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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

Thermal energy generation from renewable biomass by AIPL
Version: 01
Date: 10/06/08

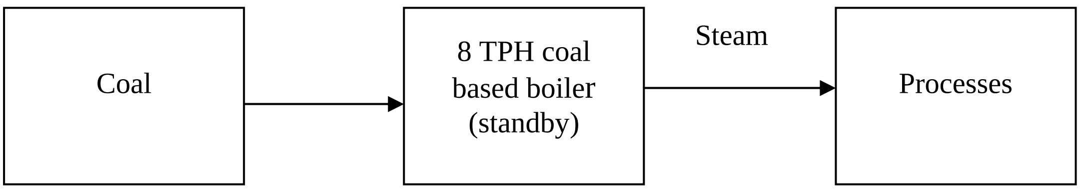
A.2. Description of the small-scale project activity:

The proposed project activity involves steam generation by utilizing locally available surplus renewable biomass (primarily rice husk) to avoid the use of fossil fuel at Agarwal Industries Private Limited (AIPL) by installation of a 12 TPH boiler and a thermopac. AIPL is one of the India's leading companies for making of refined vegetable oil and vanaspati oil. Steam generated is used in the various processes of manufacturing.

The use of renewable biomass replaces an equivalent amount of fossil fuel combustion for steam generation. Thus, an equivalent amount of GHG emissions from the combustion of fossil fuel are avoided. The project activity leads to GHG mitigation as the biomass used i.e. rice husk is a carbon neutral fuel. The project apart from mitigating the GHG emissions also reduces the local emissions of sulphur and other pollutants associated with the burning of fossil fuel.

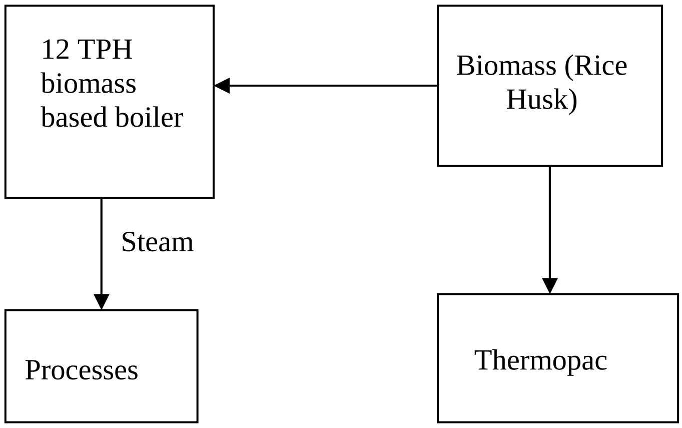
Pre-project scenario of steam generation:

The pre-project scenario comprises of an 8 TPH coal based boiler for steam generation (which in now kept as a stand by boiler as is used only in emergencies). Coal based steam generation is considered to be the business as usual or baseline scenario for the project activity.



Post project scenario of steam generation:

Due to increased steam requirements on account of expansion of the manufacturing unit, a new 12 TPH biomass based boiler and a biomass based thermopac for heat generation was installed thus doing away with the use of coal as in the pre project scenario. This project activity results in emission reduction by avoiding coal combustion in steam generation with biomass based steam. This is not the business as usual scenario, in which the project proponents could have installed a similar coal based boiler (as earlier) instead of biomass based boiler in spite of a number of operational and investment barriers. The project proponents envisage coming up with the project activity despite the barriers and back this up with CDM based revenues. The barriers are discussed in greater detail in Section B.5.



In the absence of the project activity, AIPL would have continued steam generation from coal based boiler as in the pre-project scenario. The project is in line with the development priorities of the government of increasing the use of renewable sources of energy.

Sustainable development by the project activity:

- **Social well-being**: the project activity has resulted in generation of a number of direct and indirect job opportunities for local people involved in transportation of biomass, loading-unloading, biomass storage, construction jobs, etc.

- **Economic well-being**: the project activity has led to generation of additional income for the local population due to its various activities.

- **Environmental well-being**: The project activity uses biomass (rice-husk) as fuel for steam generation. Rice-husk is a carbon neutral fuel. Using biomass in the project activity replaces an equivalent amount of GHG emissions from fossil fuel which was used earlier.

- **Technological well-being**: the project activity will provide the necessary impetus for industries to come up with more such projects in the area and will encourage technology providers in putting more R&D efforts towards new technology development.

A.3. Project participants:

Name of the party involved ((host) indicates a host party)	Private and/or Public entity (ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host)	Agarwal Industries Pvt. Ltd. (Private Entity)	No

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

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.:

State: Andhra Pradesh

A.4.1.3. City/Town/Community etc:

Village: Vakalapudi
District: Kakinada

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

The project site is located at Plot No. 5/A1, IDA village Vakalapudi in the town Kakinada Mandal of East Godavari District in Andhra Pradesh. The nearest railway station is the Kakinada Port and the nearest airport is in Rajahmundry which is approximately 70-80 km from the project site. The project site lies at the latitude 16^{o}30'18" N and longitude 82^{o}30' E.

The location is shown in the maps below.

Figure 1 Location of Andhra Pradesh state in India

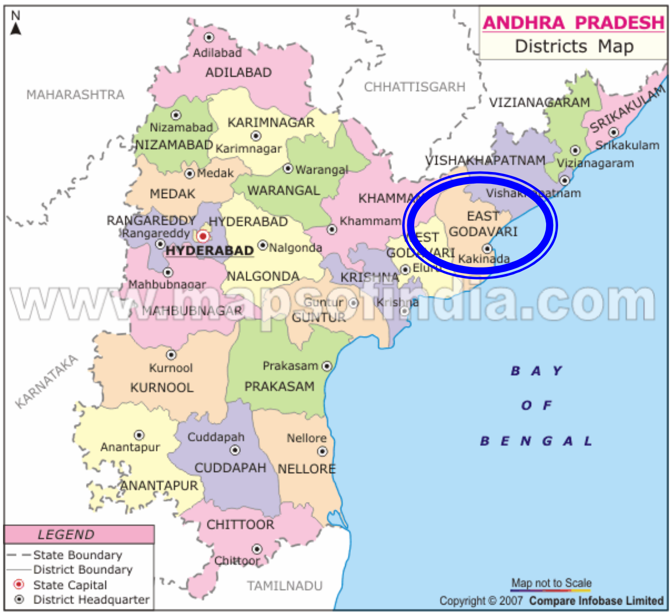


Figure 2 East Godavari District in Andhra Pradesh

Figure 3 Location of the project site in the East Godavari District

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

The project is a small scale project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

TYPE 1: Renewable Energy Projects

Category IC: "Thermal energy for the user with or without electricity" Version 13 (EB 38)

Technology in the project activity: The scheme of the technology being used in the plant is as follows.

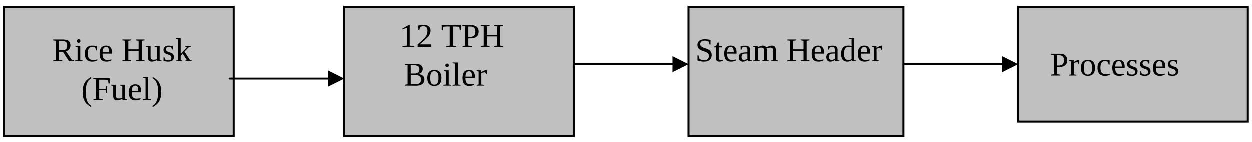


Figure 4 Project activity diagram

Table 1 Technology Specification

Parameter	**Details**
Boiler	
Type	FBC (Fluidised Bed Combustion)
Make	Thermax
Capacity	12 TPH
Pressure	17.5 kg/cm^2
Temperature	240 Deg C

Thermopac	
Type	Vertical Thermopac
Make and model	Thermax, VTA-10
Heat Output	10,00,000 kcal/hr
Maximum outlet temperature	280^{o}C
Flow rate	60 m^3/hr
Efficiency	76% (Coal) 70% (Rice Husk)

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

Years	**Estimation of annual emission reductions in tonnes of CO2 e**
2008-09	28484
2009-10	28484
2010-11	28484
2011-12	28484
2012-13	28484
2013-14	28484
2014-15	28484
2015-16	28484
2016-17	28484
2017-18	28484
Total estimated reductions (tonnes of CO2e)	284840
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tonnes of CO2e)	28484

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

No public funding from Annex-I Party or through ODA is 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:

According to the paragraph of the Appendix C of the Simplified Modalities and Procedures for small-scale CDM project activities, a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants;
- In the same project category and technology;
- Registered within the previous 2 years; and
- Whose project boundary is within 1km of the project boundary of the proposed small-scale project activity

The project is not a debundled activity of any large scale project activity. The project is unique and the only project owned by the investor in this stream.

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:

Title of the project activity: **TYPE – I RENEWABLE ENERGY PROJECT**
Reference for the project category: **IC – "Thermal energy for the user with or without electricity"**
Version: 13/EB 38

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

The proposed activity is utilization of renewable biomass (rice husk) for steam generation required for various processes at AIPL. Emission reductions due to the project activity are considered equivalent to the emissions that would have occurred from combustion of fossil fuel in the baseline scenario.

Additionally this is a small-scale project activity as the thermal output is less than $45MW_{thermal}$ (see annex 3 for details). Hence, it qualifies for the category IC.

Table 2: Justification of the applicability criteria

Category	Applicability Criteria	Justification
TYPE IC:	This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuel. Examples include solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass for water heating, space heating, or drying and **other technologies that**	The project activity is based on renewable biomass combustion for thermal energy generation in place of fossil fuel combustion which is used on-site at AIPL's plant in the baseline scenario.

Thermal energy for the user with or without electricity	**provide thermal energy that displaces fossil fuel.**	
	Cogeneration projects that **displace/avoid fossil fuel combustion in the production of thermal energy (e.g. steam or process heat)** and/or electricity shall use this methodology. The capacity of the project in this case shall be the thermal energy production capacity i.e. 45MWth.	The project activity utilizes renewable biomass and **displaces fossil fuel combustion. The total boiler output capacity is less than 45MWth (refer annex 5 for details).**

B.3. Description of the project boundary:

As per the approved methodology, "*The physical, geographical site of the renewable energy generation delineates the project boundary*".

The project boundary includes the production facility, steam generation boilers, biomass storage area and allied systems.

Project boundary is illustrated in the following diagram.

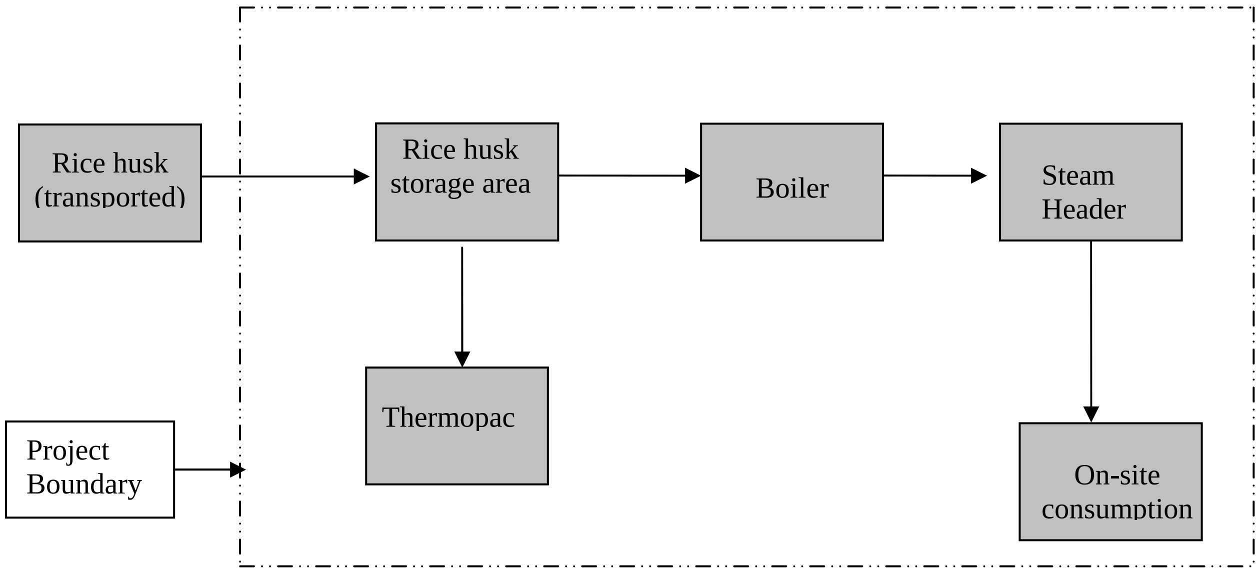


Figure 5 Project boundary as defined for the project activity

B.4. Description of baseline and its development:

As per the approved baseline methodology *"For renewable energy technologies that displace technologies using fossil fuel, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficient may be used".*

In the absence of the CDM project activity, AIPL would have used coal for steam generation. To estimate emissions in the baseline emissions, conservative boiler efficiency figures as prescribed by CERC are taken. IPCC default values for coal related emission coefficients are used.

Leakage is not considered because there is no transfer of energy generating equipment from another project activity and no transfer of existing energy equipment to another activity.

Table 3: Key information for determination of baseline scenario

Parameter	**Value**	**Data source**
Steam consumption in the plant	As measured	Plant operation data
Coal emission factor	96.1 tCO2e/TJ	IPCC default values 2006
Boiler efficiency (max.)[1]	88.7%	Recommendations from Central Electricity Authority (CEA) and expert committee. http://www.cercind.org/steam.doc
Biomass Net Calorific Value	As determined	From test report

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:

The additionality of the project activity is assessed and demonstrated based on the stipulations contained in Attachment A to Appendix B of the Simplified Modalities and Procedures for small-scale project CDM project activities.

In the absence of the project activity, AIPL would have used continued use of fossil fuel for steam generation which would have been the most likely and economically feasible option. The same is still the case with a majority of players in the industry. The key advantage with the fossil fuel based thermal generation system is the assured quantity and quality of the fuel supply and thus the related project and operation risk is very low.

There is no regulatory requirements for AIPL to invest in the biomass based plant, nor are there any planned regulations that will require it to implement the project activity.

The perceived risks and barriers for the project activity are discussed in the sequential order as explained in the Attachment A to Appendix B.

Investment Barrier

[1] This is conservative.

The major investment barrier to the project is the perceived risk in case of reduced supply of rice husk or increased rice husk prices in future. Investors are worried that shortage in supply of rice husk in future, may lead to steep rise in prices of rice husk which might render the project financially unstable.

This is evident from the fact that the cost of rice husk during the financial closure was INR 1600-1700/ton, which sometimes increases to INR 1900-2000/ton. This is attributed to the seasonal changes and improper collection mechanism, inconsistency in production, etc. This escalation in the rice husk prices was expected at the time of project conception and the same is expected to continue in future.

Table 4: Financial analysis – steam generation

Financial Analysis of Rice Husk based steam generation		
Quantity of rice husk required in a year	23695	Tonnes
Cost of rice husk in the area	1800	Rs./Tonne
Expense for rice husk in a year	426.5	Rs. Lakhs/year
Expected annual earnings from sale of CERs @15 Euros	270	Rs. Lakhs/year

As per the prevailing prices of CER, the benefits from CDM will compensate the increase in the rice husk prices. The CDM revenue hence will help to improve the sustainability of the project which will otherwise be rendered financially unstable. The coal based steam generation would not have faced such barriers.

Table 5: Comparison of steam generation from coal and biomass

Comparison with coal based steam generation		
Parameter	**Coal based**	**Biomass based**
Quantity of fuel required (tonnes)	13630	23695
Calorific Value (Kcal/kg)	4500	2800
Cost of fuel	2000	1800
Unit cost of steam generation (Rs./tonne)	286	448

The per unit cost of steam generation from biomass based project as evident is quite high as compared to that from coal based boiler. The investors expect to compensate for this investment barrier with the CDM revenues. Any unanticipated rise in the price of rice husk will increase per unit cost of steam generation even more. It has also been observed that in other parts of the country that biomass prices increase significantly because of improper collection mechanism, inconsistency in production, etc. There have been some instances where prices are shooting up from Rs. 1600/tonne to Rs. 2200/tonne. Hence, CDM revenues are very indispensable for the project activity and will help the project to become financially stable.

Technological Barriers

The biomass boiler is more laborious than fossil fuel in terms of fuel handling, fuel segregation, proper fuel supply and requires employment and training of new workers. The availability of trained personnel, having experience in biomass based thermal power plants was difficult. Hence, the experience on the biomass based plant is less when compared to fossil fuel based plant.

Corrosion from firing biomass fuels

Compared with coal, biomass has a high amount of potassium, chlorine and silicon with minor amounts of Ca, Na and S. They are very harmful in terms of causing fouling, slagging and high temperature corrosion in the boilers[2]. Chlorine can influence the corrosion of super heater tubes in many ways. Gases containing Cl_2, HCl, NaCl cause a direct corrosion by accelerating the oxidation of metal alloys, thereby eating away the metal[3].

Since, biomass causes higher abrasive impacts on boiler tube surfaces and other boiler parts exposed to it, which requires constant safeguarding and operation and maintenance as compared to a fossil fuel based power plant.

Erosion corrosion by biomass fired boiler fly ash

It has been found that biomass fired boiler fly ash has relatively high erosivity due to its composition containing high concentration of chemically active compounds of alkali, sulphur and phosphorus. This causes the material wastage by erosion and corrosion of the boiler coatings and boiler tubes. The use of rice as in this project activity would further enhance the erosion and corrosion as the fly ash content in rice husk is maximum of all the biomass types[4].

Table 6: Ash content in different biomass fuel types[5]

Biomass type	**Ash content** (wt % of dry fuel)
Sugarcane bagasse	11.3
Rice husk	**22.6**
Wheat straw	15.5
Switchgrass	8.9

Table 7: Summary of the fuel characteristics of biomass requiring special attention[6]

[2] Wei, X., Schnell, U., Hein, K. *Behavior of gaseous chlorine and alkali metals during biomass thermal utilization.* Fuel 84 (2005) 841-848.

[3] Neilsen, H.P., Frandsen, F.J., Dam-Johansen, K., Baxter, L.L. *The implications of chlorine-associated corrosion on the operation of biomass-fired boilers.* Progress in Energy and Combustion Science 26 (2000) 283-298.

[4] Bu-Qian Wang. *Erosion-corrosion of coatings by biomass-fired boiler fly ash.* Wear 188 (1995) 40-48.

[5] Demirbas, A. *Combustion characteristics of different biomass fuels.* Progress in Energy and Combustion Science 30 (2004) 219-230.

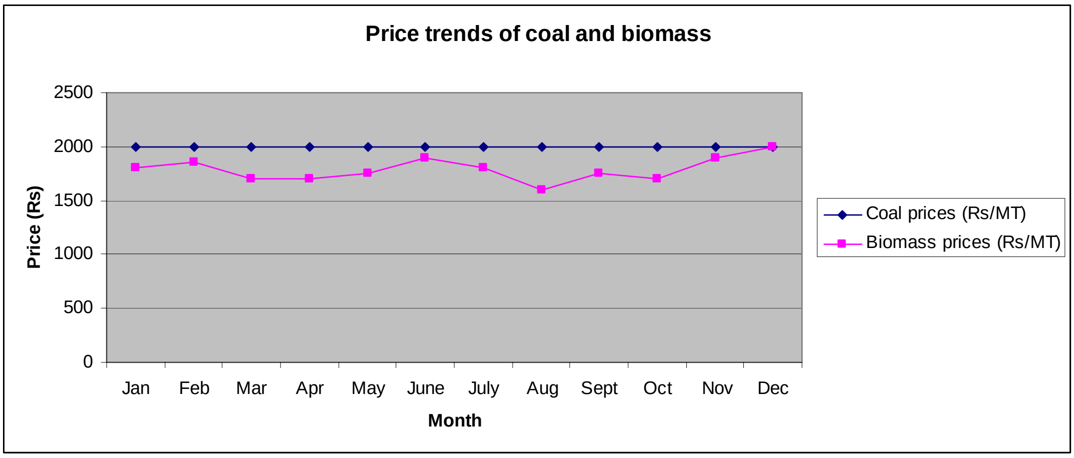
[6] Barrier issues to the utilization of biomass, Semiannual Technical Progress Report. National EnergyTechnology Laboratory, U.S Department of Energy. March 2002.

Fuel Property	Troublesome Characteristics	Potential Problem
High Alkali (Na, K)	Formation of low-melting-point compounds	Slagging/fouling of convective surfaces Sintering on the grate
Scrap Material Rock Dirt Metals Glass	Accumulation of rock and metal Glass and aluminum become molten	Plugging, mechanical breakdown Sintering Convective pass fouling
Chlorine	Formation of alkali chlorides and HCl Formation of chlorinated organic compounds	Corrosion Emissions exceeding local, state, or federal limits
Bulk Density	Low bulk density	High transportation costs High processing costs

<u>Other Barriers</u>

<u>Fluctuating prices of biomass around the year</u>

The biomass prices fluctuate from Rs.1600/MT to Rs. 2000/MT around the year as compared to coal prices which remain constant throughout the year. The fluctuating prices can make the project financially unstable.



Storage of biomass

Biomass is available only for a particular period of the year and hence requires adequate storage facilities. The characteristics of the biomass fuels also changes quickly within a short period of time. Most importantly, the calorific value decreases due to the loss of volatiles and deterioration of biomass, which affects the performance of the equipment. Hence, it is difficult to store biomass for very long period.

The proposed project activity involves the following additional barriers and uncertainties:

- The success of the biomass plant mainly depends on the availability of the biomass. Biomass availability is highly subject to seasonal variation due to the vagaries of the nature.
- Biomass prices continuously fluctuate depending on seasonal variations, making the cost of steam generation highly unstable.
- Biomass is widely dispersed in small quantities. Hence, collection and transportation of biomass to the project site becomes a constraint.

Collection, transportation of biomass

The efforts are required from the project proponent in collection and transportation of the biomass residues from various locations to the project site as presence of a structured and established market is not there and AIPL had to put in resources to make sure the availability of the biomass in the project activity regularly. A situation like this will not only create availability issues but may also impact the prices of biomass severely. Other than this, due to seasonal availability of biomass residues, AIPL had to make good arrangement for storage of biomass residues at the project site that would entail investment in land and its management. Furthermore, the bulk density of biomass is very low and as such transportation cost is much higher compared to conventional fuel.

To ensure a continuous and regular supply, a biomass management program will need to be prepared by the project proponent including the following:

- Identification of the definite sources of biomass to the project site from the neighboring areas for the continuous functioning of the unit.
- Identification of the delivery points for biomass collection, reliable agents and transport to the project site.
- Proper management of the bulk storage facility with enough space so that biomass can be brought to a certain level of moisture before use (this problem is more during monsoon time when the moisture level in the biomass would be higher and it would also take more time to dry up the biomass along with sieving system to remove impurities. All precautions should be taken by the project proponent to store the fuel from adverse weather conditions.
- An in-house facility for following:
    - Checking the quality of fuel.
    - Maintaining the daily log of the rice husk available, consumed and requirement in the plant.
    - Conducting laboratory tests at periodic intervals to check the calorific value and the moisture content of the biomass.

Common Practice Analysis

Not many industrial plants generate steam based on biomass residues in the area. AIPL is one of the few oil and vanaspati manufacturing plant in the region to run its plant based on biomass residues. Other players have not gone for similar projects due to various barriers as discussed above.

The above mentioned barriers hinder the adoption of such technology by many investors. This is evident from the fact there are no registered CDM projects from the state of Andhra Pradesh in this category. This again emphasizes the fact that CDM revenue will attract other industrial units also to come up and adopt the use of renewable biomass for steam and power generation.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions:
For renewable energy technologies that displace technologies using fossil fuel, the baseline is the emissions from the combustion of fossil fuel that would have been used in the absence of the project activity.

For steam/heat produced using fossil fuels the baseline emissions are calculated as follows:

$$BE_{y} = BE_{y,\ boiler} + BE_{y,\ thermopac}$$

and

$$BE_{y,\ boiler} = HG_{y,\ boiler} * EF\ CO_2 / \eta_{th\ boiler}$$

Where,

$BE_{y,\ boiler}$ = the baseline emissions from steam/heat displaced by the boiler in the project activity during the year y in CO_2e

$HG_{y,\ boiler}$ = the net quantity of steam/heat supplied by the boiler in the project activity during the year y in TJ

$EFCO_2$ = the CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in tCO_2/TJ,obtained from reliable local or national data if available, otherwise IPCC default emission factors are to be used.

$\eta_{th\ ,boiler}$ = the efficiency of the boiler using fossil fuel that would have been used in the absence of the project activity.

Similarly for thermopac, $BE_{y,\ thermopac} = HG_{y,\ thermopac} * EF\ CO_2 / \eta_{th\ thermopac}$

Where,

$BE_{y,\ thermopac}$ = the baseline emissions from steam/heat displaced by the thermopac in the project activity during the year y in CO_2e

$HG_{y, thermopac}$ = the net quantity of steam/heat supplied by the thermopac in the project activity during the year y in TJ

$EFCO_2$ = the CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in tCO_2/TJ,obtained from reliable local or national data if available, otherwise IPCC default emission factors are to be used.

$\eta_{th, thermopac}$= the efficiency of the thermopac using fossil fuel that would have been used in the absence of the project activity.

Project emissions:

There are no project emissions associated with the project activity since the biomass is a carbon neutral fuel and no fossil fuel will be used. In cases where biomass is not available, coal would be used in the plant for power generation. There will be GHG emissions due to burning of coal in the plant.

$$\mathbf{PE_{y, coal} = QCU_{y, coal} \times CEC_{y, coal} \times EF_{coal} \times OXID_{coal}}$$

Where, $PE_{y, coal}$ = Project emissions due to combustion of coal in boiler, tCO_2/annum

$QCU_{y, coal}$ = Total quantity of coal used in a particular year, tonnes (from the monitored data)

$CEC_{y, coal}$ = Net coal calorific value of coal, TJ/tonne

EF_{coal} = IPCC Default carbon emission factor for coal, CO_2/TJ

$OXID_{coal}$ = Coal oxidation factor (IPCC Default), %

Leakage:

As per the "General guidance on leakage in biomass project activities, Version 02 EB 28" leakage estimation has been done as follows:

Parameter	**Guidance on leakage**	**Project activity status**
Shift of pre-project activity	Decrease in carbon stock, for example as a result of deforestation, outside the land area where the biomass is gown, due to shifts of pre-project activities.	The project activity proposes use of only surplus biomass residue primarily rice husk in energy generation and does not lead to deforestation outside the land area where the biomass is grown. This would be verified through annual survey/ reports from government/ experts available in public domain.
Emissions from biomass generation/ cultivation	Potentially significant emission sources from the production of renewable biomass can be: (a) Emissions from application of	As the biomass used in project activity is only crop residues, there are no additional emissions on account of generation/ cultivation.

	fertilizer; and (b) Project emissions from clearance of lands.	
Competing use of biomass	The project participant shall evaluate annually if there is a surplus of the biomass in the region of the project activity, which is not utilized. If it is demonstrated (e.g. using published literature, official reports, surveys etc.) that the quantity of available biomass in the region (e.g. 50 – 100 km radius), is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions.	The project proponents have conducted an assessment of surplus biomass availability in the region. As per the report East Godavari district (where the project activity is located) has a surplus biomass (rice husk) of 3, 35,925 tons/year. Further the assessment is part of the project monitoring plan and AIPL would carry out these assessments on annual basis as per the Guidance if not available in public domain conducted by dependable sources.

The transportation of biomass from the biomass centers to the plant site can lead to leakages in the form of fuel burning in the various modes of transport used.

Leakage due to transportation	
Biomass load per truck	12 tonnes
Total number of trips	1974.58 km
Total distance traveled	98729 km
Average distance between collection center and plant	50 km
Consumption of diesel/trip (to and fro) @5 km/liter	39491.6 liters
Emission factor for diesel	0.00276 tCO_2/liter of diesel
Emissions due to transportation of biomass	108.96 tCO_2

Calculations in the above table suggest that the affect of leakage due to transportation is negligible (<~0.4%) in the project activity. Hence, leakage effect due to transportation is not taken in calculations.

As discussed above, project activity does not lead to any leakage. Therefore,

$\mathbf{ER_y = BE_y - PE_y}$

Where,

ER_y = Emission reductions due to the project activity in the year y in tCO_2

BE_y = Baseline emissions in tCO_2

PE_y = Project emissions due to the project activity in the year y in tCO_2

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

(Copy this table for each data and parameter)

Data / Parameter:	**$EFCO_2$**
Data unit:	tCO_2/TJ
Description:	The CO2 emission factor of coal that would have been used in the absence of the project activity by AIPL.
Source of data used:	Intergovernmental Panel on Climate Change (IPCC) default values
Value applied:	96.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per methodology
Any comment:	

Data / Parameter:	$\eta_{\text{th boiler}}$
Data unit:	Per cent (%)
Description:	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity.
Source of data used:	Recommendations from Central Electricity Authority (CEA) and expert committee. http://www.cercind.org/steam.doc
Value applied:	88.7
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is conservative
Any comment:	

Data / Parameter:	$\eta_{\text{th thermopac}}$
Data unit:	Per cent (%)
Description:	The efficiency of the thermopac using fossil fuel that would have been used in the absence of the project activity.
Source of data used:	Technical specifications as provided by the technology provider
Value applied:	76
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is conservative
Any comment:	

Data / Parameter:	**Coal Oxidation Factor**
Data unit:	%
Description:	The oxidation factor of coal that would have been used in the absence of the project activity by AIPL. Required for establishing the baseline of the project activity.
Source of data used:	Intergovernmental Panel on Climate Change (IPCC) default values, 2006
Value applied:	1.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per methodology
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

In the absence of the project activity, steam would have been generated using coal in a coal fired boiler of similar specifications. The baseline emissions are based on equation no.1 described in Section B.6.1 of this document.

$$\mathbf{BE_{y,\,boiler} = HG_{y,\,boiler} * EF\ CO_2 / \eta_{th\ boiler}}$$

$BE_{y,\,boiler}$ = 12 x 330 x 24 x (2798-439) x 96.1 / 88.7% = 24290 tCO_2/annum

Also, thermopac runs on biomass that would have been based on fossil fuel combustion in the absence of the project activity.

$$\mathbf{BE_{y,\,thermopac} = HG_{y,\,thermopac} * EF\ CO_2 / \eta_{th\ thermopac}}$$

$BE_{y,\,thermopac}$ = 1000 x 4.187 x 330 x 24 x 96.1/76%/1000/1000 = 4193 tCO_2/annum

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

Year	**Estimation of Project Activity Emissions (tCO_2 e)**	**Estimation of Baseline Emissions (tCO_2 e)**	**Estimation of Leakage (tCO_2 e)**	**Estimation of overall emission reduction (tCO_2 e)**
2008-09	0	28484	0	28484
2009-10	0	28484	0	28484
2010-11	0	28484	0	28484
2011-12	0	28484	0	28484
2012-13	0	28484	0	28484
2013-14	0	28484	0	28484
2014-15	0	28484	0	28484
2015-16	0	28484	0	28484
2016-17	0	28484	0	28484

2017-18	0	28484	0	28484
Total (tones of CO_2 e)	0	284840	0	**284840**

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:	Q_{steam}
Data unit:	Tonne
Description:	The net quantity of steam supplied by the project activity during the year y.
Source of data to be used:	Plant operation data
Value of data	-
Description of measurement methods and procedures to be applied:	Directly measured using steam flow meter
QA/QC procedures to be applied:	Steam flow meter will be checked regularly and calibrated annually
Any comment:	Frequency of monitoring: Daily

Data / Parameter:	E_{steam}
Data unit:	kcal/kg
Description:	Enthalpy of steam generated in boiler
Source of data to be used:	Estimated based on steam pressure and temperature
Value of data	
Description of measurement methods and procedures to be applied:	Estimated value
QA/QC procedures to be applied:	
Any comment:	Frequency of monitoring: Daily

Data / Parameter:	$E_{Feedwater}$
Data unit:	kcal/kg
Description:	Enthalpy of feedwater
Source of data to be used:	Estimated based feed water temperature

Value of data	-
Description of measurement methods and procedures to be applied:	Estimated value
QA/QC procedures to be applied:	-
Any comment:	Frequency of monitoring: Daily

Data / Parameter:	**$Q_{thermic\ fluid}$**
Data unit:	kcal
Description:	Quantity of thermic fluid heated in thermopac
Source of data to be used:	Plant operation records
Value of data	-
Description of measurement methods and procedures to be applied:	Directly measured using flow meter
QA/QC procedures to be applied:	
Any comment:	Frequency of monitoring: Daily

Data / Parameter:	**Ti**
Data unit:	Deg C
Description:	Temperature at inlet of thermic fluid
Source of data to be used:	Plant operation records
Value of data	
Description of measurement methods and procedures to be applied:	Directly measured using temperature gauge
QA/QC procedures to be applied:	
Any comment:	Frequency of monitoring: Daily

Data / Parameter:	**To**
Data unit:	Deg C
Description:	Temperature at outlet of thermic fluid
Source of data to be used:	Plant operation records
Value of data	
Description of measurement methods and procedures to be	Directly measured using flow meter

applied:	
QA/QC procedures to be applied:	
Any comment:	Frequency of monitoring: Daily

Data / Parameter:	**Sp**
Data unit:	Deg C
Description:	Specific heat of thermic fluid
Source of data to be used:	Plant operation records
Value of data	
Description of measurement methods and procedures to be applied:	Thermic fluid tests conducted onsite/external labs
QA/QC procedures to be applied:	
Any comment:	Frequency of monitoring: Yearly

Data / Parameter:	**$Q_{Biomass}$**
Data unit:	Tonnes
Description:	Quantity of biomass used
Source of data to be used:	Plant operation data
Value of data	20607
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	The quantity of biomass used can be cross-checked with the invoices raised by the biomass suppliers
Any comment:	

Data / Parameter:	**CV_{husk}**
Data unit:	kcal/kg
Description:	This is the calorific value of the rice husk used in the project activity
Source of data to be used:	Test reports from the plant site
Value of data	3000
Description of measurement methods and procedures to be applied:	The calorific value of the rice husk used in the project activity is measured using a bomb calorimeter
QA/QC procedures to be applied:	The bomb calorimeter is maintained and regularly calibrated
Any comment:	

B.7.2 Description of the monitoring plan:

This monitoring plan is developed in accordance with the modalities and procedures for small-scale CDM project activities. The monitoring plan, which will be implemented by the project proponents, describes about monitoring organization, parameters to be monitored, monitoring practices, QA and QC procedures, data storage and archiving.

Monitoring organization

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data sets with the Board of Directors who may delegate the same to a competent person identified for the purpose. The identified person, in the rank of General Manager, will be in charge of GHG monitoring activities within project's functioning. The General Manager will be assisted by a CDM Manager and a team of experienced personnel in disciplines such as mechanical and electrical with experience in plant operations, measurements and management. The primary responsibility of the team is to measure, monitor, and record and report the information on various data items to the CDM Manager in accordance with the applicable standards. Periodic calibration of the various instruments used in the monitoring of GHG related data and record keeping of the same also will be the responsibility of the team.

The responsibility of review, storage and archiving of information in good condition lies with the CDM Manager. The CDM Manager will undertake periodic verification and onsite inspections to ensure the quality of data collected by the team and initiate steps in case of any abnormal conditions.

An internal audit report will be prepared for review by the Board of Directors which will be later submitted for verification by an independent entity (DOE). Board of Directors will examine the internal audit reports and will in particular take not of any deviations in data over the norms and monitor that the corrective actions have resulted in adherence to the standards.

The team including the General Manager will be appointed by Board of Directors, advance before the start of project operations. The General Manager will report to the Board of Directors and seek guidance in case of conflicts or difficulties in order to maintain the monitoring organization in good spirit.

Parameters requiring monitoring

This monitoring plan requires monitoring of thermal energy generation i.e. steam consumption and biomass consumption. Necessary documents required for the verification of the data will be maintained for later archiving. Emission reductions generated by the project will be monitored at regular intervals and will be reported to the Board of Directors.

Data storage and archiving

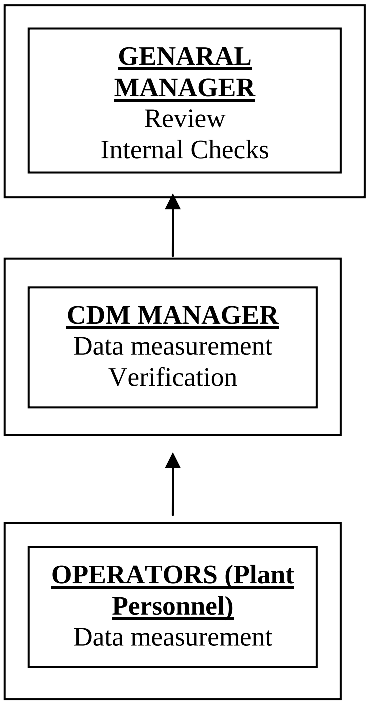
All the data items monitored under the monitoring plan will be kept for 2 years after the end of crediting period or till the last issuance of CERs for this project activity whichever occurs later. The monitored data will be presented to an independent verification agency or DOE to whom verification of emission reductions will be assigned.

Reliability of data collected: The reliability of the metering system will be checked on regular basis.

Checking data for its correctness and completeness: The CDM team would have the overall responsibility of checking data for its completeness and correctness. The data collected from the daily logs will be forwarded to the concerned person.

Emergency preparedness: The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. Still, the project proponents have prepared GHG Performance Manual discussing about emergency preparedness.

Management structure for monitoring the emission reduction



Training of CDM team personnel:
Training of the CDM team and plant personnel will be carried out on CDM principle, CDM activities, monitoring of data and record keeping through a planned schedule in advance and a record of various training programmes undertaken would be kept for verification.

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 completing the final draft of the baseline: 10/06/08

Name of the entity determining the baseline:
Agarwal Industries Pvt. Ltd.
15-1-52/1, Jagdish Niwas,
Old Feelkhana, Hyderabad

Andhra Pradesh - 500012

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:

24/03/2006

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

20 Years

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

C.2.1. Renewable crediting period

NA

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

NA

C.2.1.2. Length of the first crediting period:

NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/08/2008

C.2.2.2. Length:

10y-0m

SECTION D. Environmental impacts

The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification S.O. 1533 (http://envfor.nic.in/legis/eia/so1533.pdf) dated 14th September 2006 of the Ministry of Environment and Forests, Govt. of India. Further, the project proponent has obtained the consent to establish and operate (air and water) with the Andhra Pradesh Pollution Control Board.

The project activity comprises of electrostatic precipitators and covered ash handling conveyer system. The Ambient Air Quality is within the standards prescribed by the State Pollution Control Board.

The project activity envisages the use of biomass residue as fuel for steam generation and displacement of fossil fuel. There is no adverse impact on the project activity (air, water, land). It has only positive impacts in the form of GHG emission reduction associated with fossil fuel burning.

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

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:

SECTION E. Stakeholders' comments

>>

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

The stakeholders identified by the project proponents for the project activity are:

- Andhra Pradesh Pollution Control Board (APPCB)
- Authorities of the local administration
- Rice husk suppliers
- Local villagers and village panchayat

Advertisements were published by the project proponents in the local newspaper, describing their project activities. Comments and suggestion were asked for from the local people. A letter to District Authority intimating them about the project activity was also sent.

A meeting was conducted by AIPL with the local villagers at the plant site. AIPL described them the project activity and the impacts it would make on the people of the nearby areas.

The local communities were positive to the project activity, as it would generate direct and indirect employment opportunities for the local people for activities such as transportation of biomass, sale of biomass, loading-unloading, husk collection, etc.

E.2. Summary of the comments received:

Biomass suppliers extended their support to the project activity from AIPL and appreciated the efforts of the project proponents. Local people expressed their satisfaction on the project activity as a source of income.

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

No comments received; hence no report is applicable.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Amit Agarwal Industries Pvt. Ltd.
Street/P.O.Box:	15-1-52/1
Building:	Jagdish Niwas, Old Feelkhana
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500012
Country:	India
Telephone:	+91-040-66836909
FAX:	
E-Mail:	amit@agarwalindia.com, goldmohar@hotmail.com
URL:	
Represented by:	
Title:	Executive Director
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	
First Name:	Amit
Department:	
Mobile:	
Direct FAX:	+91-040-66635533
Direct tel:	+91-040-66836909
Personal E-Mail:	goldmohar@hotmail.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from the parties included in Annex-I or through ODA is involved in the project activity

Annex 3

Baseline Information

The baseline emissions for the project activity are calculated as below.

Parameter	Value	UoM
Boiler		
Steam quantity	12000	kgPH
Steam pressure	17.5	kg/cm2
Steam temperature	Sat	Deg C
Design efficiency of coal based boiler	88.70%	%
Coal emission factor	96.1	tCO2e/TJ
Oxidation Factor	1	
Running hours	7920	Hrs per annum
Enthalpy of steam	2798.4	KJ/kg
Enthalpy of feed water	439.3	KJ/kg
Net energy output	2359.1	KJ/kg
Energy input in boiler	28309200	KJ/h
Baseline Emissions	**24291.40**	**tCO2/annum**
Thermopac		
Thermopac capacity	1000	kcal/h
Thermopac efficiency	76.0%	%
Fuel energy input	1315.79	
Running hours	7920	hours/annum
Fuel emission factor	96.1	tCO2/TJ
Baseline Emissions	**4193.13**	**tCO2/annum**
Total Baseline Emissions	**28484.53**	**tCO2/annum**

*Design efficiency of the coal based boiler taken from Recommendations from Central Electricity Authority (CEA) and expert committee. Available at http://www.cercind.org/steam.doc

**Coal emission factor and Oxidation factor taken from IPCC default values

***Steam enthalpy referred from Standard Steam Table

Annex 4

Monitoring Information

Please refer to Section B.7 for more details on the monitoring parameters and the monitoring system.

Annex 5

Applicability criteria: Small-scale limit

Parameter	Value	UoM
Steam Quantity	12	TPH
Steam Pressure	17.5	kg/cm2
Steam Temperature	207.7	Deg C
Steam Enthalpy*	2796.65	kJ/kg
Feedwater Enthalpy	439.635	kJ/kg
Thermal Output/kg of steam	28284.18	kJ/kg
Thermal Output from boiler	**7.98**	MWth

The thermal output from boiler as calculated above is less than the small-scale limit of 45 $MW_{thermal}$. Hence, the methodology is applicable to the project activity.

* Steam table referred from Standard Steam Tables.

Annex 6

Information on biomass availability

Surplus biomass from various sources in the East Godavari District

S.No	Biomass	Surplus Tons/year	%
Agro-Field biomass			
1.	Coconut Residue	1,78,877	20.18
2.	Tapioca Stem	2,09,880	23.67
3.	Sugarcane Trash	89,448	10.09
4.	Green gram stalks	39,118	4.41
5.	Black gram stalks	16,105	1.82
6.	Maize stalks	10,705	1.21
7.	Cotton stalks	6,273	0.71
8.	Bajara stalks	209	0.02
9.	Paddy hay	0	0.00
Agro-Industrial Biomass			
10.	***Rice Husk***	***3,35,925***	***37.89***
Total		8,86,540	100.0

Source: Biomass assessment report prepared by ABI Energy Consultancy Services Pvt. Ltd.