CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

SECTION A. General description of the small-scale project activity

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

Sri Balaji 6 MW Non-Conventional Renewable Sources Biomass Power Project

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

Purpose

The purpose of the project essentially is to utilize the available biomass fuels[1] in the region effectively for generation of power. The generated power will be sold to the state grid for sustainable economic growth, conservation of environment through use of biomass fuels and Green House Gas (GHG) emission reduction. The project will also help to reduce the ever-increasing demand and supply gap of electricity.

The primary fuels proposed for the power plant are rice husk and Julie flora in addition to other available biomass fuels like Cotton stalks, sunflower stalks, and Groundnut husks. The fuel requirement for 100% capacity is estimated at around 58000 tonnes per year as against the availability of 544000 tonnes per year in the region[2]. A survey carried out indicates that the fuels to be used are available in abundance within radii of 25 km from the plant site. Other fuels like cotton stalk, blackgram stalk and groundnut shell are also available abundantly and could be considered as alternative fuels. Cuddapah district is one of the prominent agriculturally and industrially developed districts of Andhra Pradesh.

Considering the adequate availability of bio-mass in the area, Sri Balaji Biomass Power (P) Limited (SBBPPL) have set up the power plant in Chennur Village, Chennur Mandal, Cuddapah district, Andhra Pradesh.

NEDCAP and other related Govt. agencies allow up to 20-25% of coal to use in the power plant. Based on the NEDCAP biomass assessment survey reports, NEDCAP had sanctioned the biomass based power plants in the state. Sustained and continuous availability of biomass was envisaged in the reports. This ensures the continuous availability of biomass in the region. Non usage of coal in the plant since beginning indicates the sufficient availability of the biomass. In case of biomass shortage in the future, plant has option to use other fuels like coal up to 25% of the total fuel

[1] Sustainable grown renewable cyclic crops

[2] Detailed Project report of 6 MW Power plant

requirement. Also, project activity is only one power plant in the district and there are very remote chances of start of new biomass power plants in near future. This also ensures the adequate supply of biomass to the plant.

In addition, plant management also monitors the operating conditions of rice mills in the region along with monitoring the de-caricator units for ground nut shell to ensure the continuous supply of feed stock.

The following local benefits are also experienced due to the setting up of project:

- Proper utilization of surplus biomass;
- Generation of eco-friendly green power;
- Avoidance of burning of agriculture waste;
- Reduction of CO_2 emissions

Contribution to Sustainable Development

The project activity is a renewable energy power project for power generation and export of clean power to Transmission Corporation of Andhra Pradesh (APTRANSCO). This generation of power will substitute the power generated and fed to conventional fossil fuels dominated grid.

Indian economy is highly dependent on "Coal" as fuel to generate energy and for production processes. Thermal power plants are the major consumers of coal in India and yet the basic electricity needs of a large section of population are not being met. This results in excessive demands for electricity and place immense stress on the environment. Changing coal consumption patterns will require a multi-pronged strategy focusing on demand, reducing wastage of energy and the optimum use of Renewable Energy (RE) sources.

Since this project activity utilizes renewable energy source, it will positively contribute towards the reduction in (demand) use of finite natural resource like coal/gas/oil, minimizing depletion or else increasing its availability to other important processes.

Government of India has stipulated the following indicators for sustainable development in the interim approval guidelines[3] for CDM projects.

1. Social well being

[3] Ministry of Environment and Forest web site http://envfor.nic.in/cdm/host_approval_criteria.htm#

2. Economic well being
3. Environmental well being
4. Technological well being

Project activity contributes to the sustainable development in following way:

1. Social well being:

- Development of the region is expected due to the existence of the project in rural area.
- Collection and transportation of the biomass fuel from fields could generate direct and indirect employment opportunities to the rural people.
- More and more rural industries are expected be set up as a consequence to the power plant in the area. This also will cause infrastructure development in the area, which ultimately leads to the rural development. This also prevents the migration of the rural poor to cities due to opportunities created by the power plant.

2. Economical well being:

- The project activity generates employment in the local area. The project will also provide economic value to agricultural and wood wastes and provides stable and quality power to neighboring industry, farmers and households. The project will create a business opportunity for local stakeholders such as bankers, consultants, suppliers, manufacturers, contractors *etc.*
- The plant is generating commercial value to crop residues enabling the farmers to get better price out of their produce augmenting their income.

3. Environmental well being

- Since, the project uses only biomass materials for power generation, which otherwise would have been a fossil fuel such as coal, lignite and gas, the project does not lead to GHG emissions. Combustion of biomass materials in the project result in GHG emissions of CO_2, CH4 and NOx. The major constituent of GHG emissions is CO_2 which about 98%, whereas CH_4 and NOx constitute the remaining 2%. This can well be evidenced from the typical ultimate analysis[4] of biomass materials, which indicates the Nitrogen content is within 1 to 2%, therefore CH_4 emission is negligible. Hence the CO_2 is considered as the only GHG

[4] Chemical analysis of elements in the fuel (biomass)

emissions from the biomass combustion.

- Since the biomass is formed by fixing the atmospheric CO_2 by the action of photosynthesis in the presence of sunlight, the CO_2 released due to combustion of biomass is assumed to be equal to the CO_2 fixed by the photosynthesis. Again the CO_2 released during the combustion will be consumed by the plant species for their growth. In view of the above, biomass combustion and growth of biomass and associated CO_2 consumption and release can be treated as cyclic process resulting in no net increase of CO_2 in the atmosphere. Hence, the project will not lead to GHG emissions.

4. Technological well being

The technology selected for the proposed project is a more energy efficient technology due to the following features. The project uses a steam turbo generator with matching boiler of traveling grate type capable of firing multiple fuels with highest possible system efficiency. In addition, the auxiliary power consumption for traveling grate type is relatively less than other efficient combustion system types.

In view of the above the project participant considers that the project activity profoundly contributes to the sustainable development.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	Sri Balaji Biomass Power (P) Limited (Private entity. Project developer.)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

See contact information in Annex-1 to this PDD

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

The project activity is a 6 MW (Gross) capacity grid-connected biomass based renewable energy

power plant with high-pressure steam turbine configuration. On an annual average basis, the project exports around 5.4 MW power to the APTRANSCO grid by considering auxiliary power consumption of 10%. The plant is operating at an annual average plant load factor of 88%.

Further, no transmission and distribution losses are considered while calculating GHG emission reductions, since the project exports power to the nearby substation at Chennur, APTRANSCO grid, which is located at about 2.0 km from the site.

The power plant has one condensing steam turbo generator unit with a matching boiler of traveling grate type capable of firing multi fuels with rice husk, sunflower stalk, groundnut husk and cotton Husk, as the main fuels. All necessary auxiliary facilities of the power plant are provided. The boiler is sized to produce a maximum of 33 tons per hour of steam. The steam turbine is a straight condensing type machine with uncontrolled bleeds for de-aerator feed water heating. The steam conditions at the boiler heat outlet are a pressure of 67 kg/cm^2 and temperature of 485^{o}C. The higher steam parameters result in higher annual savings of fuel per annum when compared to lesser steam parameters like 44 kg/cm^2 and temperature of 440^{o}C.

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.:

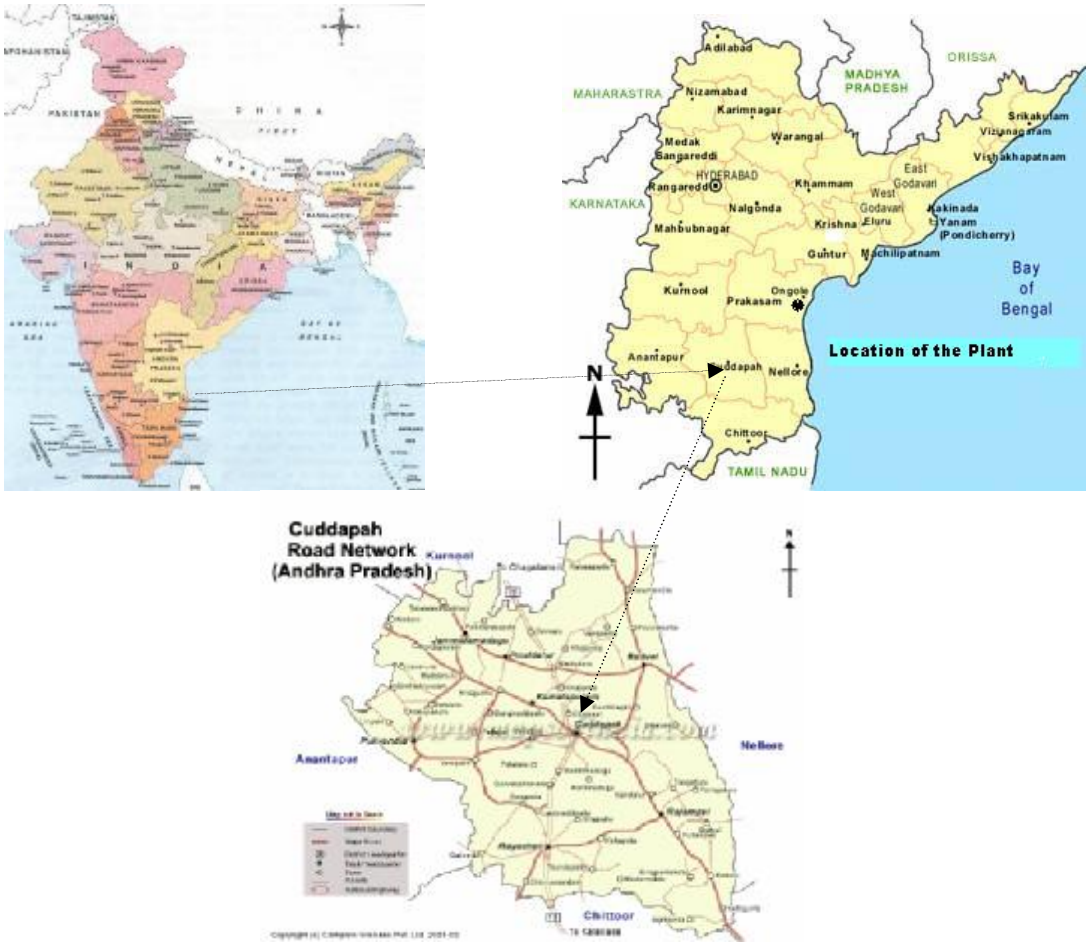
Andhra Pradesh

A.4.1.3. City/Town/Community etc:

Cuddapah district

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

The plant is located in Chennur village, Chennur Mandal, Cuddapah district, Andhra Pradesh. The plot area of the site measures approximately 26 acres. Power generated from the plant is proposed to be evacuated to Andhra Pradesh Transmission Company (APTRANSCO) grid through their 33/11 kV Chennur sub station which is about 2.0 km from the site.



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

As per Clause 2 of Type I.D of Appendix B of **simplified modalities and procedures for small-scale CDM project activities (Version 05: 25 February 2005),** in case of unit which co-fires renewable biomass and fossil fuel the capacity of the entire unit shall not exceed the limit of 15 MW, for the project to qualify as a small-scale CDM project. Therefore, the proposed project activity can be defined under

Main Category: Type I - Renewable Energy Project (Small Scale)

Sub Category: "D", Renewable Electricity Generation for a Grid (Biomass based Power Project)

Technology of the project

The technology adopted for the project activity is a standard and widely accepted practice for power generation using renewable sources. No technology transfer is required and know how for

the project technology is well established. Steam is generated in a high pressure boiler which is sized to produce a maximum of 33 tons per hour of steam. High pressure steam is passed through a straight condensing type machine with uncontrolled bleeds for de-aerator feed water heating to generate power to export to grid.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The power plant uses environmentally sustainable grown biomass. The GHG emissions of the combustion process mainly CO_2, is consumed by plant species, representing a cyclic process. Since, the biomass contains only negligible quantities of other elements like Nitrogen, Sulphur *etc.* release of other GHG are considered as negligible. The biomass is CO_2 neutral and thus environmentally benign limiting greenhouse effect.

Conventional energy equivalent of around 241 million kWh for a period of 7 years in AP would be replaced by exporting power from the 6 MW non-conventional renewable sources biomass based power plant thereby resulting in CO_2 emission reduction of around 200,130 tons. In the absence of the proposed activity, the same energy load would have been taken-up by thermal power plants and emission of CO_2 would have occurred due to combustion of conventional fuels like coal / gas.

According to the draft 16th electrical power survey[5] conducted by the Central Electricity Authority (CEA), the projected growth in the total energy consumption is expected to be 7.5 % per annum for the period 1997-98 to 2004-05. The energy requirement - 392 billion kWh in 1997-98 - is assessed to be 632 billion kWh in 2004-05. This puts tremendous pressure on fast depleting natural resources to use more to meet the continuous increase in demand. Effective utilization of abundantly available renewable sources to minimize the usage of fossil fuels is the need of the hour. However, due to various technical and policy related barriers (as mention in section B3) the share of renewable energy in the APTRANSCO grid is less than 5%. The power plant not only justifies the shortage of power availability and energy but also the eco-friendly power generation.

[5] CEA Publication

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2e
2004-2005	29700
2005-2006	28405
2006-2007	28405
2007-2008	28405
2008-2009	28405
2009-2010	28405
2010-2011	28405
Total estimated reductions (tones of CO2e)	**200130**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	28,590

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

No public funding from parties included in Annex I is available to the project.

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

According to Appendix C of Simplified Modalities & Procedures for small scale CDM project activities, 'Debundling' is defined as the fragmentation of a large project activity into smaller parts.

With reference to the criteria mentioned, this biomass power plant is not a de-bundled component of a large project activity as there is no registered small scale CDM project activity (previous 2 yrs) or an application to register another small scale CDM project activity by the same (SBBPPL) project proponent, in the same project category and technology/measure with project boundary within 1 km radius of this project activity.

SECTION B. Application of a baseline methodology:

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

Title:

Renewable electricity generation for a grid

Reference:

The project activity meets the eligibility criteria to use the simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7.

Details of methodology for baseline calculations for CDM projects of capacity less than 15 MW are available in the "Appendix B of the simplified modalities and procedure for small scale CDM project activities". Reference has been taken from indicative simplified baseline and monitoring methodologies for selected small scale (CDM projects less than 15 MW) project activity categories.

Renewable technologies that supply electricity to the grid are covered in category I.D. The category comprises renewable such as small hydro, wind, geothermal and biomass that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or nonrenewable biomass fired generation unit.

B.2 Project category applicable to the small-scale project activity:

Main Category: Type I - Renewable Energy Power project

Sub Category: I. D Renewable Electricity Generation for a Grid

As per the Kyoto Protocol (KP) baseline should be in accordance with the additionality criteria of article 12, paragraph 5(c), which states that the project activity must reduce emissions that are additional to any that, would occur in the absence of the certified project activity.

Document Annex B to attachment 3 regarding indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories, provides guidelines for preparation of Project Design Document (PDD) including baseline calculations. The category and the sub type of the activity are given above.

Baseline methodology mentioned in the paragraph no. 7 of Type I. D. of Annex B of the simplified modalities and procedures for small scale CDM project activities, states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2/kWh) calculated in transparent and conservative manner as under:

a) The average of the "approximate operating margin" and "build margin", where;

i) The "Approximate operating margin" is the weighted average emissions (in kg CO2 equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

ii) The 'Build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent[6] 20%[7] of existing plants or the 5 most recent plants";

OR

b) The weighted average emissions (in kgCO_2equ/kWh) of current generation mix.

A complete analysis of southern regional grid has been carried out with the study of various related issues like technology scenario, policy matters, economic conditions, development of renewable energy projects etc. for preparation of baseline scenario and calculation of baseline emission factor of the grid.

The project activity would displace an equivalent amount of electricity that would have been drawn from the grid generation mix. Since the displaced electricity generation is the element that is likely to affect both the operating margin in the short run and the build margin in the long run, electricity baselines should reflect a combination of these effects. Therefore the most appropriate approach for baseline methodology would be as descried in Paragraph no. 7 under category I.D of Appendix B of the simplified M&P for small scale CDM project activities of the UNFCCC.

In this project case, the project is small scale only having generating capacity of 6 MW. Hence, this is a operating margin scenario where we can assume that the principal effect will be on the operation of current or future power plants. However in view of the predicted power deficit status

[6] Generation data available for the most recent year

[7] If 20% falls on part capacity of a plant, that plant is included in the calculation

in the state in future, a delay effect in future power plants may creep in due to the occurrence of this project although to a limited extent. Ideal baseline approach is envisaged as the one that combines both operating and build margin as prescribed in first alternative given in paragraph 7 under Category 1.B of the UNFCCC M&P for small scale projects.

The other alternative is to go by the weighted average emissions (in kgCO2/kWh) of all existing sources of power generation in the grid mix, and arrive at the baseline emission factor.

For the project activity, combined margin approach has been adopted to derive the baseline emission factor for the entire southern grid.

However, the key information and data used to determine the baseline scenario (variables, parameters, data sources, etc.) are listed in the following table.

Key Parameter	**Value**	**Data Source**
P_{wlc}	Power generation by all sources, excluding hydro, biomass and nuclear	All related authentic sources like APTRANSCO, KPTCL, TNEB, KSEB, CEA etc
P_{fuel}	Share of power generation by each fuel used	Calculated for power plants in Southern regional grid
CMF	Base line "Combined Margin" emission factor calculated for grid electricity generation	Calculated for power plants in Southern regional grid
OM_{bef}	CO_2 operating margin emission factor for grid	Calculated for power plants in Southern regional grid
BM_{yr}	CO_2 build margin emission factor for grid	Calculated for power plants in Southern regional grid
TP_{gen}	Total power generated by the project activity	Measured from the plant records
TP_{exp}	Power exported to the grid per annum	From plant and APTRANSCO records
Text	Identification of power source / plant for the OM	
Text	Identification of power source / plant for the BM	

B.3. 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 project activity meets the eligibility criteria to use simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7.

As per the decision 17/cp.7 Para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

Further referring to Appendix A to Annex B document of indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories, project participants shall provide a qualitative explanation to show that the project activity would not have occurred anyway, at least one of the listed elements should be identified in concrete terms to show that the activity is either beyond the regulatory and policy requirement or improves compliance to the requirement by removing barrier(s) ;

1. Financial barrier

The CDM fund for the project was initially considered to cover the project risk related to the fuel (biomass) price increase in the future. The CDM fund is critical considering biomass availability and prices are seasonal, which depends on many external factors whereas the earnings for the power plant are at long term fixed rate. Therefore, the revenue from CDM could prove to be vital, as they would significantly improve the sustainability of the project, as the project can be rendered financially unstable due to

a. The increase in cost of fuel ; and
b. The decrease in tariff by virtue of revised tariff by the off taker

The above factors are true for the project activity and in absence of CDM funds it is very likely that project activity would have used (or may use) more financially viable option such as coal as fuel.

Raw material cost per tonne since inception has increased, a brief comparison of which is given herewith.

	DPR COST, RS.	EXISTING COST (2004-05),RS.
Rice husk	600	1100
Cotton stalk	300	600
Sunflower stalk	300	600
Groundnut shell	600	1100

Due to the increase in the raw material cost there has been a continuous increase in the cost per unit of generation since the project inception. It is envisaged that the raw material cost in the subsequent years would continue to increase.

Due to the increase in the raw material cost there has been a continuous increase in the cost per unit of generation since the project inception. It is envisaged that the raw material cost in the subsequent years would continue to increase.

The initial PPA with off taker APTRANSCO was signed at a tariff of Rs. 2.25 per unit with base year as 1995-96 and 5% escalation per year. The tariff for the year 2003-04 was Rs. 3.48 per unit. However, with the revised[8] tariff order by Andhra Pradesh Electricity Regulatory Commission (APERC), the tariff rate is Rs.2.88 per unit. This would result in heavy financial losses and put an additional burden on the financial sustainability of the project.

CDM Benefit s for 7 years

	CERs	Rate (Euros)	Exchange rate	Million INR	Million Units replaced	Cost per unit (Rs.)
SBBPPL	200,130	5	55	55.03	241.0	0.23

The CDM benefit per unit (kWh) of power replaced is about Rs. 0.23. It is envisaged that the raw material cost would further increase, which would lead to further increase in the cost of generation from present Rs. 2.85 to more than Rs. 3.0 in coming years. Presently the revenue from the sale of power to state grid is just sufficient enough to meet the production requirements. This CDM benefit per unit of power would definitely help the plant to operate in sustainable manner.

Thus the project justifies the need of CDM funds for the project activity, which will help in

[8] APERC tariff order, R.P. No.84 / 2003 in OP No 1075 / 2000 dated 20.03.2004

significantly improving the project competitiveness and financial sustainability due to reduction in tariffs and increase in raw material cost.

2. Policy related barriers

APERC in a landmark order has proposed to reduce the power tariff rates for non-conventional energy sources. The rate per unit has been decreased from Rs 3.48/- per unit to Rs 2.88/- per unit. As per the new proposal the tariff rates will be of two parts – fixed and variable. The fixed cost is based on the year of commissioning and it will come down gradually over a period of 10 years, whereas variable cost will go up by 5% every year up to a control period of 5 years.

However, it has been observed that the cost of the fuel from inception to date has increased thereby increasing the cost of generation. This has resulted in creating an imbalance in the % increase in variable cost and operating cost.

The year wise (for credit period) effect of tariff changes with respect to fixed and variable price & cost

Fixed cost tariff:

Year of operation	fixed cost (Rs./unit)
1st	1.61
2nd	1.57
3rd	1.53
4th	1.49
5th	1.45
6th	1.41
7th	1.37
8th	1.33
9th	1.26
10th	0.87

Variable cost

Financial year	Variable cost (Rs./unit)
2004-05	1.27
2005-06	1.33
2006-07	1.40
2007-08	1.47
2008-09	1.54

The biomass plant had been successfully operating at a PLF between 85-90%. However, as per the new policy initiative, plants operating with 80% PLF (including auxiliary consumption) will be paid a fixed rate as per the PPA and the additional units generated at the additional PLF will be paid at a variable cost of Rs.1.27 with an incentive of Rs.0.25 amounting to a total of Rs.1.52.

Though the plant has a design capacity to operate at a higher PLF it does not operate as it is not financially viable. The variable cost of operating the plant at a PLF greater than 80% is about Rs. 1.76 per unit generation. However, with the revised policy, the proponent would be paid only

Rs.1.52 per unit of excess generation making it financially unviable. However, with the additional CDM benefit of Rs.0.23 per unit, if made available, the total benefit for the proponent would be Rs.1.75 (i.e. Rs. 1.52 + 0.23) which is still lower than the variable cost and would encourage the proponent to operate at PLF greater than 80% to generate more CERs and also reduce the production, operation & maintenance cost.

Thus it is imperative that, to generate power in excess of 80% PLF will significantly hamper the sustainability of the project. The CDM funds can contribute towards viability of generation of the balance 20%, which will indirectly help in reduction of CO2 emission, if not generated.
Thus it is imperative that the present tariff is not sufficient and will significantly impact the sustainability of the project. To generate renewable power, the CDM funds can contribute towards sustainability of the project, which will indirectly help in reduction of CO2 emission, if not generated. Also, the power tariff will be under revision every 5 years instead of 10 years as per the new proposal from APERC.

The existing APTRANSCO generation mix comprises of:

- ✓ 57% thermal and gas power plants;
- ✓ 42% hydro projects; and
- ✓ 1% wind and cogeneration projects

In thermal and gas power plant category, coal based plants contribute for 46% and balance 11% is contributed by the gas based power plants. This illustrates that biomass plants are still considered as rather financially risky proposition and with changing scenario, the CDM revenue will contribute to their financial stability.

For example, earlier, there was 3rd party sale and the tariff was not supposed to be less than the high tension line (HT1) tariff of Rs.4.32. However with the advent of Regulatory Commission in 1999 there is no 3rd party sale. Earlier there was 2% wheeling charges on 3rd party sale and later it was changed to 28.4% and Rs. 0.50 per unit to neutralize the tariff of 3rd party and APTRANSCO. Hence, all the Biomass power plants have shifted their sale of power to APTRANSCO, wherein they have to abide by the APRANSCO policies.

This discussion suggests that there are clear policy related threats and barrier to the proposed project activity, which can be mitigated to certain9 extent from CDM benefit.

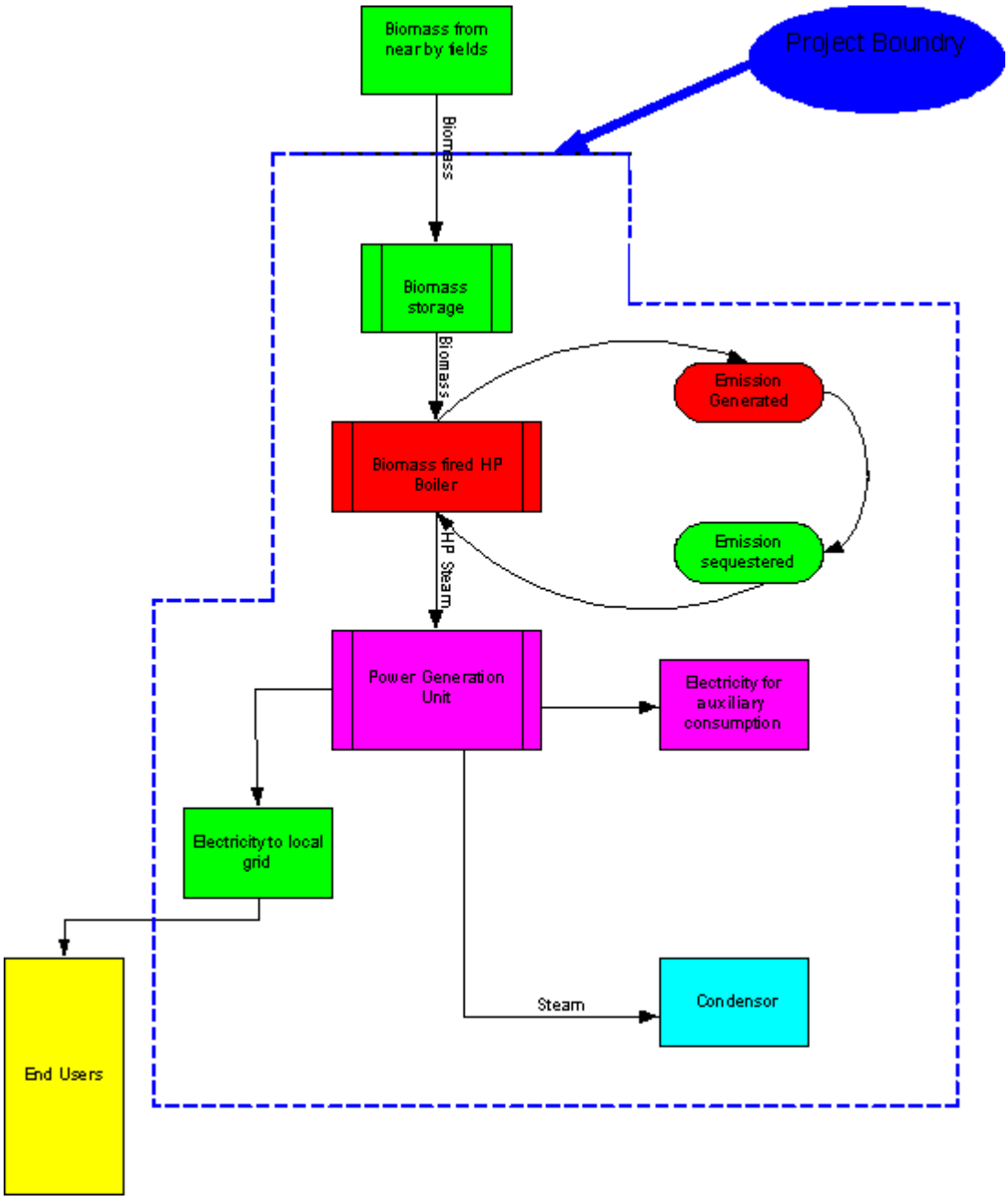
B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

As per the guidelines mentioned in Type I. D. of Annex B of the simplified modalities and procedures for small-scale CDM project activities, project boundary encompasses the physical and geographical site of the renewable generation source.

The project boundary covers the point of fuel supply to the point of power export to the grid where the project proponent has a full control. Hence, project boundary is considered within these terminal points. However, for the purpose of calculation of baseline emissions, AP state electricity grid is also included in the project boundary.

Thus, boundary covers fuel storage and processing, boiler, Steam Turbine Generator (STG) and all other auxiliary consumption units and electricity grid.

[9] Uncertainty related to carbon market and cash flows is also a deterrent.



B.5. Details of the baseline and its development:

The baseline methodology has followed the one specified under Project category I.D in Appendix B of the Simplified M&P for small scale CDM project activities.

All existing sources of power generation have been considered from various authentic sources. Percentage share of power generation from different fuel sources has been calculated. The IPCC

emission factors for different sources of power generation have been considered. The baseline has been considered as the using the combined margin method.

The calculation of the emission factor and corresponding CO2 emission reductions have been done in an excel sheet which is enclosed as Appendix – III.

Southern Regional grid has been considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. As mentioned earlier, in the Southern regional grid generation mix, coal and gas based power projects are responsible for GHG emissions.

Method: The average of the approximate operating margin and the build margin

1. Approximate operating margin and build margin is calculated as per the OECD and IEA reference document and UNFCCC methodology specified for small scale activities
2. For estimation of operating margin, weighted average of all resources, excluding hydro, geothermal, wind, low cost biomass and solar generation and captive waste heat recovery based generation is considered.
3. For estimation of the build margin (or recently built) the weighted average emissions (in $kgCO_2/kWh$) of recent capacity additions to the system is considered. The greater of the following two options are considered –
    a. The plants contributing to most recent 20% of the gross MWh generation (as specified in paragraph 7 under category I.D of Appendix B of the simplified M&P for small scale CDM project activities, if 20% falls on part capacity of a plant that plant is included in the calculation)
    b. MWh from the 5 most recent plants

The value of emission factor from the combined margin method is **0.830** kgCO2/kWh for the southern regional grid.

Date of completing the final draft of this baseline section: ***DD/MM/YYYY***

08/08/2005

Name of person/entity determining the baseline:

Sri Balaji Biomass Power Private Limited, who is also a project participant (as mentioned in Annex-I) and associated experts.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

Project started construction during January 2003 which is after 1 January 2000 and is operational since 14th April 2004.

C.1.2. Expected operational lifetime of the small-scale project activity:

Life time of the project: 25 years

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

C.2.1. Renewable crediting period:

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

Starting date of first crediting period: 15/04/2004

C.2.1.2. Length of the first crediting period:

7 years (7y)

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a monitoring methodology and plan:

D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

Monitoring methodologies / guidelines mentioned in the UNFCCC document of "Annex B of the simplified modalities and procedures for small scale CDM project activities" for small scale projects (Type I:D) is considered as basis for monitoring methodology for the activity. The document states that the monitoring shall consist of metering the electricity generated by the renewable technology.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

The project activity meets the eligibility criteria to use simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7.

Details of approved methodology for baseline calculations for CDM projects of capacity less than 15 MW are available in the "Appendix B of the simplified modalities and procedure for small scale CDM project activities". As the power plant is of 6 MW capacity, reference has been taken from indicative simplified baseline and monitoring methodologies for selected small scale (CDM projects less than 15 MW) project activity categories.

D.3 Data to be monitored:

ID number *(Please use numbers to ease cross-referencing to table D.6)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.3.1	Power	Electricity generated	KWh	Measured	Daily	100%	Electronic	2 years	From the control room energy meter
D.3.2	Power	Auxiliary consumption	KWh	Measured	Daily	100%	Electronic	2 years	Based on the difference between energy generated and energy exported
D.3.3	Power	Power export	kWh	Measured	Daily measurement and monthly recording	100%	Electronic	2 years	Based on the readings from tri-vector meter in APTRANSCO sub station
D.3.4	Fuel	Biomass used	MT	Measured	Daily	100%	Paper	2 years	
D.3.5	Fuel	Avg. calorific value of Biomass used	Kcal/Kg	Measured	Monthly	100%	Paper	2 years	Through sample testing in lab. Tested monthly only if the source of biomass is different.
D.3.6	Fuel	Coal	MT	Measured	Daily	100%	Paper	2 years	Will be recorded when plan uses coal
D.3.7	Fuel	Carbon content in coal	%	Measured	For each batch of coal	Grab sample	Paper	2 years	Through sample testing in lab. Tested every batch only if the source of fuel is different.

D.3.8	Fuel	Calorific value of coal	Kcal/Kg	Measured	For each batch of coal	Grab sample	Paper	2 years	Through sample testing in lab. Tested every batch only if the source of fuel is different.

Note: All the data will be archived for two years during the crediting period after issuance of CERs

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

>>

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.3.1 to 3.8	*Low*	*The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency*

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

Project proponent will implement the following operational and management structure in order to monitor emission reductions and any leakage effects, generated by the project activity

Project proponent form a CDM team/committee comprising of persons from relevant departments, which will be responsible for monitoring of all the parameters mentioned in this section. In the CDM team, a special group of operators will be formed who will be assigned responsibility of monitoring of different parameters and record keeping. On daily basis, the monitoring reports will be checked and discussed.

On monthly basis, these reports will be forwarded at the management level.

D.6. Name of person/entity determining the monitoring methodology:

Sri Balaji Biomass Power Private Limited (As mentioned in Annex-I), who is a project participant and associated experts

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

The project uses only biomass as fuel. No other fuel usage is envisaged. However, usage of coal in the plant will be monitored and recorded as per the monitoring plan when the coal is used for power generation.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

The leakage activity identified, which contributes for GHG emissions outside the project boundary is transportation of biomass from biomass collection centers to biomass power project site. Calculation of leakage has been carried-out as under:

▪ Biomass to be procured	-	60,000 MT
▪ Average Distance between project site and biomass collection centers	-	50 km
▪ Biomass load per truck	-	8 MT
▪ Number of return trips	-	7,500
▪ Consumption of Diesel per trip	-	13 liters (4km/litre)
▪ Total Diesel consumption	-	93,750 liters p.a
▪ CO_2 emission factor for Diesel (as per IPCC guidelines)	-	74.10 tons CO_2 / TJ
▪ CO_2 emission per annum	-	246 tons

The CO_2 emission (leakage) occurs during the transportation of coal from the mines to respective coal based power plants. The distance between the coal mines and the power plants is higher as compared to the transportation distance between biomass collection centers to biomass power project site and hence the higher CO_2 emissions. To be on conservative side, this leakage due to coal transportation has not been added while calculating the baseline of AP grid and hence a small

leakage due to transportation of biomass has been neglected from the calculations and estimations of emission reductions.

Also, the project emissions due to transportation of fly ash from the plant to brick manufacturers are negligible as the quantity of ash generated in the plant is very less and is of the order to 15 to 25 T per day. There are 3 to 4 truck movements per day and hence the emissions are not considered.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

Considering the negligible CO_2 emissions due to leakage and no need to operate the plant using coal as a fuel during non-availability of biomass, net emissions by project activity are considered to be zero.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

Southern Regional grid is considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. It is observed that, in the southern regional grid generation mix, coal and gas based power projects are responsible for GHG emissions. The following scenario of approved methodology has been considered for baseline calculations.

Method: The average of the approximate operating margin and the build margin (Combined margin)

Method: Combined Margin

(a) Baseline Power Generation

$$P_{wlc} = P_{tot} - P_{lrc}$$

Where

P_{wlc}	Power generation by all sources, excluding hydro, biomass and nuclear
P_{tot}	Power generation by all sources of grid mix
P_{lrc}	Power generation by Hydel, nuclear, biomass projects

(b) Sectorwise baseline power generation

$$P_{fuel} = \frac{P_f}{P_{wlc}} x 100$$

Where

P_{fuel} Share (in %) of power generation by each fuel used (coal and gas in present scenario), out of total power generation excluding Plrc

P_f Power generation by fuel used (in million kWh units)

(c) Calculation of Operating Margin emission factor

$$OM_{bef} = \sum P_{fuel} \; x \; E_{fuel} \; for\ base\ year\ for\ Scenario\ 1$$

Where

OM_{bef} OM emission factor of baseline calculated for each year (kg/kWh)

E_{fuel} Emission factor (actual or IPCC) for each fuel type considered (e.g coal, gas)

(d) Calculation of Build margin emission factor for each source of baseline generation mix

BM_{yr} = Weighted average of emissions by recent 20% capacity additions or MWh of five most recent plants, which ever is higher

Where

BM_{yr} = Build margin for base year (kg/kWh) = $\frac{\sum P'_f \; x \; E'_f}{\sum P'_f}$

Where

P'_f Generation capacity from specific fuel in the most recent 20% power plant or five most recently built plants, whichever is higher

E'_f Emission factor for the specific fuel in the most recent 20% power plants built or five most recently build plants

(e) Combined Margin Factor

CMF for each year crediting period

= $(OM_{bef} + BM_{yr}) / 2$ (in kg/kWh)

Final (net) baseline emission factor (NEFB) = 0.830

(Refer to Baseline excel sheet)

(f) Power Generation and Export by project activity

$TP_{gen} = TP_{exp} + TP_{loss}$

Where

TP_{gen}	Total power generared
TP_{exp}	Total clean power export to grid per annum
TP_{loss}	T&D loss

(g) Emission reduction by project activity

$ER = TP_{exp} \times (NEF_B - NEF_p) - EL$

Where

ER	Emission reduction per annum by project activity (tones/year)
TP_{exp}	Total clean power export to grid per annum
NEF_B	Final emission factor of baseline
NEF_p	Net emission factor of project activity (=0)
EL	Emission leakage (tonnes/year) (= 0)

Step by step calculation using combined margin methodology of CO_2 emissions due to burning of coal and gas for power generation and emission reductions by the project activity is as under.

Step 1	**:**	Net operating emission factor for coal	=	Actual emission factor for coal x % of generation by coal out of total generation excl. RE projects
Step 2	**:**	Net operating emission factor for gas	=	Step 1 is to be repeated for gas.
Step 3	**:**	Operating margin factor	=	Net emission factor for coal + Net emission factor for gas
Step 4	**:**	Built Margin factor	=	Weighted average of emission factors of most recent 20% plants or 5 most recently built plant, whichever is higher
Step 5	**:**	Average of operating and build margin factor	=	(operating margin factor + built margin factor)/2
Step 6	**:**	Units exported to APTRANSCO		Total Power generation –Total auxiliary consumption.
Step 7	**:**	CO_2 emission reduction	=	Units exported to AP grid x Average of operating and build margin factor

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Following formula is used to determine Emission reduction

CO_2 emission reduction due to project activity	=	Net CO_2 baseline emission x Electricity exported to grid in 7 years (in kWh)	-	Project emission
	=	241 million units x 0.830	-	0
	=	**200,130**		

E.2 Table providing values obtained when applying formulae above:

	Operating Years	Baseline Emissions (tonnes of CO_2)	Project Emissions (tonnes of CO_2)	Certified Emission Reductions (tonnes of CO_2)
1.	2004-2005	29700	0	29700
2.	2005-2006	28405	0	28405
3.	2006-2007	28405	0	28405
4.	2007-2008	28405	0	28405
5.	2008-2009	28405	0	28405
6.	2009-2010	28405	0	28405
7.	2010-2011	28405	0	28405
	Total	**200,130**	**0**	**200,130**

Therefore, an conventional energy equivalent of 241 Million kWh for a period of 7 years in AP would be saved by exporting power from the 6 MW Biomass based power plant which in turn will reduce 200,130 tons of CO_2 emissions considering baseline calculations.

Baseline data used for the calculation is provided in Annex-3 and the detailed calculation using the formulae is presented in an Excel Sheet (refer Enclosure – I to this PDD.)

SECTION F.: Environmental impacts:

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

The project being a renewable energy biomass based power project it does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. As per the Government of India notification dated June 13, 2002 based on environment protection rule, 1986, public hearing and EIA is required for those industries/projects which are listed in the predefined list of ministry of environment and forest. Thermal power projects with investment of less than Rs. 100 crore have been excluded from the list. Hence, it is not required by the host party.

Though EIA is not required, plant has adopted several measures to mitigate impacts to environment due to project activities. Measures taken by the plant in this respect are as given below:

1. As per the APPCB guidelines, to disperse pollutants from boiler, 50 m height stack is provided.
2. The water and air quality checks will be made every month and the same will be submitted to concerned authorities. Plant maintains different water and air quality parameters within the prescribed limits.
3. To control the suspended particulate matter emissions from the plant, Electrostatic precipitator is provided.
4. Acidic and alkaline effluent streams from the plant are neutralized in a neutralization tank.
5. The boiler blow down due to its higher pH is neutralized before mixing with other effluent streams.
6. Plantation of small and tall trees is done around the plant area for better environment.
7. The ash collected from the ESP is utilized for brick manufacturing.

SECTION G. Stakeholders' comments:

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

The local stakeholder comment invitation and compilation process involved is as follows:

The local stakeholders are immediately affected by the activities of the project. The effect is on the local environment, social life and economics. All the individuals and organizations falling in the above effects are perceived as stakeholders. They can be within the boundaries of the village, district, state or nation.

On deciding above criteria for qualification of the stakeholders, the idea was to decide most appropriate representatives who are covering above. During interaction of the corporate headquarter and the plant management, the stakeholders were identified as:

- Office bearers of the neighbouring villages local bodies
- Authorities of the District local administration
- Biomass suppliers
- Local NGOs
- Customer (APTRANSCO)
- Licensing and regulatory authorities like
    - NEDCAP
    - APPCB
    - MoEF (Govt. of India)
    - MNES (Govt. of India)

SBBPPL has been constantly in touch with other identified stakeholders like licensing and regulatory authorities. Their views are reflected in the form of permissions granted for the project. In this aspect, the permission by NEDCAP, MoEF, APPCB and MNES are indication of favorable impression for the project.

Stakeholders Involvement

The village *Panchayat* /local elected body of representatives administering the local area is a true representative of the local population in a democracy like India. Hence, their consent / permission to set up the project is necessary. SBBPPL has already completed the necessary consultation and documented their approval for the project.

Local population comprises of the local people in and around the project area. The roles of the local people are as a beneficiary of the project. The local population will be involved in the supply of the biomass and hence the project would be a beneficial project for the local population. In addition to this, the project would also lead to local manpower working at the plant site. Since, the project will provide good direct and indirect employment opportunities the local populace is encouraging the project.

The project does not require displacement of any local population. In addition, the local population is also an indirect consumer of the power that is supplied from the power plants.

The distance between the electrical substation for power evacuation and the plant is less, installation of transmission lines will not create any inconvenience to the local population.

Andhra Pradesh Pollution Control Board (APPCB) has prescribed standards of environmental compliance and monitors the adherence to the standards. The project has already received No Objection Certificate (NOC) from APPCB to start the plant.

Non-conventional Energy Development Agency of AP (NEDCAP) implements policies in respect of non-conventional renewable power projects in the state of Andhra Pradesh and has accorded approval to the project.

As a buyer of the power, the APTRANSCO is a major stakeholder in the project. They hold the key to the commercial success of the project. APTRANSCO has already cleared the project and SBBPPL has already signed Power Purchase Agreement (PPA) with APTRANSCO.

The government of India, through Ministry of Non-conventional Energy Sources (MNES), has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro and bagasse cogeneration / bio-mass power. The project meets their requirements.

G.2. Summary of the comments received:

As mentioned above, SBBPPL has already received the approvals and clearances for their project from the following stakeholders:

- Consent order of Establishment from Andhra Pradesh Pollution Control Board;
- Power Purchase Agreement with APTRANSCO;
- Clearance from the Gram Panchayat, Chennur village

Although, in India, public participation at any stage of project implementation is not required, being a CDM activity, project proponent has invited the local stakeholders including Sarpanch (head) of village, representative of local population, representative of local NGO and biomass suppliers to express their views on the project and the summary is presented as below.

Village Sarpanch (head of locally elected body) expressed his happiness about the implementation of project in his village since the project activity has created employment opportunities for the villagers and also for creating an additional means of revenue for local farmers/biomass waste suppliers which will positively help to improve living standard and the socio-economic condition of the village. Other benefit mentioned by Secretary of gram panchayat is additional revenue from the project activity in terms of tax, to gram panchayat, which will be utilized for the development of the village. One of the Zilla Parishad (ZP) member (village representative at district level) expressed that by various means the village has been benefited by the project activity, specifically the project has created source of income for poor farmers of the nearby area. Poor farmers are getting reasonable monitory gains for harvesting the available biomass and supplying it to project activity.

Representative biomass suppliers also expressed their happiness about project implementation by SBBPPL in this area, which has provided them an opportunity of small business. They mentioned that it is providing employment for local labors, skilled and unskilled workers and preventing their transfer to nearby cities. It is also helping to improve economic standard of poor farmers of the region by giving them a reasonable value for their biomass waste. They further added that, the project activity has provided business opportunity for local transporters also.

In summary, every stakeholder expressed that the project activity is helping the socio-economic development of the village and nearby area without affecting the local environment adversely.

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

The relevant comments and important clauses mentioned in the project documents like Detailed Project Report (DPR), environmental clearances, power purchase agreement, local clearance etc. were considered while preparation of CDM project development document.

Further, the document will be published on UNFCCC/Validator's website for public comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Sri Balaji Biomass Power Pvt. Ltd.
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E-Mail:	
URL:	
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Pradyumna
Middle Name:	
First Name:	Soma
Department:	
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Annex 2

No Public Funding is available to the project.

Annex-3

BASE LINE DATA

The methodology adopted for the calculation of the baseline is 'the combined margin emissions of the current generation mix". Year 2004-05 is considered as the base year for prediction of future capacity additions during the crediting period. Southern Grid generation data as tabulated in Enclosure-II is used for consideration of installed southern grid capacity and energy availability during the period 2004-05.

In order to arrive at the detailed breakup of power generation mix in Southern Region, various documents and various web sites were refereed. The websites refereed for estimating the generation mix in Andhra Pradesh are:

1. http://www.infraline.com
2. http://www.bisnetworld.net
3. http://www.apgenco.com
4. http://www.kptcl.com
5. http://cea.nic.in
6. http://www.tneb.org
7. http://www.ksebboard.com

As per the availability, actual generation figures as against the sector wise installed capacity were used. Wherever the breakup of generation was not available, proportionate calculated figures were used so as to match the total energy availability.

Annex 4

Calibration and Monitoring Plan of Plant Activities.

The calibration of monitoring equipment is being maintained as per the requirement of APTRANSCO and the same is being done regularly. Power Generation, Export & Auxiliary Consumption, fuel consumption are recorded daily and the same is verified and approved by General Manager of the plant. These records will be regularly cross checked by personnel from Head Office.

Calibration and monitoring procedure for energy meter as per PPA:

The Plant is equipped with energy meters/export meters for monitoring and control purpose. There are two energy meters at APTRANSCO sub station to measure the export power, namely main meter and check meter with 0.2 class accuracy. The energy meters shall be tested and calibrated utilizing a standard meter. The standard meter shall be calibrated once in a year at the approved laboratory of Govt. of India or Govt. of AP as per terms and conditions of supply. The tests of meters shall be jointly conducted by authorised representatives of both the parties and the results and correction so arrived at mutually will be applicable and binding on both the parties. The energy meters shall not be interfered with, tested or checked except in the presence of representatives of company and APTRANSCO. If any of the meters is found to be registered inaccurately, the affected meter will be immediately replaced. The meters will be checked in presence of both the parties on mutually agreed periods. If during the test checks both the meters are found beyond permissible limits of error, both the meters shall be immediately replaced and the correction applied to the consumption registered by the main meter to arrive at the correct energy exported for billing purposes for the period of one month up to the time of test check, computation of exported energy for the period thereafter till next monthly reading shall be as per the replaced meter. Corrections in exported energy shall be applicable to the period between the two previous monthly reading and the sate and time of test calibration in the current month when error is observed.

If both the both and check meters fail to record or if any of the PT fuses are blown out, the export energy will be computed on a mutually agreeable basis for the point of defect.

Also, log sheets for turbine, boiler and other major electrical equipments are also maintained for the critical equipment of the plant and readings are recorded on day to day basis:

Emission levels are also monitored as per the statutory requirement. Plant emission levels are monitored and the results are sent to APPCB. For this purpose, the service of external agency is being utilized.

Appendix A

Abbreviations

AP	Andhra Pradesh
APERC	Andhra Pradesh Electricity Regulatory Commission
APPCB	Andhra Pradesh Pollution Control Board
APTRANSCO	Transmission Corporation of Andhra Pradesh
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
Cm	Centimeter
CO_2	Carbon Dioxide
DPR	Detailed Project Report
GHG	Greenhouse Gas
SBBPPL	Sri Balaji Biomass Power Private Limited
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
IREDA	India Renewable Energy Development Agency
Kcal	Kilo Calories
Kg	Kilogram
KM	Kilometer
KP	Kyoto Protocol
KW	Kilowatt
KV	Kilovolts
kWh	Kilowatt hour
LP	Low Pressure
MNES	Ministry of Non-Conventional Energy Sources
MT	Metric Tons
MU	Million Units
MW	Megawatt
NEDCAP	Non Conventional Energy Development Corporation of Andhra Pradesh
NGO	Non Government Organizations
NOC	No Objection Certificate
PDD	Project Design Document
PIN	Project Idea Note
PLF	Plant Load Factor
PPA	Power Purchase Agreement

QA	Quality Assurance
QC	Quality Control
RE	Renewable Energy
SEB	State Electric Board
STG	Steam Turbine Generator
T&D	Transmission and Distribution
TJ	Tera Joule
UNFCCC	United Nations Framework Convention on Climate Change

Appendix B

REFERENCE LIST

Sr. No	References
1.	Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) **www.unfccc.int/cdm**
2.	Website of United Nations Framework Convention on Climate Change, **http://unfccc.int**
3.	UNFCCC decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol
4.	UNFCCC document: Annx B to attachment 3, Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories
5.	Detailed project report on 6 Biomass based power project – SBBPPL Power Private Limited
6.	Website of Central Electric Authority (CEA), Ministry of Power, Govt. of India- **www.cea.nic.in**
7.	CEA published document "16th Electric Power Survey of India"
8.	Website of APGENCO, **www.apgenco.com**
9.	Website of Ministry Non-Conventional Energy Sources (MNES), Government of India, **www.mnes.nic.in**
10.	Website of Indian Renewable Energy Development Agency (IREDA), **www.ireda.nic.in**
11.	Andhra Pradesh Power Profile at **www.bisnetworld.net/bisnet/states**
12.	**www.infraline.com/power/**
13.	APERC tariff order, R.P. No.84 / 2003 in OP No 1075 / 2000 dated 20.03.2004.
14.	Website of Climate Change Cell, Ministry of Environment & Forest, Govt. of India. **www.envfor.nic.in**

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