it financially and to some extent cover the risks involved.

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

Title: AMS I.C: Thermal energy production with or without electricity AMS-IC, Version: 16, Sectoral Scope: 1, EB 51

Reference of project categories: Category I C of Appendix B of the simplified modalities and procedures for small-scale CDM project activities as mentioned on UNFCCC CDM website.

11 http://www.osti.gov/energycitations/servlets/purl/791079-K0YZWO/native/791079.PDF
12 http://www.osti.gov/energycitations/servlets/purl/791079-K0YZWO/native/791079.PDF

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

1. Purpose - The purpose of monitoring the project is to assess the annual emission reductions in tonnes of CO_2 that the project activity has achieved.

2. Data to be reported - As per data monitored in section 3.3.

3. Source of data - As per Monitored data in section 3.3.
4. Monitoring Frequency - The data will be monitored on a continuous basis but will be recorded daily.

5. Data Accuracy - The meters recording the steam flow will be calibrated once a year.

6. Emission Reduction Calculation Approach - The emission reductions are calculated as a product of the net quantity of heat generated from the project activity and the emission factor of coal (IPCC default value – 96.1tCO_2e/TJ). The calculation approach is explained in detail under section 4.1 of this document.

Emission Reduction Estimation: $ER_y = BE_y - PE_y - L_y$

Baseline Emission calculation:

The baseline emission is calculated based on the following guidance of AMS IC, version 16:

Specific energy consumption

$$SEC_{Biomass,\,PJ,\,y,} = (\sum FC_{Biomass,\,PJ,\,y} * NCV_{Biomass,\,y})/\ EG_{PJ,y}$$
$$= (57117.8*1000*2930*\ 4.1868)/\ (70662000*7920)$$
$$= 1.25$$

$$SEC_{Biogas,\,PJ,\,y,} = (\sum FC_{Biogas,\,PJ,\,y} * NCV_{Biogas,\,y})/\ EG_{PJ,y}$$
$$= (22789.0*1000*5875*4.1868)/(70662000*7920)$$
= 1.00[13]

$$SEC_{Coal,\,PJ,\,y,} = (\sum FC_{Coal,\,PJ,\,y} * NCV_{Coal,\,y})/\ EG_{PJ,y}$$
$$= (31350.8*1000*4271*4.1868)/(70662000*7920)$$
= 1.00[14]

As per Para 35 of AMS IC, version 16

Baseline emissions [1]		
Quantity of biomass combusted	MT/ annum	57117.8
NCV of biomass	kcal/ kg	2930
SEC of biomass	kJ/ kJ steam	1.25
Eff. - baseline boiler	%	100%
Baseline emissions	tCO2/ annum	53781

[13] Efficiency of biogas combustion is considered 100% for most conservative estimations
[14] Efficiency of coal combustion is considered 100% for most conservative estimations

As per Para 15 of AMS IC, version 16

Baseline emissions [2]		
Total thermal energy output	TJ/ annum	560
Thermal energy output - biogas	TJ/ annum	85.9
Thermal energy output - coal	TJ/ annum	473.7
Eff. - baseline boiler	%	100%
Baseline emissions	tCO2/ annum	45523

As per Para 36 of AMS IC, version 16

Baseline emissions [MIN (1,2)]	tCO2/ annum	45523

Project emissions:

There are no project activity emissions as this is a renewable project activity. However, small quantity of fossil fuel would be used for start up the boiler. Project emissions on account of use of fossil fuel would be considered and monitored.

$PE_y = \Sigma FF_{i,y} \text{ X } NCV_i \text{ X } EF_i$

Where

PF_y	=Project emissions from on-site fossil fuel combustion in year y, tCO2e
$\Sigma FF_{i,y}$	=Quantity of fossil fuel combusted in the project plant in year y, tonne
NCV_i	=Net calorific value of fossil fuel type i, TJ/tonne
EF_i	=Emission factor for fuel i; IPCC default value, tCO2/ TJ

For ex-ante calculation it is assumed that no fossil fuel is combusted.

Hence, $PE_y = 0$

Leakage:

As per EB51 annex 19, leakage has to be accounted only, if the biomass transportation distance exceeds 200km. PP has carried out an extensive biomass assessment study covering 75km radii from the site and it is found that biomass is available in surplus in the studied region which can meet the project requirement. Hence in the project case average round trip distance of transportation is 150km which is well below 200km. Hence, leakage is considered as zero.

Emission reduction calculation:

Emission reduction is calculated as follows:

$$ER_y = BE_y$$

$$ERy = 45523$$

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

The following data are available at the time of validation

Data / Parameter:	η $_{BL, Thermal}$
Data unit:	%
Description:	Efficiency of baseline coal fired boiler
Source of data to be used:	Default value
Value of data	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	A maximum of 100% is assumed in the baseline emission calculation as per the methodology which is a conservative value.
Any comment:	This parameter is fixed ex-ante

Data / Parameter:	η $_{BL, Thermal}$
Data unit:	%
Description:	Efficiency of biomass fired boiler
Source of data to be used:	As per supplier information
Value of data	80%
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per supplier information
Any comment:	This parameter is fixed ex-ante

Data / Parameter:	EF_i
Data unit:	tCO_2e/ TJ
Description:	Emission factor for fossil fuel i
Source of data to be used:	IPCC default value of coal
Value of data	96.1

Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value. Ref: 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	This parameter is fixed ex-ante

The following data and parameters are monitored

Data / Parameter:	Q_{steam}
Data unit:	Tonne
Description:	Quantity of steam generated
Source of data to be used:	Onsite measurement
Value of data	237600
Description of measurement methods and procedures to be applied:	Directly measured using steam flow meter/ totalizer installed at the site. Data will be monitored on hourly basis and logged in the sheet at site. Consolidated data for a month shall be the basis for estimations.
QA/QC procedures to be applied:	Steam flow meter will be calibrated/ tested annually independently by a third party. Meter accuracy: ±0.25% Least Count: 0.1 tonne/hr
Any comment:	-

Data / Parameter:	T_{steam}
Data unit:	Degree C
Description:	Temperature of the steam generated
Source of data to be used:	On-site measurement
Value of data	205
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge. The data will be monitored on hourly basis and logged in the sheet at site. Average of such data captured in a month shall be used for the estimation purpose.
QA/QC procedures to be applied:	Gauge will be tested at least once annually as per manufacturer's prescribed standards. Gauge Accuracy: ±0.1% Least count: 1 Dec C
Any comment:	-

Data / Parameter:	P_{steam}
Data unit:	kg/cm2
Description:	Pressure of the steam generated
Source of data to be used:	On-site measurement
Value of data	17.5
Description of measurement methods and procedures to be applied:	Measured using on-site pressure gauge. The data will be monitored on hourly basis and logged in the sheet at site. Average of such data captured in a month shall be used for the estimation purpose.
QA/QC procedures to be applied:	Gauge will be tested at least once annually. Gauge Accuracy: ±0.5% Least Count of gauge: 1 kg/ cm^2
Any comment:	-

Data / Parameter:	T_{FW}
Data unit:	Degree C
Description:	Temperature of the feed water into boiler
Source of data to be used:	On-site measurement
Value of data	105
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge. The data will be monitored on hourly basis and logged in the sheet at site. Average of such data captured in a month shall be the used for estimation purpose.
QA/QC procedures to be applied:	Gauge will be tested at least once annually by a third party. Gauge Accuracy: ±0.1% Least Count: 1 Deg C
Any comment:	-

Data / Parameter:	$Q_{biomass, i,y}$
Data unit:	Tonne
Description:	Quantity of biomass of type i transported and combusted in year y
Source of data to be used:	On-site measurement
Value of data	50102
Description of measurement methods and procedures to be applied:	Quantity of biomass used in project activity would be measured using weighing scale and recorded in log books regularly.
QA/QC procedures to be applied:	The weighing scale will be calibrated periodically by a third party.
Any comment:	-

Data / Parameter:	$Q_{fossil, i,y}$
Data unit:	Tonne
Description:	Quantity of fossil fuel of type i combusted in year y
Source of data to be used:	On-site measurement
Value of data	0
Description of measurement methods and procedures to be applied:	Quantity of fossil fuel used in project activity would be measured using weighing scale and recorded in log books regularly.
QA/QC procedures to be applied:	The weighing scale will be calibrated periodically by a third party.
Any comment:	

Data / Parameter:	$NCV_{biomass, i}$
Data unit:	kcal/kg
Description:	Net calorific value of biomass of type i used
Source of data to be used:	On-site measurement
Value of data	2930
Description of measurement methods and procedures to be applied:	Measurement will be done by project proponent through sample testing at the site using bomb calorimeter. The testing will be done each time the fuel is procured. An external testing will also be done half yearly.
QA/QC procedures to be applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
Any comment:	-

Data / Parameter:	$NCV_{ff, i}$
Data unit:	kcal/kg
Description:	Net calorific value of fossil fuel of type i used
Source of data to be used:	On-site measurement / IPCC default value
Value of data	Coal: 4271 Diesel:10287.08
Description of measurement methods and procedures to be applied:	Measurement will be done by project proponent through sample testing at the site using bomb calorimeter. The testing will be done each time the fuel is procured. An external testing will also be done half yearly.
QA/QC procedures to be applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
Any comment:	-

Data / Parameter:	$Q_{biogas,y}$
Data unit:	Nm3
Description:	Amount of biogas combusted in boiler in year y
Source of data to be used:	Directly measured with gas flow meter installed at site
Value of data	12960
Description of measurement methods and procedures to be applied:	Continuous flow of biogas is recorded in the meter at boiler inlet. The data will be recorded on daily basis from the totaliser and logged in the sheet at site. This will be aggregated for a month monthly for calculations. Gas Flow Meter type : Orifice type Accuracy : ±0.25%
QA/QC procedures to	Gas flow meter is supplied with the manufacturer calibration certificate. The subsequent calibration will be done at least once in 3 years. Gas flow meters undergo maintenance/calibration yearly.
Any comment:	The volume will be normalised to take Normal temperature and pressure into account

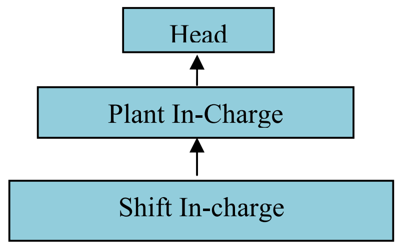
Data / Parameter:	NCV_{Biogas}
Data unit:	kcal/m^3
Description:	Net calorific value of biogas
Source of data to be used:	External laboratory test report.
Value of data	5915
Description of measurement methods and procedures to be applied:	External laboratory tests are conducted on half yearly basis.
QA/QC procedures to be applied:	-
Any comment:	-

3.4 Description of the monitoring plan

GAEL proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members.

1. Head
2. Plant In-charge
3. Shift In-charge

<u>Organizational Structure for Monitoring</u>



Responsibilities of Head: Overall functioning and maintenance of the project activity.

Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data (calibration of equipments).

Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day log book for monitored data.

Data source: As per section 3.3

Data collection and record keeping: Data will be collected at the plant operation site under the supervision of the shift-in-charge and records will be maintained in daily logs. The reports are checked periodically by the Plant In-charge and discussed thoroughly with the data monitoring personnel. A separate log will also be maintained for the biomass supply on the site, its storage and usage in the project activity.

Reliability of data collected: The reliability of the measuring equipments will be calibrated as per section 3.3 Documents pertaining to testing of equipments shall be maintained by Plant In-charge.

Frequency of monitoring: As per section 3.3.

Archiving of data: Data collected as part of monitoring will be archived and kept for at least 2 years after the crediting period or from the last issuance whichever is later.

Maintenance of instruments and equipments used in data monitoring:
The Operations Department shall be responsible for the proper functioning of the equipments/ instruments and shall take a corrective action if found not operating, as required.

Emergency preparedness: The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Emission reduction calculation: Emission reduction calculations and monitoring report will be done annually based on the data collected. This will be done by the team. The monitoring report and the emission reduction calculation will be maintained by the head for verification.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

As discussed in section 2.4, the baseline for the project activity is steam generation using coal, therefore baseline emission is calculated as per para 15 of the small scale methodology AMS I. C version 16.

Baseline emission (BEy):

According to the para 15, the baseline emission is calculated as per the equation below:

$$BE_{Thermal,\,CO2,\,y} = (EG_{Thermal,\,Biomass,\,y} / \eta_{BL,\,Thermal}) * EF_{FF,\,CO2}$$

Where,

$BE_{Thermal,\,CO2,\,y}$	= The baseline emissions from steam/heat displaced by the project activity during the year y; tCO2e
$EG_{Thermal,\,Biomass,\,y}$	= The net quantity of steam/heat supplied by the project activity through biomass during the year y; TJ
$EF_{FF,\,CO2}$	= The CO2 emission factor of the fossil fuel that would have been used in the baseline plant; tCO2 / TJ, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used
$\eta_{BL,\,Thermal}$	= The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

$$EG_{Thermal,\,Biomass,\,y} = EG_{Thermal,\,y} - EG_{Biogas,\,y}$$

$EG_{Thermal,\,y}$	= Total steam/ heat supplied by the project activity during the year y; TJ
$EG_{Biogas,\,y}$	= Total steam / heat supplied to project activity through biogas during the year y; TJ

Project Emission (PEy):

There are no project activity emissions as this is a renewable project activity. However, small quantity of fossil fuel would be used for start up the boiler. Project emissions on account of use of fossil fuel would be considered and monitored.

Project Emissions due to Auxiliary Fuel (e.g. Coal) Consumption is estimated as per the following equation:

$$PE_y = \Sigma FF_{i,\,y} \text{ X } NCV_i \text{ X } EF_i$$

Where

PF_y	=Project emissions from on-site fossil fuel combustion in year y, tCO2e
$\Sigma FF_{i, y}$	=Quantity of fossil fuel combusted in the project plant in year y, tonne
NCV_i	=Net calorific value of fossil fuel type i, TJ/tonne
EF_i	=Emission factor for fuel i; IPCC default value, tCO2/ TJ

Leakages (Ly):

Leakage due to transfer of equipments to/ from the project activity
As per the methodology, if the equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. The equipments installed in the project activity are not transferred from any other activity. Besides, no existing equipment has been transferred from the project site. Hence leakage for this part is zero.

Leakage due to transportation of biomass to the plant site
As per EB51 annex 19, leakage has to be accounted only, if the biomass transportation distance exceeds 200km. In the project case average round trip distance of transportation is 150km which is well below 200km. Hence, leakage considered is zero.

Emission reduction (ERy):
The emission reduction achieved by the project activity will be the difference between the baseline emission and the sum of the project emission and leakage.

ERy = BEy – PEy - Ly)

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

The year-wise breakup of emission reductions by the project activity during the above mentioned period is as follows:

Year	Estimation of baseline emissions (tCO2e)
2008*-2009	45523
2009-2010	45523
2010-2011	45523
2011-2012	45523
2012-2013	45523
2013-2014	45523
2014-2015	45523
2015-2016	45523
2016-2017	45523
2017-2018	45523
Total (tonnes of CO2e)	455230

***1st April -31st March**

4.3 Quantifying GHG emissions and/or removals for the project:

Year	Estimation of project emissions (tCO2e)	Estimation of leakage (tCO2e)
2008-2009	0	0

2009-2010	0	0
2010-2011	0	0
2011-2012	0	0
2012-2013	0	0
2013-2014	0	0
2014-2015	0	0
2015-2016	0	0
2016-2017	0	0
2017-2018	0	0
Total (tonnes of CO2e)	0	0

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Since $ER_y = BE_y$

Year	Estimation of Emission Reductions (tCO2e)
2008-2009	45523
2009-2010	45523
2010-2011	45523
2011-2012	45523
2012-2013	45523
2013-2014	45523
2014-2015	45523
2015-2016	45523
2016-2017	45523
2017-2018	45523
Total (tonnes of CO2e)	455230

5 Environmental Impact:

An environmental impact assessment is not required by law for these types of project activities[15]. *As per the prevailing regulation of the Host Party i.e. India represented by Ministry of Environment and Forests (MoEF), Govt. of India and also the line ministry for environmental issues in India EIA need not to be carried out for projects which falls under the list whose investment is less than Rs. 1000 million[16,17]. As per MoEF (Government of India) notification the project activity does not fall under the purview of the Environmental impact Assessment thus the project activity is exempted from the environmental clearances[18].*

6 Stakeholders comments:

The local stakeholders were identified based on the impact or the possibility of impact due to the project activity. GAEL identified the following as their local stakeholders:

a) Office bearers and residents of the neighbouring villages

15 http://envfor.nic.in/legis/eia/so1533.pdf (page 10, Schedule)
16 http://envfor.nic.in/legis/eia/so-60(e).html (schedule 1)
17 http://www.envfor.nic.in/legis/eia/eia130602.html (sub point [iii])
18 http://envfor.nic.in/divisions/iass/notif/eia.htm_ (schedule 1)

b) District magistrate
c) Local Gram Panchayat
d) Local employees

Local community was kept aware about the project activity through an advertisement in a local newspaper **"Uttaranchal darpan"** dated 17th April, 2009. Invitation letter was sent to the District Magistrate, Sitarganj and Gram Panchayat of village-Lalar Khas with the details of the project activity and request for their presence in stakeholder meeting and valuable suggestions.

The opinion of the institutional stakeholder about the project activity is reflected in the approvals received by GAEL. However, in order to provide the local villagers, an opportunity to express their view on the project activity and build a rapport with the local population, GAEL decided to conduct a stakeholder meeting in its plant in Eldeco Sidcul Industrial Park, Sitarganj on 25th of May 2009 and invitations were sent in advance intimating them about the day, time, venue and the purpose of the meet.

In the meeting Mr. R.K.Rai of GAEL welcomed all the invitees and briefed about the company and Sitarganj unit. Mr.Udesh Vij of GAEL explained them about the causes and effect of global warming and how it could possibly affect the planet. He also introduced them to the concept of CDM and explained as to how the project activity would help in reducing greenhouse gas emissions. Then Mr.R.K.Gupta invited the stakeholders to present their views on how the setting up of the project activity had affected their lives and their expectations from GAEL.

a) Is there any negative impact on surrounding area?

There is no negative impact on surrounding area or crop fields as the fuel being utilized for 30 TPH steam Boiler is Rice husk and bio-gas generated during the process of treatment of effluent.

The process does not use additional fossil fuel and does not lead to any additional emission of pollutants. However, this boiler can be operated with coal also.

b) How does CDM benefit society?

CDM is clean development mechanism, a tool to provide initiatives to mitigate the emission of greenhouse gases, which are enhancing the climate change. The purpose of this programme is to reduce emission of GHGs as well as promote sustainable development in host country. Therefore developing country like India will gain financial and environmental benefits by reducing the emission of ever increasing GHGs to save the earth.

c) What are carbon credits? How these will be obtained? Who will buy them?

Carbon credits are generated in the developing countries by reducing the greenhouse gases emission in the atmosphere. One ton of Carbon dioxide saved is equal to one carbon credit.

d) Will the boiler in discussion affect rain fall?

No the working of boiler does not affect rainfall by any chance.

In summing up, the project has not received any negative or discouraging feedback from the stakeholders concerned. All the stakeholders have appreciated the measures taken by the GAEL, they were also in favour of the project activity. As this has lead to various direct and indirect benefits socially and economically. All the stakeholders have entrusted their support for this project activity.

7 Schedule:

The chronological plan for the project activity is as follows:

- Commissioning of Biomass boiler: The biomass boiler was commissioned in March 2008
- Start date of the project – 1st April 2008
- VCS Crediting period start date: 1st April 2008
- Duration of crediting period: 10 years fixed
- Lifetime of the project: 15 years

The PP will monitor the parameters as explained in Section 3.3. The PP plans to conduct annual verifications to quantify the emission reductions (VCUs) from the project activity and report them in a transparent manner.

8 Ownership:

8.1 Proof of Title:

For the ownership details of the project following may be referred:

1. PCB clearance
2. Commissioning certificates
3. Purchase Orders
4. Annual reports

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

NA

Annex-1

Parameter	Unit	Details
Qty of steam generated	TPH	30
Pr. of steam	kg/cm2	17.5
Temp of steam	Deg C	Saturated
Enthalpy of steam	kJ/kg	2794.7
Enthalpy of feed water	kJ/kg	439.0
Net Energy output of boiler at rated capacity	kJ/kg	2355
Total thermal energy output	MJ/h	70662
Thermal output from boiler	MWth	19.63