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

CONTENTS

Revision history of this document

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

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

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

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Title of the CDM project: **6 MW RPPL biomass based power plant**
Location: Khammam district, Andhra Pradesh, **India**
Project Design Document Version No. 1
Date of completion: 27th of November 2006

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

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a. Purpose of the project activity

Rithwik Power Projects Limited (RPPL) is a biomass based power plant with a capacity of 6 MW, located in Tekulapalli village of Khammam District of Andhra Pradesh. The plant is in operation since the 22nd of November 2002.

Since its commissioning date, the plant has been facing many technical and economical difficulties which have led its previous owners to stop running the plant in May 2006. The low efficiency of the plant combined to an increase of the biomass price and to the unilateral decrease of the electricity rate by APTRANSCO, has made the operation of the plant quite unprofitable.

Expecting future CERs income, Velcan Renewable Energy Private Limited has taken over RPPL on 30th October 2006. Velcan Renewable Energy Private Limited is a clean energy company specialized in electricity generation and in the reduction of greenhouse gas emissions. The company's main objective is to produce energy from renewable sources and fight global warming.

The expected CERs income will support not only the heavy investments required to improve the efficiency of the plant but will also help the new operators to face the unfavorable economical situation of the biomass power plant operation (low electricity rate and high biomass price). Without this additional expected income, it is most probable that RPPL would have definitely ceased its operation and thus, its green power generation would have been replaced by the fossil fuel based power generation of the grid. Or, the plant would have gone bankrupt and it would have been converted into a coal based power plant.

Thus, the purpose of the project activity is to pursue the valorisation of the available surplus biomass fuels in the surrounding region for generation of green power and selling of the power generated to APTRANSCO, the Andhra Pradesh state grid.

The project activity area is located in a region dominated by agriculture and forests. The power plant is using various renewable agricultural and forestry residues such as rick husk, bagasse, coconut waste, cotton stalk, red gram stem, groundnut shell and wood waste. These materials are abundantly available at a range of 30-50 kms from the site. The biomass requirement for 75% operation of the plant is approximately 70 kt/year. In Khammam district the surplus biomass availability for power generation is 338.4 kt/year[1] from which 41.5 MWe of renewable energy can be generated. In 2006, only 29 MWe[2] of renewable power plants are established in Khammam district.

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[1] http://cgplab.cgpl.iisc.ernet.in/biomassindiaweb

For many years, Andhra Pradesh has been facing recurrent power shortages. The installed generation capacity in the state is 11,325.44 MW. The peak requirement shortage has varied from 2 to 19.90%, while the energy requirement shortage has varied from 0.70 to 8.7 % since 1998-99 till date[3]. The project activity will assist to continue reduce the ever-increasing demand and supply gap of electricity, sustainable economic growth of the region, and conservation of the environment through the use of biomass fuels contributing to Greenhouse Gases (GHG) emission reduction.

b. Contribution of the project activity to sustainable development

According to the Ministry of Environment and Forests, Govt. of India[4], the indicators for sustainable development are as follows:

*a. **Social well being** – The CDM project activity should lead to alleviation of poverty, additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in their quality of life.*

The project activity is leading to alleviation of poverty by establishing direct and indirect employment benefits[5]. During normal operation, almost 120 persons are working on the site of RPPL from which 60 are people with low or no qualification. The huge quantity of biomass required by RPPL, also provides employment for transportation and handling from the fields or mills to the power plant. Finally, the biomass power generation is also providing ample indirect opportunities for employment in manufacture, installation and maintenance operations linked to the project activity. Thereby, since its commissioning date, the power plant has been contributing to support the employment in the local area. The cessation of activity of the power plant will let these people unemployed or at least, with quite diminished resources.

On a wider scale, the plant has also contributed to the improvement of the infrastructure in and around the plant area. This includes improvement of electricity quality, frequency and availability as the electricity is fed into a deficit grid.

*b**. Economic well being** - The CDM project activity should bring in additional investment consistent with the needs of the people.*

First of all, as biomass resource is the first expenditure of the plant activity, the procurement of the raw material has generated a great surplus of resources to the farmers around. Before RPPL commissioning, agri-residues were valorised at quite low rates or even, burnt on open fields.

During normal operation, Rithwik power plant is injecting into the local area around Rs. 6 crores per year (around 1.2 million $) in raw material procurement. This amount corresponds to an extra-activity for the local activity since without the plant the raw material will have no or low value.
Secondly, the generated electricity is currently fed into the Southern region grid of India through local grid, improving consequently the grid frequency and availability of electricity to the local urban and rural

[2] Gowthami Bioenergy (6MW pure generation), Kakatiya Sugar & Cement industries (17 MW co-generation)

[3] http://powermin.nic.in/indian_electricity_scenario/pdf/SR1106.pdf

[4] http://cdmindia.nic.in/host_approval_criteria.htm

[5] http://www.nedcap.org/Index_files/Page445.htm

habitants. These improvements contribute to the reduction of the power shortage and so, support the economical growth of the area.
As mentioned here above, the collection and handling of crop residues to the plant generate additional revenue for the farmers and mills operators. In other words, the plant is generating commercial value to crop residues enabling the farmers to get a better price for their produce augmenting their income. This also prevents the migration of the rural people toward cities by creating employment opportunities. The plant has also created business opportunities for local stakeholders such as bankers, consultants, suppliers, manufacturers, contractors etc.

c - ***Environmental well being*** *- This should include the impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health and reduction of levels of pollution in general.*

i - Contribution to the reduction of GHG and other pollutants into the atmosphere
The project activity is a renewable energy power plant. The generated power by the plant is sold to APTRANSCO, which distributes it to the southern grid. Since sustainable renewable biomass is used for power generation (minor use of coal to sustain the combustion in case of rains), the electricity generated does not lead to GHG net emissions. In fact, biomass combustion and growth and associated CO_2 consumption and release can be treated as a cyclic process resulting in no net increase of CO_2 in the atmosphere.

This "0-carbon content" power fed into the grid contributes to the decrease of the conventionally fossil fuel based power generation of the grid. As shown in the Figure 1[6], the Indian economy is highly dependent on coal for electricity generation. Furthermore, in Andhra Pradesh, as in other states of Southern grid, the state has decided to implement in coal based power plants (Table 4). This will again increase the carbon content of the electricity generated in the coming years.

Moreover, the use of biomass instead of coal for power generation results in reduction in the emission of sulfur oxides and other pollutants, thereby improving local environmental conditions. RPPL power plant has commissioned all the required equipment for pollution mitigation such as Electrostatic precipitator for ash collection, water treatment plant and green cover around the site.

ii - Contribution to the decrease of the consumption of a finite resource

As mentioned above, thermal power plants are the major consumers of coal in India .The basic electricity needs of a large section of population are still not being met, leading to a wide gap in the supply demand situation in the country. This is resulting in excessive demand 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 sources. Since this project activity utilizes renewable energy source, it will positively contribute to the mitigation of the consumption of finite natural resources like coal/gas/oil for electricity generation.

[6] www.cea.nic.in. Central Electricity Authority (CEA), General Review 2006, page 47.

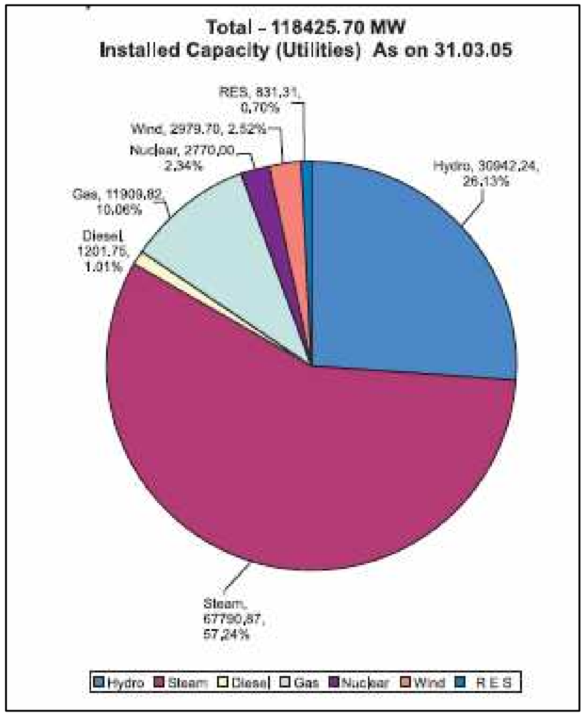

Figure 1 : Installed capacity of power generation in India

d- Technological well being - The CDM project activity should lead to transfer of environmentally safe and sound technologies that are comparable to best practices in order to assist in up-gradation of the technological base. The transfer of technology can be within the country as well from other developing countries also.

The technology used within the power plant follows the 'state of the art' of the most efficient biomass based power plant. It is constituted of a Thermax (licence Babcock/Wilcox) boiler equipped by a spreader-stocker which allows burning of different types of fuel. Since RPPL was one of the first biomass based power plants commissioned in the state, it has greatly contributed to the improvement of the standard design and conception of this kind of installation. Since then, many others promoters have been using the same technology and have gained from the plant experience.

Thus, the continuation of the operation of RPPL will contribute to maintain the great advantages offered by the plant to the local communities in terms of economical resources, social and environmental well being.

A.3. Project participants:

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Name of the Party involved	Private and/or public entity (ies) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	**Private Entity** Rithwik Power Projects Limited (RPPL) Tekulapalli Village, Penuballi Mandal, Khammam District, Andhra Pradesh - 507209	**No**

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

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The power plant is constituted of a boiler with a traveling grate and pneumatic feeders, a steam turbine generator with associated auxiliaries and utilities. The fuels used are rice husk, bagasse, cotton stalk, coconut waste, and wood waste. The generated power is fed into the grid at the 33 kV substation of Penuballi owned by Andhra Pradesh State Electricity Board (APSEB) located at old Penuballi Mondal in Khammam district at a distance of 4 Kms from the plant site.

The technical details are as follows:

TRAVELING GRATE BOILER TYPE	
Type	Natural circulation, vertical, bi-drum, semi-outdoor installation
Maximum continuous rating	35 TPH
Steam parameters at super heater outlet	66 kg/cm^2, 485° C
Feed water temperature at economizer inlet	130°C
TURBO-GENERATOR	
Type	Straight condensing machine
Steam parameters at the turbine inlet	66 kg/cm^2, 485° C
Condenser pressure	0.1 kg/cm^2
Generator rating	7.5 MW (max capacity / normal rate is 6MW), 9.3 MVA, 50 Hz, 11 kV

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

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A.4.1.1. Host Party(ies):

>> India

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

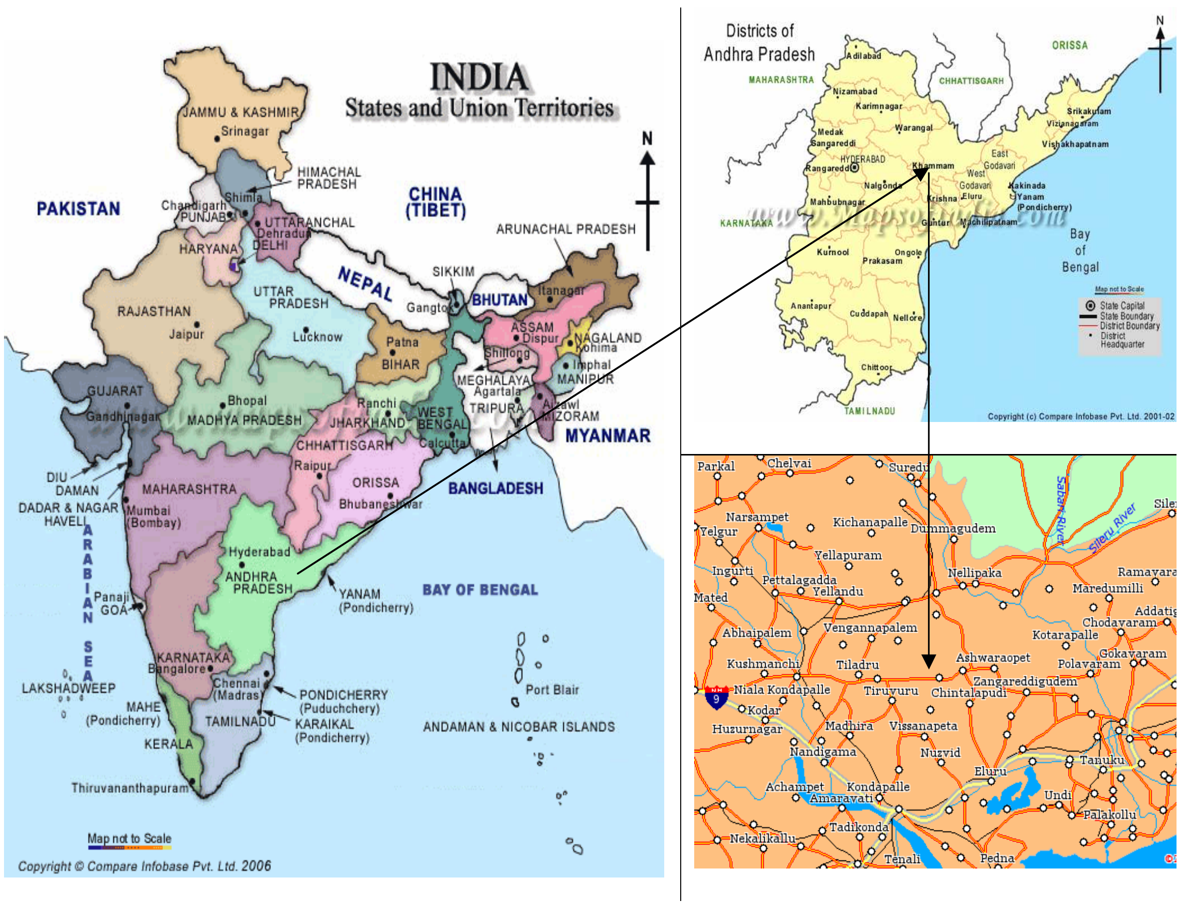
>> Andhra Pradesh

A.4.1.3. City/Town/Community etc:

>> Tekulapalli Village, Khammam District

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

>> The power plant is installed on a 26 acres area, located at Tekulapalli village, about 3 Kms from the Penuballi Mondal Road junction on APSH No. 7 state highway linking Aswaraopet and Khammam. The nearest railway station, Khammam is 68 kms away and the nearest airport is Vijayawada at 100 kms from the project site.



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

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As per Type I.D of Appendix B of **simplified modalities and procedures for small-scale CDM project activities (Version 09: 28th July 2006),**

1. This category comprises renewable energy generation units, such as photo-voltaic, hydro, tidal/wave, wind, geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

The project activity is a biomass based power plant, which feeds its power generation into the southern grid of India. This green power generation avoids the corresponding generation of electricity by the other units of the states, which are mainly fossil fuels based power plants (76% of the Southern grid electricity generation is supplied by fossil fuels fired units).

2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.

The project activity is a 6 MW biomass power plant using renewable biomass. The main renewable materials used are: rice husk, cotton waste, wood waste and coconut waste. A small percent of coal (<5%) is being co-fired during rainy seasons to ensure consistent generation. However, in any case, the electricity generation will not exceed 6 MW as the licensed capacity sanctioned by NEDCAP is only for 6 MW. Any increase requires a new agreement.

In addition, a Power Purchase Agreement (PPA) has been signed with APTRANSCO for the purchase of the sanctioned capacity of 6 MW. Thus, the electricity generation is being monitored both by the project proponent and APTRANSCO (a government body). Any increase in capacity requires fresh license and sanction from APTRANSCO. Hence the capacity of the biomass power plant will not exceed 15 MW.

3. Biomass combined heat and power (co-generation) systems that supply electricity to and/or displace electricity from a grid are included in this category. To qualify under this category, the sum of all forms of energy output shall not exceed 45 MW thermal. E.g., for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 MW thermal.

The only purpose of the plant is electricity generation and does not include co-generation. The rating of the boiler is 32 MW thermal[7].

4. *Project activities adding renewable energy capacity should consider the following cases:*
1) Adding new units;
2) Replacing old units for more efficient units.
To qualify as a small scale CDM project activity, the aggregate installed capacity after adding the new units (case 1) or of the more efficient units (case 2) should be lower than 15 MW.

Not applicable to the project activity since neither addition nor replacement of equipments occur.

5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

Not applicable to the project activity.

Thus the project activity falls under the following:
Main Category: Type I - Renewable Energy Project (Small Scale)
Sub Category: **"D", Renewable Electricity Generation for a Grid (Biomass based Power Project)**

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[7] 9 TPH of fuel with a GCV equal to 3,275 kCal/kg

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.

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:

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I. 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

i. National circumstances: a continuous increase of coal-dependence for electricity generation

Energy demand in the region is constantly increasing and there is a wide gap between supply and demand of the energy needs in Andhra Pradesh and the southern grid. According to the 16th electric power survey by CEA, the electricity growth in India is about 6.5% per year[8]. As of now the share of thermal power generation is 76% in the total installed capacity of southern region (Table 1).

Source	Generation Andhra Pradesh (GWh)	%	Generation Southern Grid (GWh)	%
Hydro	5,514.76	14.25	24,951.04	16.67
Steam	23,359.70	60.37	99,009.99	66.16
Diesel	0.00	0.00	2,433.93	1.63
Gas	8269.89	21.37	12,428.43	8.31
Nuclear	0.00	0.00	4,408.00	2.95
Renewable Energy				
- Wind	160.79	0.42	3,079.12	2.06
- Biomass power	1390.00[9]	3.59	3,332.54	2.23
- Biomass gasifier	0.00	0.00	0	0.00
- U&I	0.00	0.00	0	0.00
Total	**38,695**	**100.00**	**149,643.05**	**100.00**

Table 1 : Gross electrical energy generation (utilities only) in 2004-2005 in GWh[10]

The majority of projects proposed by private and public sector utilities to meet the future demand are based on fossil fuels such as coal, lignite, gas, etc., which result in GHG emissions (Table 4). Nuclear capacity additions are the least, due to continuous rising environmental consciousness and long gestation

8 Electricity Demand Projection. Source: http://www.dae.gov.in/publ/doc10

9 http://mnes.nic.in/annualreport/2004_2005_English/ch7_pg2.htm : 182 MW capacity for biomass based and 63MW for co-generation. No figure available for the generation. We took as an assumption a global plant load factor of 80% and an availability of 90% which is quite conservative.

10 www.cea.nic.in. Central Electricity Authority (CEA), General Review 2006, page 71

periods coupled with huge investments. Consequently, at the present time, nuclear energy contributes a paltry 2.86% of India's power needs[11] and 2.95% of the Southern grid (Table 1).

According to the Department of Atomic Energy, India, approximate percentage contributions of various resources towards electricity generation in the year 2052-53 will be coal - 47%, hydrocarbon - 16%, hydro - 8%, non-conventional renewable - 4% and nuclear - 26%[12]. Thus the energy mix will be dominated by fossil fuel. Hence, the baseline scenario, for expanding electricity production capacity, is driven by fossil fuel fired power stations. As a result, the baseline is highly carbon intensive.

***ii. Renewable energy in India*: Far from the goal assigned by the public authorities**

The Government of India has set a goal of increasing the share of renewable energy to 10% of the additional planned capacity by 2012. This goal is indicative and not binding. A look at the progress of non-conventional energy especially biomass energy in India shows that so far of a potential of 16,000 MW, only 912.53 MW have been installed[13]. Andhra Pradesh shows that though the potential for renewable energy especially from biomass is 625 MW[14], so far only 178.50 MW[15] projects have been commissioned accounting for 28% of the potential. In the Southern Grid, the share of biomass energy is less than 3% of the total electricity generation (Table 1).

II. 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

A. Low carbon content electricity

The power plant is using biomass grown in a sustainable way. This means that for 1 kg of biomass cropped, 1 new kg of biomass will soon grow again in the same location. So, the combustion of this biomass by the plant does not contribute to the increase of the GHG into the atmosphere since the CO_2 emitted comes initially from the atmosphere and was sequestered by the plant during its growth. Thus, this process can be considered as a closed loop with a neutral balance in terms of CO_2 net emission. In the opposite, burning of fossil fuels releases CO_2 captured by photosynthesis millions of years ago and so, positively contributes to a net increase of GHG concentration into the atmosphere.

The electricity produced by RPPL power plant can be considered as “0-content” electricity, which is the opposite of a coal based power plant having positive balance CO_2 emissions. Hence, each unit exported by our green power plant into the grid decreases the carbon intensity of the fossil fuel dominated grid electricity.

In addition, the project activity is using surplus biomass, which otherwise would have been left for decay in barren lands or burnt causing environmental pollution or methane emissions. This use of biomass energy is greatly reducing greenhouse gas emissions since methane has a greater Global Warming Potential than the CO_2 released through the combustion process inside the boiler.

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[11] http://www.cea.nic.in/power_sec_reports/general_review/0405/ch3.pdf

[12] Meeting the demand projection. Source: http://www.dae.gov.in/publ/doc10

[13] http://mnes.nic.in/frame.htm?majorprog.htm

[14] http://www.hinduonnet.com/businessline/2001/09/08/stories/140860en.htm

[15] http://aptranscorp.com/pact01.html

B. Viability ensured with CDM incomes

Without CDM opportunity, the benefit described here above in terms of GHG mitigation may not occur since RPPL would probably have definitely ceased its operation. Thanks to CER revenue, the new promoter has decided to takeover the plant and so, have also decided to face the major constraints which have led the previous owners to stop running the plant.

Conventional energy equivalent of around 240 GWh for a first crediting period of 7 years would be replaced by generating power in the 6 MW non-conventional renewable sources biomass based power plant. This will result in CO_2 emission reduction of 23,165 tonnes of CO_2/annum. In the cessation of the proposed activity, the same energy generation would have been taken-up by existing or new thermal power plants and emission of CO_2 would have occurred due to combustion of conventional fuels like coal/gas.

The continuation of the project activity is providing non-fossil electricity production capacity to the regional system that is currently and will continue to be dominated by fossil fuel based electricity generation.

There is no government or sectoral policies to aid non-viable renewable biomass plants technically or economically. Also the project activity is not legally binding and is above and over the state and national requirement.

The project activity will thereby reduce the demand for fossil fuel fired power generation and resulting in reduced anthropogenic GHG emissions.

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

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Years	Annual estimation of emission reduction in tones of CO_2 e
2007-2008	23,165
2008-2009	23,165
2009-2010	23,165
2010-2011	23,165
2011-2012	23,165
2012-2013	23,165
2013-2014	23,165
Total estimated reductions (tonnes of CO_2e)	162,155
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	23,165

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

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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:

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A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- *With the same project participants;*
- *In the same project category and technology/measure; and*
- *Registered within the previous 2 years; and*
- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.*

None of the above criteria is applicable as the project proponent does not have any CDM project activity or application to register in this project category and technology within 1 km of the project boundary of the proposed small-scale activity. Thus, this project activity is not a debundled component of a larger 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:

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According to the indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, the project activity falls under:

TYPE – I Renewable Energy Projects
Category – AMS I.D. Grid connected renewable electricity generation
I.D./Version 9, Scope 1, 28 July 2006

This category comprises renewable energy generation units, such as photo-voltaic, hydro, tidal/wave, wind, geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit. Biomass combined heat and power (co-generation) systems that supply electricity to and/or displace electricity from a grid are included in this category. To qualify as a small scale CDM project activity, the aggregate installed capacity should be lower than 15 MW.

Since the project activity is a 6 MW renewable biomass power plant that supplies electricity to the Southern grid of India, the Type I.D – Grid connected renewable electricity generation baseline methodology is applicable.

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

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Main Category: Type I - Renewable Energy Power project
Sub Category: I. D Renewable Electricity Generation for a Grid
I.D./Version 9, Scope 1, 28 July 2006

The project activity is a renewable energy generation unit that is supplying electricity to the Southern Grid. The aggregate installed capacity is 6 MW, thus lower than 15 MW. As the project activity meets all the criteria, it can be classified as a small-scale project.

According to Appendix B regarding indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories (Type I.D, Version 9, Scope 1, 28th July 2006), the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2/kWh) calculated in a transparent and conservative manner as following:

(a) *A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered*

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available) and made publicly available.

Considering the available guidelines and the present project scenario, Southern regional grid, into which the plant feeds the power, has been chosen for baseline analysis (see argumentation here below). **The Combined Margin (CM) has been applied to calculate the CO_2 emission of southern grid**. The baseline data used to calculate the grid emission factor is based on the CEA report and calculations "CO_2 Baseline Database for Indian Power Sector", which is available at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm.

Choice of grid

The generated electricity from the project activity will displace an equivalent amount of electricity from the grid. The emission reduction due to the project activity depends on the emission factor of the grid mix. Therefore it is required to select the appropriate grid where an equivalent amount of electricity would be displaced by the electricity generated from the project activity. There are three choices from the grid systems for the project activity, i). national grid, ii). regional grid and iii). state grid

The grid level for baseline calculations has been determined based on the following:

- In India, power is a concurrent subject between the state and the central governments. The perspective planning, monitoring of implementation of power projects is the responsibility of Ministry of Power, Government of India. At the state level, the state utilities or state electricity boards (SEBs) are responsible for supply, transmission, and distribution of power. Following power sector reforms, there have been unbundling and privatization of this sector in many states. Many of the state utilities are engaged in power generation also. In addition to this, there are different central / public sector organizations involved in generation, transmission and financing. There are five regional grids: Northern, Western, Southern, Eastern and North-Eastern. Different states are connected to one of the five regional grids as shown in Table 2.

Regional Grid	Northern	Western	Southern	Eastern	North Eastern
States	Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, Delhi	Gujarat, Madhya Pradesh, Maharashtra, Goa, Chattisgarh,	Andhra Pradesh, Karnataka, Kerala, Tamilnadu	Bihar, Orissa, West Bengal, Jharkand,	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

Table 2 : States connected to different regional grids

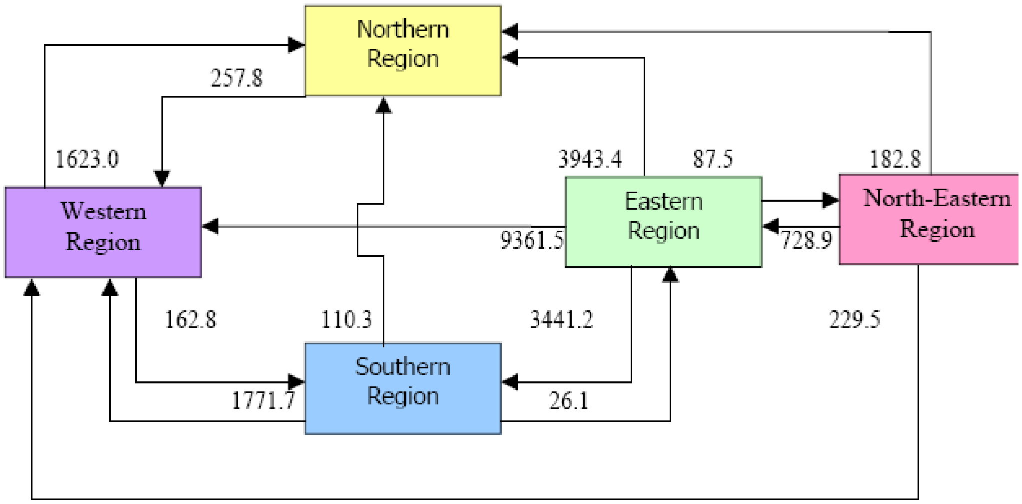
- The management of generation and supply of power within the regional grid is undertaken by the load dispatch centres (LDC). Different states within the regional grids meet the demand from their own generation facilities plus generation by power plants owned by the central sector. Specific quota is allocated to different states from the central sector power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. Thus there is trading of power between states in the grid. Similarly there are imports and export of power between regional grids.
- The total installed capacity of the power generating stations and the electricity generation in the National Grid, Southern Regional Grid and Andhra Pradesh State is given in Table 3.

Grid Level	Installed Capacity (MW)	Generation (GWh)
National level[6]	118,425.70	594,456.20
Southern Grid (refer Table 1)	36,599[3]	149,643.05
Andhra Pradesh (refer Table 1)	11,325[3]	38,695.14
Project Activity	6	34.05

Table 3 : Installed capacity, energy generation in 2004-2005

- From Table 3, it can be seen that the project activity of 6 MW biomass based power plant, is too small to have a significant impact on the national grid . It will only marginally effect changes in the generation and operating margin or delay future power projects that may be commissioned during the crediting period (build margin) in the national grid. Therefore, the principal effect of the project activity on the National grid would be insignificant.
- The status of inter-regional energy exchange (in GWh) in India[16] during 2004-2005 is as follows:

[16] CEA Annual Report 2004-2005.Source: http://www.cea.nic.in/about_us/Annual%20Report/chapter04.pdf



- The inter-regional exchange is presently too low due to the lack of infrastructure. Hence, it is not found appropriate to consider the national grid system for estimation of emission coefficient for a very small electricity project such as the proposed one. Thus, for the project activity National grid system is not being considered for the estimation of emission coefficient.
- The regional grid to which the present project is connected is considered for estimating the baseline emission coefficient, which is operated and managed by Southern Region Electricity Board (SREB). SREB facilitates the share of power generated by the central generating stations. Among the installed capacity of 36,569 MW of the Southern Grid, the Central stations have a generating capacity of 9,320 MW[17] (25.5%) and the balance is by the private and state power stations. The states in the Southern Grid are dependent on power from Central generating stations. Thus, considering state grid for baseline determination is not appropriate and therefore Southern regional grid is considered as the appropriate grid system for the project activity.
- Thus, it is evident that the electricity from the power plant can be dispatched without any constraint in the southern region and the spatial extent covered by southern grid for baseline is most appropriate for the project activity.
- Currently the electricity supply position in the region is deficit by 2% (peak) and energy shortage is about 1.1%[3]. Present capacity addition will not be sufficient to meet the energy demand and it is most likely that all power generating plants will be in operation during the crediting period. In the hypothesis of a cessation of activity of RPPL, deficit power may be met from fossil fuel based power plants. Hence, the weighted average emissions of Operating Margin (OM) and Built Margin (BM) of the generating mix of southern grid will represent the carbon intensity of the grid system.
- The proposed installed capacity for the southern grid during 11th plan period is 13,373 MW, of which share of thermal power generation (coal, gas, lignite) is expected to be 9,275 MW (70%) and share of hydro and nuclear is estimated at 4,098 MW (30%)[3]. So, the carbon intensive nature of the southern grid is not going to get reduced in the near future.
- As per ACM0002, "In large countries with layered dispatch systems (e.g. state /provincial /regional/national) the regional grid definition should be used. A state/provincial grid definition

[17] http://powermin.nic.in/JSP_SERVLETS/internal.jsp

may indeed in many cases be too narrow given significant electricity trade among states/ provinces that might be affected, directly or indirectly, by a CDM project activity".

Considering the above factors, **the Southern Region Grid has been considered as the most representative system boundary** (i.e. project electricity system) where an equivalent amount of electricity would be replaced by the implementation of the project activity. The carbon intensity of the Southern Regional Grid has been considered to arrive at the baseline emission factor for baseline emission calculations for the project activity's crediting period. It is also preferable to take the regional grid as project boundary than the state boundary as it minimizes the effect of inter state power transactions, which are dynamic and vary widely. Southern Region grid which comprises of Andhra Pradesh, Karnataka, Kerala and Tamilnadu is chosen as the grid system for the project activity, since the project activity is in Andhra Pradesh.

LIST OF PROJECTS FOR LIKELY BENEFITS DURING 11TH PLAN (TENTATIVE)

Sl.No.	PLANT NAME	STATE	AGENCY	SECTOR	ULTIMATE CAPACITY (MW)	TYPE	BENEFITS 11TH PLAN (2007-12)	LIKELY YEAR OF BENEFIT
	SOUTHERN REGION							
CENTRAL SECTOR								
1	ENNORE-JV	TN	NTPC+TNEB	C	1000	COASTAL	1000	2010-12
2	TUTICORIN JV	TN	NLC+TNEB	C	1000	COASTAL	1000	2010-12
3	NEYVELI - II	TN	NLC	C	500	PH	500	2008-10
4	KAYAMKULAM	KERL	NTPC	C	1950	LNG	1950	
	SUB-TOTAL(THERMAL CENTRE)				4450		4450	
5	KUDANKULAM U 1,2	TN	NPC	C	2000	LWR	2000	2007-09
6	PFBR(Kalapakkam)	TN	NPC	C	500	FBR	500	2011-12
7	KAIGA*	KAR	NPC	C	440	PHWR	220	2007-08
	SUB-TOTAL(NUCLEAR CENTRE)				2940		2720	
	TOTAL CENTRAL SECTOR SOUTHERN				7390		7170	
STATE SECTOR								
1	JURALA PRIYADARSHNI*	AP	APGENCO	S	234	STO	195	2007-08
2	NAGARJUNA SAGAR TR	AP	APGENCO	S	50	STO	50	2009-10
3	LOWER JURALA	AP	APGENCO	S	240	STO	240	2011-12
4	VARAHI EXTN.	KAR	KPCL	S	230	ROR	230	2008-09
5	GUNDIA	KAR	KPCL	S	300	ROR	300	2011-12
6	ADIRAPALLY	KERL	KSEB	S	163	STO	163	2009-10
7	MANKULAM	KERL	KSEB	S	40	STO	40	2010-11
8	PALLIVASAL	KERL	KSEB	S	60	ROR	60	2009-10
9	THOTTIAR	KERL	KSEB	S	40	ROR	40	2011-12
10	BHAWANI BARRAGE II & III	TN	TNEB	S	60	ROR	60	2009-10
	SUB-TOTAL(HYDRO STATE)				1417		1378	
11	BHOPALAPALLY	AP	APGENCO	S	500	LC	500	2008-09
12	VIJAYWADA TPP	AP	APGENCO	S	500	LC	500	2008-09
13	KOTHAGUDEM ST-V	AP	APGENCO	S	500	PH	500	2011-12
14	KRISHNAPATNAM	AP	APGENCO	S	1600	COASTAL	800	2011-12
15	RAICHUR U 8	KAR	KPCL	S	210	LC	210	2008-09
16	BELLARY EXT	KAR	KPCL	S	500	LC	500	2008-09
	SUB-TOTAL(THERMAL STATE)				3810		3010	
	TOTAL STATE SECTOR SOUTHERN				5227		4388	
PRIVATE SECTOR								
1	NAGARJUNA TPP	KAR	NPCL-IPP	P	1015	COASTAL	1015	2008-09
2	ULTRA MEGA PROJECT IN AP(4000 MW)	AP	IPP	P	4000	COASTAL	800	2011-12
	SUB-TOTAL(THERMAL PRIVATE)				5015		1815	
	TOTAL PRIVATE SECTOR SOUTHERN							
	TOTAL SOUTHERN REGION				17632		13373	
	TOTAL ALL INDIA				88720		62475	

Table 4 : List of planned power projects in the Southern Region[3]

Key Information and data used to determine the baseline scenario (variables, parameters, data sources, etc.)

The key information and data used to determine the baseline scenario is from the CO_2 Baseline Database for the Indian Power Sector which is available at the following website:

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

The calculations are based on generation, fuel consumption and fuel quantity obtained from the power stations. According to the database, conservativeness of calculations has been ensured by the following[18]:

- The quality of station-level data was ensured through extensive plausibility testing and interaction with the station operators.
- In cases of data gaps at station level, standard data from CEA was used. For example, standard auxiliary power consumption was assumed for a number of gas-fired stations. Comparison with monitored values shows that these standard values are rather conservative.
- Where required, the emission factors of thermal units were also derived from standard CEA values (design heat rate plus 5%). Again, these values are conservative (i.e. relatively low) compared to the heat rates observed in practice.
- The fuel emission factors and oxidation factors used are generally consistent with IPCC defaults. For coal, the emission factor provided in India's Initial National Communication was used (95.8 tCO_2/TJ on NCV basis), being somewhat lower than the IPCC default for sub-bituminous coal (96.0 t CO_2/TJ).

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:

>>

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.

The RPPL is actually facing 3 difficulties which threaten its profitability and thus, its viability:

- Technical problems leading to a very low level of efficiency
- Unilateral revision of the purchased price of electricity by APERC
- Biomass procurement risk (price)

From the commissioning time (Nov 2002), the above issues have been generating a continuous decrease of the profitability of the plant and compelled the previous promoters to stop running the plant for 4 months[22] in 2006 (from May to September).

In the eventuality of a definitive cessation of activity, the power capacity initially supplied to the grid by the power plant would have to be produced by the grid through an extra-generation of the existing power plants or through the erection of new ones. Andhra Pradesh grid system is mainly fed by fossil fuel based power plants and thus, this extra-power requirement will lead to an increase in GHG emissions.

With CER incomes support, the project participant proposed to pursue the running of the plant and to proceed with heavy investments in order to reach the standard level of efficiency and profitability.

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

Hence, the pursuance of the project activity will avoid the generation through fossil fuel based power plants and thus, contribute to the reduction of the emission of GHG into the atmosphere.

Further referring to Appendix A to Appendix 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 pursuance of the project activity would not have occurred anyway, at least one of the following elements should be identified in concrete terms :

- ***Investment barrier**: a financially more viable alternative to the project activity would have led to higher emissions*
- ***Technological barrier**: a less technologically advanced alternative involves lower risk due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions*
- ***Barrier due to prevailing practice** or existing regulatory policy requirement would have led to implementation of a technology with higher emissions*
- ***other barriers**: without the project activity, for any specific reason identified by project participant, such as institutional barriers; or limited information, managerial resources, organizational capacity, financial resources or capacity to absorb new technologies, emission would have been higher*

1 –Investment Barrier

Rithwik power plant was commissioned on 22nd of November 2002[19]. Since then, the efficiency of the plant has not been reaching the expecting level as per the design specifications. Reasons of this failure are not yet precisely identified but the turbo-alternator group is highly suspected to be the source of the low performance. Operation of a biomass power plant is much more difficult than a coal based power plant since the quality of the fuels are far from being constant: the gross calorific value can vary of 30% from a fuel to another. As a consequence, the key parameters of the installation, as temperature or pressure of the steam produced, can hardly be maintained constant and thus, for the equipment, which are not designed for, can led to this kind of low performance.

Hence, the fuel and steam specific consumptions of the installation are far above the standard level. As shown in Figure 2, the global yield of the installation has been varying between 16% and 20%, which is well below standard yield as defined by APERC (21%[20]). Combined with the increase of the cost of biomass, this led to an increase of generation cost of 37% from Rs 3.26 per unit in 2003-2004 up to Rs. 4.45[21] per unit in 2005-2006. Compared to the actual tariff electricity of Rs 3.16 per unit, the power plant was no more profitable and as a consequence, the 2005-2006 fiscal year ended with a deficit representing around 7.5% of the global turn over of the year.

Hence, the previous promoters decided to stop running the plant from May 2006 to September 2006[22]. During that time some technical tests have been conducted and some parts of the turbine have been changed. Despite these preliminary works, the low efficiency of the plant remained the same. Previous

[19] First commercial operation

[20] Calculated by making the ratios of the electricity exported per the energy content of the fuel fed into the boiler

[21] This high generation cost is partly due to the low PLF of the FY 2005-2006

[22] Only 20 days of generation in June 2006 for test purposes

promoters did not have the capability and the financial capacity to proceed further and make heavy technical investments and so decided, to put up the project activity for sale.

Velcan Renewable Energy Private Limited acquired the plant on the 30th of October 2006. This acquisition was strongly correlated to the expected incomes from CERs. Without this expected income, the plant would either may have been decommissioned, or more likely, the RPPL company would have gone bankrupt. Then, its assets (the plant) would have been taken over by another set of promoters, but not the contracts and the liabilities. With the help of the bankruptcy law, the new operators would not have been bound by the existing contract with the state of Andhra Pradesh which states that the company cannot burn more than the 25% of coal. They would then have run the plant on 100% coal, which is much easier than burning biomass. This would have led to much higher emissions than that taken currently for the baseline, the southern grid.

From now, the project participant expects to retrieve a standard yield through technical improvements achievable through heavy modifications and equipments re-designing. These works have two main targets: the increase of the turbine efficiency (decrease of the steam specific consumption) and a better quality of the fuels loading into the boiler (less moisture, appropriate granulometry, constant feeding). These improvements will cost around 10% and 15% of the initial capital cost.

Type of investment	Cost (Rs)
Land improvement (water draining, level)	Rs 7,000,000
Turbine diagnostic and re-designing	Rs 2,000,000 to Rs 30,000,000
Fuel proper storage area to avoid moisturizing of the fuels during rainy seasons (covering, concrete shaping)	Rs 10,000,000
New fuel Handling system to ensure a constant and regular feeding of the boiler (Slat chain conveyor, pullers and vehicles)	Rs 4,000,000 to 6,000,000
ESP Up-gradation (Improvement of the bag section of the equipment)	Rs 8,000,000
TOTAL	**Rs 3.1 Crores to Rs 5.1 Crores** *(690,000 to 1,130,000 US$)*

These investments generate many risks due to technical uncertainties of the installments and recovery of a standard level of performance. Therefore, the previous promoters did not wish to proceed with the heavy changes. The project participant find in the CER funds the way to cover these risks and thus, implement the required changes.

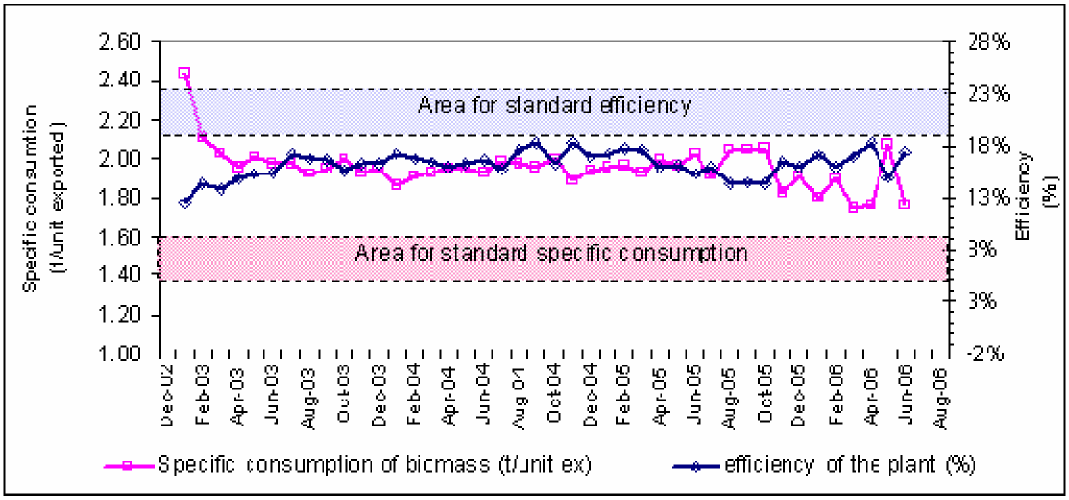


Figure 2 : Standard efficiency and specific consumption in biomass power stations

2 – Policy barrier

In March 2002, the RPPL had signed a Purchase Price Agreement (PPA[23]) with APTRANSCO. This PPA was established following Ministry of Non-Conventional Energy Sources (MNES) recommendations which fixed the tariff that should be used throughout the country for biomass based power plant: Rs 2.25 per unit with a 5% escalation on the 1994-1995 base year tariff. Power plant building was decided taking into consideration this tariff, which permitted to reach an acceptable profitability.

In March 2003, Andhra Pradesh State through its Electricity Regulatory Commission (APERC) decided to review the PPA signed between APTRANSCO and the project participant. The new PPA tariff was then fixed to Rs 2.78 per unit compared to Rs 3.48 per unit following MNES rules.

FIXED RATE (paid up to 80% PLF)		**VARIABLE RATE**	
Year of operation	**Value (Rs/unit)**	**Year of operation**	**Value (Rs/unit)**
1st	1.61	2004-2005	1.27
2nd	1.57	2005-2006	1.33
3rd	1.53	2006-2007	1.4
4th	1.49	2007-2008	1.47
5th	1.45	2008-2009	1.54
6th	1.41		
7th	1.37		
8th	1.33		
9th	1.26		
10th	0.87		

[23] No.10 578 / dated 19th March 2002

According to new rules of rate calculation, the new proposed tariff is divided into a fixed part (investment and recurrent costs) and a variable part (fuel cost mainly). The fixed part is paid up to a Plant Load Factor of 80%, beyond this threshold, only the variable cost and an additional incentive of 21.5 Paises per unit will be paid (Rs.1.54 per unit in 2005-2006). According to the actual high costs of fuel (Rs.1.91 per unit), there is no incentive for RPPL to run above 80% PLF. CDM income fetches an additional income (Rs.0.47 Rs/unit) that will be conducive for the project participant to run the plant above 80% PLF.

CER price €/CER	Rate Rs/€	CER generation CER/Unit (x1000)	Additional CER incomes (Rs/unit)
10	55	0.85	0.47

To obtain this tariff, APERC used an economical calculation which should normally guarantee a 16% IRR to the operators. Unfortunately, as shown in Table 5, parameters used for this calculation are far from the reality of the biomass power plant operation (Figure 3).

	APERC Assumptions *(see order RP 84/2003)*	***Project activity actual conditions***
PLF	*80 %*	*93% in 2003/2004* *84% in 2004/2005* *58% in 2005/2006*
Capital cost	*Rs 4 Crs per MW*	*Rs 5 Crs per MW*
Auto consumption (% of the generation)[24]	*9%*	*14 %*
O&M (% of the capital cost)	*4% of the capital cost*	*7-8%*
Biomass average cost (Rs/kCal)	*0.31*	*0.45*
Steam Specific consumption (kg of steam per unit)	*1.16*	*1.8 – 2*

Table 5 : Comparison between APERC assumptions and real conditions on site

Association of biomass power plant operators has been constituted in order to appeal this revision. As per the High Court Order dated 20/08/2004 in Writ Petition No. 12921 of 2004, an interim order of the court has directed APTRANSCO to pay additional 50 % of the differential amount between the old and the revised tariff (Rs 3.16 per unit in 2005-2006), while waiting for the final decision of the court. The project participant is still waiting for this final verdict at the time of the edition of the Project Design Document.

The uncertainty related to the Supreme Court verdict may result in cash outflow for last three years and may impact the sustainability of the project activity. Therefore, CDM benefits is essential for the plant viability.

[24] Auto-consumption includes auxiliary consumption of the equipment, fuel processing equipment consumption, transformer losses and transmission line losses.

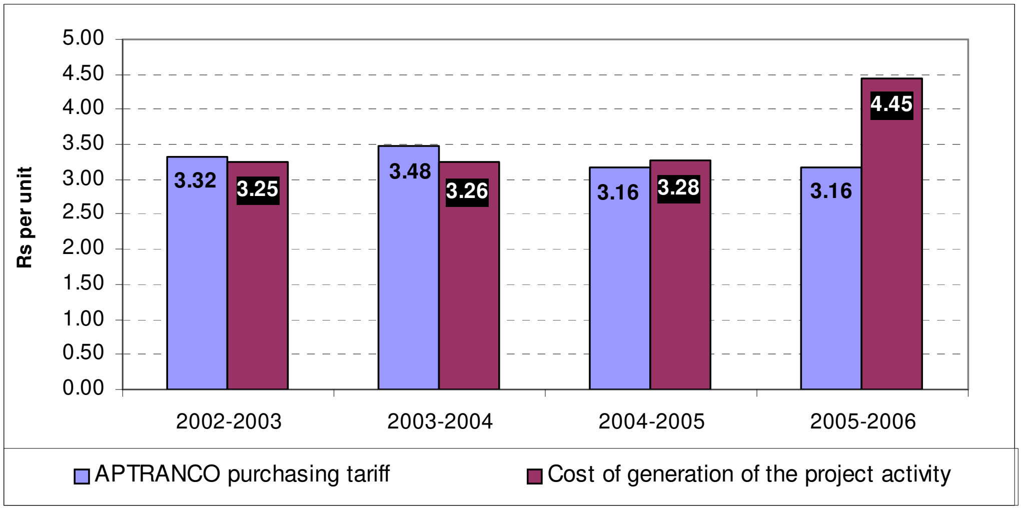


Figure 3 : Comparison of APTRANSCO Tariff and Cost of production of the project activity

3 – Financial barrier

As of now, power plant has been using mainly rice husk and wood waste from the AP Forest Department as raw material. A minor part of coal is also used to sustain combustion during rainy seasons. According to the license delivered for the use and purchase of coal by the government, the plant can not burnt more than 25% of coal.

Wood and agri-residues are plenty available in the area of the project activity (ref Table 7&8). Despite this fact, the prices are continuously increasing since the commissioning of the plant (Figure 4). Considered initially as an agri-residue with a low market value, the suppliers have been constantly increasing the price considering the price of the direct substitute of rice husk: Coal. Hence, agri-residues are now priced as fuels by almost all the farmers and suppliers, thereby increasing their revenues.

At the time of the commissioning of the plant, low price of bio-fuels was one of the main incentives for power plants erection throughout the state of Andhra Pradesh. Now, biomass operators need incentives to compensate the loss corresponding to the increase of fuel cost. Without additional incentives and with the actual rate of electricity, the project participant is not able to run the project activity in a profitable manner.

CDM funds which represent an additional income of Rs 0.47 per unit generated, can cover a part of the loss linked to the fuel price and give the operator sufficient support to pursue the running of the plant in better conditions.

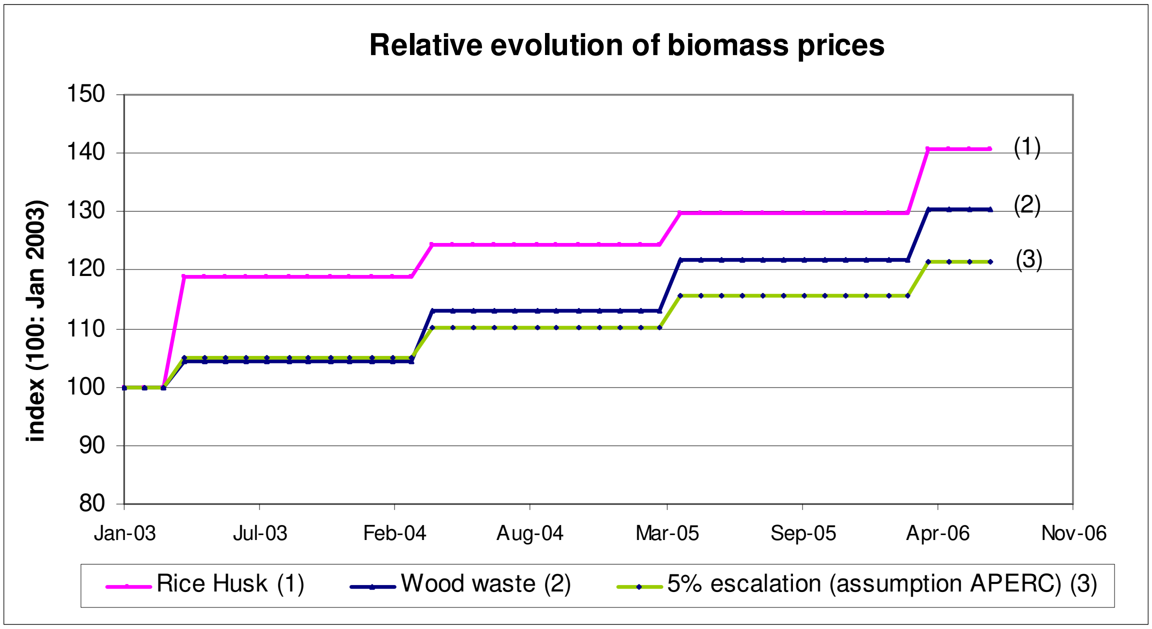


Figure 4: Relative escalation of the fuel prices (5% per year corresponds to the average inflation rate in India since 2003)

Moreover, CDM funds will also push the project participant to limit the usage of coal to the strict required minimum since each kg of coal burnt decreases the number of CERs finally issued.

Conclusion

As a conclusion, abnormal efficiency of the plant combined to the actual unfavourable economical context for biomass power generation (increase of biomass cost and decrease of electricity tariff) makes the profitable running of the plant quite uncertain. It is highly probable that without the anticipated CER incomes, the plant would have been decommissioned or converted into fossil based power plant.

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:

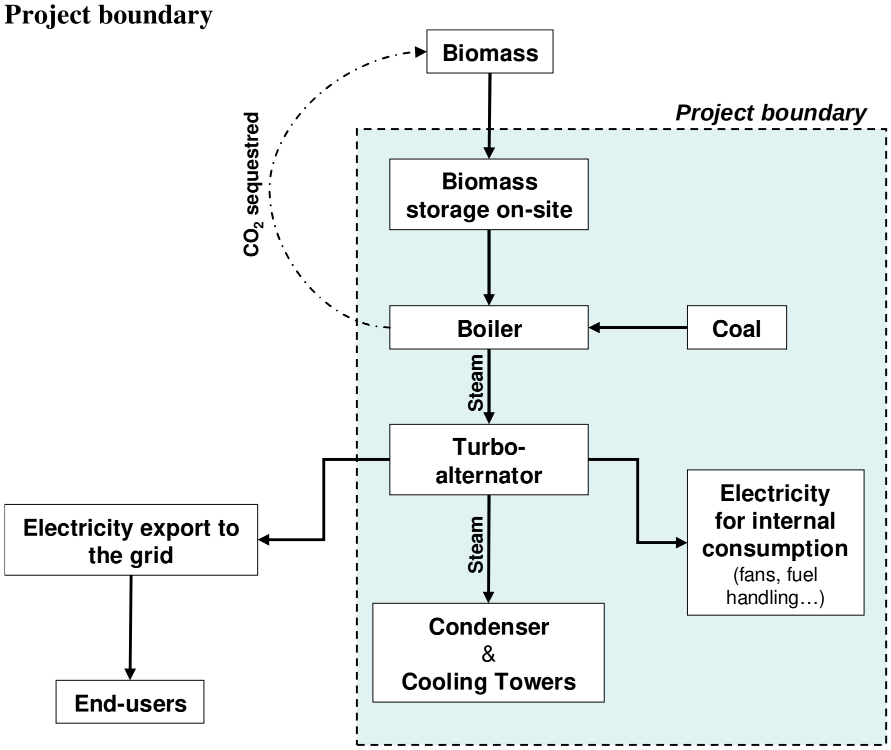
>>

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.

a) The biomass source – wood from the forest area, agricultural residues from the nearby fields
b) Biomass based boiler to produce steam along with other boiler auxiliary equipment.
c) Steam turbine generator and other auxiliary equipment.
d) Power synchronizing equipment required for connecting to the grid.
e) Other equipments which are part of project activity within the physical boundary of site.
f) Co-fired fossil fuel consumption of project activity.

	Source	GHG gases	Included/ Excluded	Justification/Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Conservative approach
		N_2O	Excluded	Conservative approach
	Burning or decay of surplus biomass	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	In line with approved methodology. Emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources.
		N_2O	Excluded	
Project emissions	On-site fossil fuel consumption due to project activity	CO_2	Included	Co-fired fossil fuel consumption.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be negligible.
		N_2O	Excluded	
	Of-site transportation of biomass	CO_2	Included	See leakage calculation
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be negligible.
		N_2O	Excluded	
	Combustion of biomass for electricity generation	CO_2	Excluded	Renewable resource
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be negligible.
		N_2O	Excluded	
	Biomass storage	CO_2	Excluded	Very short-term storage – No decay
		CH_4	Excluded	Very short-term storage – No decay
		N_2O	Excluded	Very short-term storage – No decay

Project boundary



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

>>
The baseline as per the approved methodology of Type I.D Grid connected renewable electricity generation, AMS I.D./Version 9, Scope 1, 28 July 2006 is as follows:

The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as:
(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002
OR
(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available) and made publicly available.

The combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) was applied using the simple OM and using Option 1 for the build margin emission factor, i.e. calculation of the build margin factor *ex-ante* based on the most recent information available on plants already build for sample group at the time of PDD submission. The sample group consists of power plant capacity additions that comprise 20% of the system generation (in MWh) and that have been built most recently as this sample group comprises the larger annual generation compared to recently built 5 power plants.

For consideration of baseline calculations, since the displaced electricity generation is the element that are 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 ideal baseline approach is envisaged as the one that combines both Operating and Build Margin as prescribed in first alternative given in *Paragraph 9(a) in AMS I.D of the UNFCCC M&P for small scale projects*.

The Central Electricity Authority of India in association with GTZ CDM-India has worked out the baseline carbon dioxide emissions from power sector based on detailed authenticated information obtained from all the operating power stations in the country. This has been in the intention of obtaining uniformity of approach in the country towards a common objective. This will avoid indistinctive, unrealistic emission reductions calculation. **The baseline developed by CEA for the Indian Power Sector is considered here**[18]. This is an official publication of the Government of India for the purpose of CDM baselines. It is based on most recent data available to the CEA.

Grid System

The project activity supplies generated electricity to APTRANSCO, which is part of the Southern Grid. Hence the Southern Grid has been considered for the baseline calculations as briefed in section B.2.

The combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002 has been considered for calculation of the baseline emission factor.

The calculated emission factor is **0.850 tonnes of CO_2 equ./MWh**.

Calculation of electricity produced by the project activity and the net electricity supplied to the grid

The annual export of electricity, main parameter for CER calculation, is estimated following this formula:

Annual Export (MWh) = Installed capacity (MW) x 8 760 h x availability (%) x Plant Load Factor in operation (%) x (1-homeload (%))

Calculation of CO_2 baseline emissions from the grid

$$ER_{elec,y} = EG_y \times EF_y$$

Where:

$ER_{elec,y}$ is the emission reductions due to displacement of electricity during the year y in tonnes of CO_2

EG_y is the net electricity supplied through APTRANSCO to southern grid

EF_y is the Combined Margin of the current generation mix of southern grid for the electricity displaced due to the project activity during the year y in tonnes CO_2/MWh = 0.850 CO_2/MWh

Hence as shown in the Table 6, the annual baseline emissions are 28,950 tCO_2.

Data	Value
Installed capacity (MW)	6
Plant Load Factor in operation (%)	80%
Availability (Maintenance, failure) (%)	90%
Generation (MWh)	**37,843**
Autoconsumption (%)	10%
Export (MWh)	**34,059**
Emission Factor (tCO_2/MWh)	0.85
Baseline Emissions (tCO_2)	**28,950**

Table 6 : Estimation of the annual export (MWh) of the plant

Date of completion of the baseline
27/11/2006

Name of entity for contact information

See Annex 1 for contact information. The person/entity is also a project participant as listed in Annex 1.

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

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

>>
30 years

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

>>
18th April 2001 – Start date of construction
14th Nov 2002 – Synchronization with grid
22nd Nov 2002 – First commercial operation

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

>>
30 years and 0 months

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

>> Renewable crediting period

C.2.1. Renewable crediting period:

>> 7 years and 2 times renewable = 21 years

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

>> 01/03/2007
According to guidelines, the start date of crediting period is the date of registration of the project activity.

C.2.1.2. Length of the first crediting period:

>> 7 years

C.2.2. Fixed crediting period:

>> Not applicable

C.2.2.1. Starting date:

>> Not applicable

C.2.2.2. Length:

>> Not applicable

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:

>> According to the "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories" the applicable type and category is

Type 1	-	Renewable energy projects
Category	-	AMS I.D. Grid connected renewable electricity generation
Version	-	AMS I.D./Version 9 Scope 1, 28th July 2006

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 due to the following reasons.

- The project activity is a 6 MW biomass power plant using renewable biomass. Any increase of the capacity requires fresh sanction/license. The technology and the installed equipment such as the boiler and steam turbo generator do not have the capacity to generate more than 15 MW power. Hence the capacity of the biomass power plant will not exceed 15 MW.
- The electricity generation from the power plant is being supplied to the Andhra Pradesh State Electricity Board, which is connected to the Southern Grid. The grid is an electricity distribution system in which 76% generation is supplied by fossil fuels fired units.
- The main renewable biomass used is rice husk, cotton waste, Bengal gram, red gram stalk, bagasse, wood waste and coconut waste.
- The project activity is only renewable electricity generation and does not include co-generation.
- The Grid for baseline calculations considered is the Southern Grid and *ex-ante* has been chosen for baseline emission factor.
- Monitoring will consist of metering the electricity generated by the renewable technology. The amount of biomass and coal input is also being monitored in terms of quantity and also the quality.

D.3 Data to be monitored:

>>

ID No.	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
1.E_{GEN}	Electricity quantity	Total electricity generated	MWh	Measured	Continuously/monthly	100%	Electronic	During the Crediting period + 2 years	Generation meter at the output of generator. Reading each morning by the operators and recorded electronically
2.E_{AUX}	Electricity quantity	Auxiliary electricity consumption	MWh	Calculated	Continuously/monthly	100%	Electronic	During the Crediting period + 2 years	Based on the difference between energy generated and energy exported
3.E_{IMP}	Electricity quantity	Electricity import from the grid	MWh	Measured	Continuously/monthly	100%	Electronic	During the Crediting period + 2 years	Electricity supplied by the grid to the project activity based on the readings from the meter in APTRANSCO sub-station.
4.E_{NET}	Electricity quantity	Electricity supplied to the grid by the project	MWh	Measured	Continuously/monthly	100%	Electronic	During the Crediting period + 2 years	Electricity supplied by the project activity to the grid based on the readings from tri-vector meter in APTRANSCO sub-station. Double check by receipt of sales.

5.$Q_{biomass,y}$	Fuel	Biomass used per type	Tonnes/ day	Measured	Daily	100%	Electronic/paper	During the Crediting period + 2 years	Measured and can be verified by the weigh bridge recordings, stock registers/ incoming receipts
6.$NCV_{biomass}$	Fuel	Avg. calorific value of Biomass used	Kcal/Kg	Measured	Yearly for each type of biomass	Grab sample	Paper	During the Crediting period + 2 years	Through sample testing in lab. Tested monthly only if the source of biomass is different.
7.$Q_{coal,y}$	Fuel	Coal	Tonnes/ day	Measured	Daily	100%	Paper/ Electronic	During the Crediting period + 2 years	For more accuracy, the sum of the delivery will be taken as consumed. In fact, the weight bridge is more precise than the belt weightier. A cross-check will be done through the belt-weightier measurement and stock balance.
8.NCV_{coal}	Fuel	Net Calorific Value (NCV) of coal	Kcal/Kg	Measured	For each batch of coal	Grab sample	Paper	During the Crediting period + 2 years	Through sample testing in lab. Tested every batch only if the source of fuel is different.

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

>>

Data	Uncertainty level of data High/Medium /Low	Are QA/QC procedures planned	Outline explanation why QA/QC are or are not being planned
1 & 2	Low	No	The daily generation is recorded by the site. The energy generated and consumed is measured using calibrated meters and recorded by project proponent. Auxiliary consumption is calculated by doing the difference between generation and export.
3 & 4	Low	No	The export and the import to/from the grid is measured by both APTRANSCO (2 serial meters at the substation) and the project proponent. APTRANSCO meters are yearly calibrated. Each month, reading and cross-checking are done for bill establishment.
5 & 7	Medium	No	The weight bridge is a quite precise device. It takes the difference of the truck load at the inlet and outlet of the site. The weight bridge is frequently calibrated. Fuel quantity loaded into the boiler is measured through a weight device located on the belt conveyor.
6	Medium	No	GCV and NCV of the biomass have been measured during DPR. According to the great variation due to moisture content, monthly lab analyses are not relevant. The site will perform a lab analysis once a year for all main biomass materials used.
8	Low	No	Net calorific content and moisture content of the coal are key parameters for determining the quality of coal. Most of the time, an analysis performed by the supplier is provided with the delivery. Anytime this analysis would not be available. RPPL will take samples from the coal delivered and perform the analysis by a certified lab.

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:

>>

Operation and Management Structure for Monitoring

The management structure proposed for monitoring of emission reductions due to the project activity mainly comprises a GHG monitoring team which will be established immediately after registration of the project activity. The tasks of the team will be:

- Collect all the data to be monitored as listed in the table of section D-3
- Prepare a monthly and an annual report for the emission reduction monitoring
- Identify key devices implied in the monitoring of the activity and ensure that they receive frequently a proper calibration and maintenance.

- Archive the data during the required period.
- Collect samples of the materials to be analyzed.
- Prepare the monitoring report for CER issuance.
- Alert the DOE in case of temporary failure of the monitoring system and implement corrective actions.

The team will comprise representatives of the project participant and other experts as decided from time to time. It is proposed that whenever required external independent GHG auditors would be deputed for the monitoring of the project activity.

Leakage effects generated by the project activity

I. Usage of Renewable Biomass

According to the definition of renewable biomass[25], the biomass used by RPPL is renewable as there is no change in land use due to the project activity. The reasons for renewal nature of biomass is as shown below.

Biomass Type	Category	Activity/Source	Comments
1. Biomass from forests	- Miscellaneous firewood (From the AP Forest Development Corporation Limited)	Existing forests	- The land has remained forests (see Table 7) - Sustainable management practices followed by APFDCL - Complies with national regulations
2. Biomass from Horticultural Orchards	- Biomass residue from coconut Plantations (coconut coir and dry fronds) - Harvested trees	Existing Horticultural Orchards	- The area has remained horticultural orchards - The trees are harvested when the crop productivity is very low. - The land is replanted after harvest (see Table 7)
2. Biomass residues or wastes	- Rice husk - Bengal gram husk - Groundnut shell - Cotton and redgram stalk	Biomass wastes or residues are collected and used	- Renewable biomass as the area remains cropland
3. Biomass of industrial waste	- Bagasse	Existing sugar factory	Non-fossil fraction of biomass

25 http://cdm.unfccc.int/EB/Meetings/023/eb23_repan18.pdf

Year	Area under APFDCL plantations in Khammam district (ha)[26]	Year	Horticultural Crops (ha) in Khammam district[27]
2002-2003	414	1999-00	44,902
2003-2004	959	2000-01	45,424
2004-2005	1509	2001-02	35,760
2005-2006	2090	2002-03	49,992
2006-2007 (including future planting area)	2830	2003-04	51,914
2007-2008 (including future planting area)	4560	2004-05	56,571

Table 7: Area of APFD plantations and private orchards in Khammam district, AP

According to the Attachment C to Appendix B Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, 3 kinds of leakage can be considered:

A. ***Shifts of pre-project activities****. Decreases of carbon stocks, for example as a result of deforestation, outside the land area where the biomass is grown, due to shifts of pre-project activities.*

B. ***Emissions related to the production of the biomass****.*

C. ***Competing uses for the biomass****. The biomass may in the absence of the project activity be used elsewhere, for the same or a different purpose.*

The major biomass types that are used by RPPL, the biomass category, its source and the emissions sources that need to be considered[28] are as shown in the following table:

Biomass Type	Category	Activity/ Source	Shift of pre-project activities	Emissions from biomass generation /cultivation	Competing use of biomass
1. Biomass from forests	- Miscellaneous firewood (From the AP Forest Development Corporation Limited)	Existing man-made forests	-	-	X
2. Biomass from Private Forests (Orchards)	- Private Horticultural Orchards Lands	- Lops and tops of trees - old and decaying trees	-	-	X

[26] From AFPDCL, Regional Office, Rajamundry.

[27] http://www.aphorticulture.com/area_production.htm

[28] According to general guidance on leakage in biomass project activities, Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity.

3. Biomass residues or wastes	- Rice husk - Bengal gram husk - Groundnut shell - Cotton and redgram stalk	Biomass wastes or residues are collected and used	-	-	X
4. Biomass of industrial waste	- Bagasse	Existing sugar factory	-	-	X

Accordingly the most important activity that would cause leakage is competing use of biomass, which is discussed.

Leakage due to competing use of biomass

The woody biomass is purchased from the Andhra Pradesh Forest Department Corporation Limited (APFDCL). The APFDCL was set up in 1975 under the aegis of the National Commission on Agriculture, India, to raise man-made forests so as to meet the domestic and industrial needs of forest produce. One of the objectives of APFDCL is to raise industrial plantations like Eucalyptus, Bamboo, fuel-wood species etc., to meet the raw material requirement of the wood based industries in the state[29]. These lands are cultivations by the Forest Department on degraded lands to cater to industrial purposes of the district. So far in Andhra Pradesh, 85,483 ha of area have been planted by APFDC. The area of planting is increasing every year. Up to 2009, another 15,000 ha will be raised to meet the demands of the industrial sector. The wood that is given for power plants are those with less than 10 inches girth (B and C grade wood) not preferred by the industry. The wood given to the power plants are as follows:

- Failed cashew APFDCL areas/low productive cashew plantations
- Failed Eucalyptus seed routed plantation areas
- Eucalyptus plantations that have completed 3 rotation cycles
    - After harvest at the 7th year, 33% of total biomass (after extraction of pulp wood) is lops and tops and faggot wood. This accounts for almost 10 t/ha.

The other source of biomass is from the horticultural orchards. Horticultural orchards such as cashew wood and mango is harvested and replanted when the productivity of fruits are very low usually after 25 years of planting. The lops and tops of the tree with girth of less than 10 inches is sold to the power plants. Farmers obtain permission certificate from the village officer confirming that the firewood, which is being brought to the power plant, is from his own registered agricultural field.

The only competing use of biomass would be as fuel wood.

To show that there is no competing use of biomass *"the project participant needs to evaluate if there is a surplus of the biomass in the region of the project activity, which is not utilized. If it is demonstrated that the quantity of available biomass in the region, 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."*

[29] http://apfdc.apts.gov.in/

Khammam is a highly forested area. Out of total geographical area of 1,602,900 ha, the area under forests is 843,694 ha accounting for 52.64% of the area (Figure 5). The per capita forest area is 0.62 which is 8 times higher than the national average of 0.08 ha.
Due to the presence of paper and pulp industry in the area, farm forestry is highly prevalent in the area. So far 6000 ha of wasteland area is under plantations of eucalyptus, subabul, casuarina and others in 224 villages belonging to 18 mandals in Khammam district[30]. In addition, the Andhra Pradesh Forestry Development Corporation has planted 11, 687 ha of forest land with Eucalyptus (5337 ha), Bamboo (6008 ha), cashew (59 ha) and teak (83 ha) to cater to the need of wood industries in Khammam[31]. The waste wood from farm forestry plantations and the APFDC plantations are being used as fuelwood. The annual usage of wood by RPPL is approximately 35,000 t/yr. The approximate total fuelwood requirement for the district is 294,680 t/year for a population of 2,562,412 and at fuelwood consumption of 115 kg/capita/yr[32]. From sustainable use of forests itself, 464,644[33] t of fuelwood can be obtained. In addition, 33% of non-commercial wood as fuelwood use from the harvested APFDC and farm forestry areas is also obtained. Also, the woody non-commercial biomass from 56,571 ha of horticulture lands such as coconut, mango, oil palm and cashew contributes to the fuelwood availability in the district. This is in addition to nearly half of the households collecting fuelwood from their own farms.[34]

In the state, NEDCAP has introduced biogas plants in almost 25,000 households in Khammam thus displacing fuelwood usage totally. The fuelwood usage has further decreased by almost 30% in Khammam due to implementation of fuelwood saving devices under Joint Forest Management Programme[31]. Thus these evidences show that the total fuelwood availability including the biomass used by the project activity is 25% larger than the quantity of biomass that is utilized and this source of leakage can be neglected. Thus there are no competing uses of the biomass which will displace the activity due to the project activity outside the project boundary.

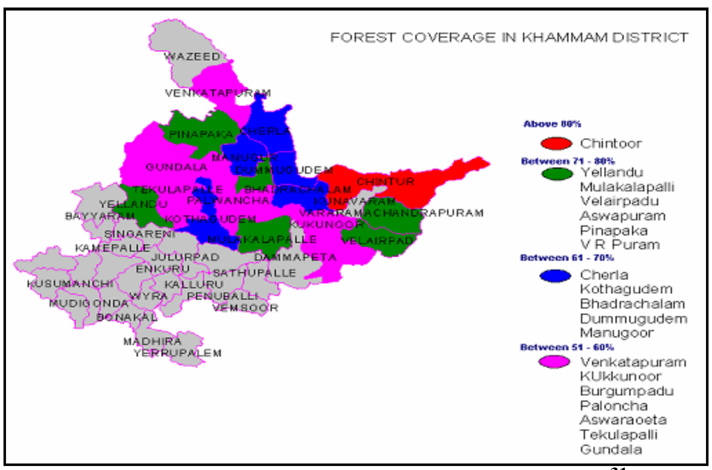


Fig 5: Forest coverage in Khammam district[31]

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[30] www.thehindubusinessline.com/2006/04/22/stories/2006042201972100.htm

[31] http://www.khammam.com/html/revenue/forest-2.htm

[32] Source: http://envfor.nic.in/nfap/download.html. In National Forestry Action Plan based on a survey done by FSI, 1996.

[33] http://www.rwedp.org/c_ind.html - 0.55 t/ha can be considered as sustainable fuelwood supply from forest area

[34] http://www.cifor.cgiar.org/publications/pdf_files/Books/Fuelwood.pdf

Based on a systematic study conducted by Indian Institute of Science, which involved mapping of surplus biomass for energy generation, it can be seen that from surplus crop residue biomass available in Khammam district, 41.5 MW power can be generated (Table 8). Currently only 29 MWe[2] of power is being generated from biomass plants in the district. Thus the availability of surplus biomass is far more than the utility for power production. Then, no leakage due to competitive use of biomass residue (crop residue and Bagasse) need to be considered.

Crop	Area (kha)	Crop production (kt/yr)	Biomass generation kt/yr	Biomass consumption (kt/yr)	Biomass surplus (kt/yr)	Power potential (mwe)
Kharif Crops						
Paddy	162.3	443.0	753.0	615.7	137.3	15.1
Cotton	89.0	24.9	338.1	236.7	101.4	14.2
Other crops	6.3	41.0	43.3	27.1	16.3	2.0
Maize	16.4	38.0	87.3	72.9	14.4	1.9
Sugarcane	3.8	319.0	63.8	51.0	12.8	1.5
Dry chilli	13.1	46.0	68.9	62.0	6.9	0.9
Arhar	23.4	11.7	32.8	28.1	4.7	0.6
Moong	34.0	17.0	21.3	19.1	2.1	0.3
Tobacco	10.8	23.2	23.2	20.9	2.3	0.3
Jowar	4.4	3.0	7.3	6.1	1.1	0.1
Total	**363.5**	**966.8**	**1439.1**	**1139.7**	**299.3**	**36.9**
Rabi Crops						
Paddy	25.1	69.4	118.1	96.5	21.5	2.4
Ground nut	12.2	15.8	36.3	29.9	6.5	0.8
Jowar	21.9	14.0	33.6	28.4	5.2	0.7
Dry chilli	8.0	17.0	25.5	23.0	2.6	0.3
Other crops	5.5	7.0	7.4	4.6	2.8	0.3
Urad	3.3	1.8	2.4	2.0	0.4	0.0
Sesamum	7.9	1.4	2.5	2.2	0.2	0.0
Total	**83.9**	**126.5**	**225.7**	**186.6**	**39.1**	**4.6**
Grand Total		**1093.3**	**1664.8**	**1326.3**	**338.4**	**41.5**

Table 8: Taluk Data for Major Kharif and Rabi Crops for Khammam district

The other leakage activities identified due to the project activity which contributes for GHG emissions outside the project boundary is:

- Transportation of biomass from biomass collection centers to biomass power project site. Approximately 70kt of biomass is transported per year to the site from an approximate distance of 50 km.
- In addition to above, project emissions also occur due to transportation of the fly ash for disposal. The RPPL generates around 14,000 tonnes of fly ash per annum. This ash is supplied to the brick factory, which is 75 kms from the plant.

The emissions from these activities is included in section E.1.2.2

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

>>

Preparation of this document has been done by the project participant.
See Annex 1 for contact information. The person/entity is also a project participant as listed in Annex 1.

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:

>>

CO_2 emissions from on-site fuel consumption of coal for co-firing

During rainy seasons or following rains episode, the wet biomass can not be burnt efficiently without any support. As in most of the other biomass power plants, RPPL is using a minor part of coal to sustain the combustion when biomass is wet. Up to now, the proportion of coal in the annual fuel mix has not been above 5%. In order to be conservative enough, we will take an assumption of 5% for the estimation of the emissions of the plant. It should be pointed out that CER income will push the operators to use coal as less as possible and so, RPPL managers expect to go far below the level of 5% in the coming years.

Considering an annual consumption of biomass of 70 kt, we will keep for our calculation an amount of coal of 3,500 tons per year.

GHG emissions occurring within the project boundary will be calculated using the following formula:

$$ECoal_y = \sum_i Qcoal_{i,y} \times NCV_i \times EF_{CO2,i} \times OXID_i$$

Where:

$Ecoal_y$ are the emissions due to coal burning from the project activity during the year y in tons of CO_2

$Qcoal_{i,y}$ is the quantity of coal of batch i combusted during the year y to sustain the combustion of the biomass residues in the boiler during the year in tons

NCV_i is the net calorific value of the coal of batch i in TJ per ton, obtained from local fuel supplier[35]

$EFCO_{2i}$ is the CO_2 emission factor per unit of energy of the coal of type i in tons of CO_2 per TJ (96.1 in the 2006 IPCC guidelines[36])

$OXID_i$ is the oxidation factor of the coal (1 oxidation factor is included within the standard factor given by IPCC guidelines)

[35] In average 3,600 kcal/kg

[36] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

The project emissions will be updated based on the ex-post monitoring of quantity of coal usage and calorific value of coal. The emissions from coal are deducted from the baseline emissions to arrive at emissions reductions of the project.

The anticipated project emissions are as follows:

	unit	Value
Quantity of coal burnt	t/year	3,500
Average NCV of coal	kJ/kg	15,000
Emission factor of coal (IPCC)	tCO_2/TJ	96.1
Oxidation factor	%	100%
Emissions due to coal co-firing	tCO_2/year	**5,045**

As per the calculation, the estimated emission of coal per year is **5,045 tCO_2**

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

>> As explained in the section D.5, the leakage activity identified which contributes for GHG emissions, is the transportation of biomass from biomass collection centers to biomass power plant and transportation of flying ashes from the biomass power plant to the local brick manufacturers.

To calculate the leakage in a transparent and a conservative manner, average ratios will be used from year to year. The calculation will be performed as following:

$$LT_{biomass,y}\_or\_LT_{fa,y} = \frac{Q_{biomass,y}\_or\_Q_{fa,y}}{L_{truck}} \times 2D \times C_{truck} \times EF_{diesel}$$

Where:

$LT_{biomass,y}$ is the emissions due to transportation of the biomass during the year y in tCO_2
$LT_{fa,y}$ is the emissions due to transportation of the flying ashes during the year y in tCO_2
$Q_{biomass,y}$ is the quantity of biomass combusted in tons during the year y
$Q_{fa,y}$ is the quantity of flying ashes generated in tons during the year y
L_{truck} is the average load of a truck in tons
D is the average distance between the point of loading and the point of unloading
C_{truck} is average consumption of diesel of a truck in liters per km
EF_{diesel} is the emission factor of the diesel as per the 1996 revised guidelines (2708[37] gCO_2/liter)

For the estimation of the leakages, the following assumptions have been chosen:

Distance from the fields to the power plant : 50 km
Distance from the power plant to the brick manufacturer: 75km
Production of flying ashes: 20% of the raw material which corresponds to the maximum ratio of production (rice husk).

[37] 2006 IPCC factors for diesel: 43 TJ/t and 74,1 tCO_2/TJ density is taken equal to 0.85

Average consumption of a truck: 30 liters per 100km.

These ratios will be updated for each calculation afterwards if the situation has changed.

	unit	Value for the biomass	Value for the flying ashes
Material to be transported	MT/year	70,000	14,000
Average distance (one way)	km	50	75
Average load per truck	MT/truck	10	10
Oil Consumption of truck	litre/km	0.30	0.30
Specific emission of truck (2006 IPCC factors)	gCO2/litre	2708	2708
Emissions due to transportation	tCO2/year	**569**	**171**

As per calculation, the leakage due to transportation of biomass is 569 tCO_2/year and the leakage due to the transportation of flying ashes is 171 tCO_2/year

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

>> Sum of E.1.2.1 and E.1.2.2 = 5,045 + 569 + 171 tCO_2 = 5,785 tCO_2/annum

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:

>> Method: The Combined margin consisting of combination of operating margin and build margin according to ACM0002.

The baseline emission factor (EF_y) of Southern grid was calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps as specified in ACM0002/version 6 dated 19 May 2006. The baseline calculation for this combined margin is based on data from Central Electricity Authority (CEA), an official source and is made publicly available at www.cea.nic.in.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

Among the 4 options for the calculation of the operating margin emission factor, the simple Operating Margin (OM) was chosen. The Simple OM method was chosen as the low-cost/must run resources constitute less than 50% of total grid generation in the average of the five most recent years.

The Simple OM, was calculated using *ex-ante,* the full generation-weighted average for the most recent 3 years for which data was available at the time of PDD submission. The *ex-ante* vintage is chosen for calculations and will not be changed during the crediting period.

(a) *Simple OM*. The Simple OM emission factor ($EF_{OM,simple,y}$) was calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

where

$F_{i,j,y}$ = amount of fuel i (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants, and including imports to the grid,
$COEF_{i,j\,y}$ = CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*,
$GEN_{j,y}$ = electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission factor $\boldsymbol{COEF_i}$ was obtained as

$$COEF_i = NCV_i \times EF_{CO2,i} \times OXID_i$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*,
$OXID_i$ is the oxidation factor of the fuel (default value given in 1996 Revised IPCC Guidelines),
$EFCO_{2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

The Simple OM emission factor ($EF_{OM,simple,y}$) was calculated *ex-ante* the full generation weighted average for the most recent three years (2004-2005, 2003-2004 and 2002-2003) and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,,y}$).

STEP 2. Calculate the Build Margin emission factor (*EFBM,y*) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where:

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants *m*.

Of the two options given in ACM0002 for calculation of Build Margin emission factor, option 1 was chosen which is as follows and will not be changed during the crediting period.

Option 1. The Build Margin emission factor $EF_{BM,,y}$ *ex-ante* was calculated based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently, which comprises the larger annual generation.

STEP 3. Calculate the baseline emission factor *EFy* as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

where the weights *wOM* and *wBM*, by default, are 50% (i.e., *wOM* = *wBM* = 0.5), and $EFOM_{,y}$ and $EFBM_{,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.
The calculations for baseline emission factor EF_y is given is based on the calculations done by CEA. The baseline emission factor for southern grid is **0.850 tCO_2/MWh**.

STEP 4. Estimation of baseline emissions

Baseline emissions or emissions avoided by the project activity was estimated using the following formula.

$$ER_{elec,y} = EG_y \times EF_y$$

Where:

$ER_{elec,y}$ is the emission reductions due to displacement of electricity during the year y in tonnes of CO_2
EG_y is the net electricity supplied through APTRANSCO to southern grid
EF_y is the emission factor in current generation mix for the electricity displaced due to the project activity during the year y in tones CO_2/MWh = 0.850 CO_2/MWh

The power export from the project is anticipated at 34,059 MWh/year.

$ER_{elec,y}$ = 34,059 MWh/year x 0.850 tCO_2/MWh = 28,950 tCO_2.

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:

>> Emission Reductions

$$ER_y = ER_{elec,y} - E_{coal\ y} - LT_{biomass,y} - LT_{fa,y}$$

Where:

ER_y is the emissions reductions of the project activity during the year y in tones of CO_2,
$ER_{elec,y}$ *is the* emission reductions due to displacement of electricity during the year y in tonnes of CO_2,
$E_{coal,y}$ *is the* Emission arising out of combustion of fossil fuel (Coal) due to co-firing during the year y
$LT_{biomass,y}$ *is the emission due to the transportation of biomass* during the year y
$LT_{fa,y}$ *is the emission due to the transportation of the flying ashes*during the year y

ERy = 28,950 – 5,045 – 569 - 171 = 23,165 tCO_2/year

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

>>

Year	Estimation of baseline emission reduction tonnes of CO_{2e}	Estimation of project activity emission tonnes of CO_{2e}	Estimation of leakage tones of CO_{2e}	Estimation of emission reduction tones of CO_{2e}
2007-2008	28,950	5,045	740	23,165
2008-2009	28,950	5,045	740	23,165
2009-2010	28,950	5,045	740	23,165
2010-2011	28,950	5,045	740	23,165
2011-2012	28,950	5,045	740	23,165
2012-2013	28,950	5,045	740	23,165
2013-2014	28,950	5,045	740	23,165
Total for the crediting period	202,650	35,315	5,180	162,155

SECTION F.: Environmental impacts:

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

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The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. Hence, it is not required by the host party.

However, detailed environmental management plan is in place in the project activity location. Brief description on the measures taken towards the environment protection in the plant is given below:

1. Electrostatic precipitator is provided to bring down the SPM emissions from boiler to 115 mg/nm3 according to the AP pollution control board.
2. Solid wastes i.e. ash is disposed on a daily basis to avoid air pollution. The fly ash is being stored in silo only and is not stored in the open.
3. The boiler blow down due to its higher pH is neutralized before mixing with other effluent streams. The treated boiler blow down and cooling bleed off effluents is utilized for fly ash quenching and for green belt development within the plant premises.
4. Acidic and alkaline effluent streams coming from cation and anion units of DM plant are neutralized in a neutralization tank.
5. The sanitary waste water is treated in septic tank followed by soak pit.
6. A good housekeeping is being maintained in both, within the factory and in the premises. All hoods, pipes, valves are being maintained leak proof.
7. Green belt is maintained around the plant by planting mango trees and shading forest species on 12 acres.
8. Black boards have been displaced at the entrance of the factory carrying the water, air and noise monitoring data.

SECTION G. Stakeholders' comments:

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

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As per the guidelines, the stakeholders of the Project Activity are the people who face immediate effect of the project activity including local environment, social life and economics.

The stakeholders of the project activity are the following:

- Neighborhood villages
- Biomass suppliers
- Electricity purchaser (APTRANSCO)

Neighborhood villages

The Plant is surrounded by 2 villages: Tekulapalli and V M Banjar.

The 120 persons working on Rithwik Power Plant site are mostly originated from the nearby villages. Thus, since the commissioning of the plant additional financial resources have been generated into the local economical activity. It is widely known that the project bring great socio-economic benefits since it has been generated many direct and indirect opportunities to the population in the following activities: Manpower on site, biomass supplying chain, sub-contractors, transportation, etc.

In addition to the economical welfare generated by the project activity, the local population is also an indirect consumer of the power that is supplied from the power plants.

The villages elected representatives who administer the local area, are true representatives of the local population. We invited them[38] to give us their feedback on how the project has helped them improve their livelihood. Only positive impacts were mentioned by them.

On the environmental side, the plant has implemented all the required equipment to guarantee an eco-friendly operation of the plant. Andhra Pradesh Pollution Control Board (APPCB) has prescribed standards of environmental compliance and monitors the adherence to the standards. The project has the approval from NEDCAP to operate the plant.

Biomass Suppliers

About 30 different suppliers are delivering agri-residues to Rithwik Power plant on a day to day basis. Before the commissioning of the plant, the activity of agri-residues transportation and handling was quite reduced compared to the network that has been implemented since then.

Concerning the wood from Forest Department, the additional income due to the energy valorization of the wood waste has brought to the public department the resource to sustain the wood plantation across the area.

The presence of the plant and the pursuance of the operation of Rithwik is of great economical opportunity for those companies.

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[38] Mr SuryaDevara Ravi and Mr. Naga Prasad

Electricity Purchaser (APTRANSCO)

As a buyer of the power, the APTRANSCO is a major stakeholder in the project.

APTRANSCO has cleared the project during commissioning time and Rithwik Power Plant signed with APTRANSCO a Power Purchase Agreement (PPA) (vide No.10578 dated 19/3/2002).

As mentioned in the previous section, tariff has been decreased in 2004-2005. This revision has been contested by all biomass power plants operators constituted into an association. The decision of the court was still pending at the time of PDD submission.

G.2. Summary of the comments received:

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No negative comments were received on the plant activity.

It is quite clear that in the hypothesis of a cessation of activity, the local economy will be highly affected.

The Present Document will be hosted by the DOE website during 1 month for further comments.

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

>> Not applicable. Only positive comments received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is available to the project

Annex 3

CEA CALCULATION FOR BASELINE

In order to facilitate adoption of authentic baseline emissions data and also to ensure uniformity in the calculations of CO_2 emission reductions by CDM project developers, Central Electricity Authority (CEA), in cooperation with GTZ CDM-India, has compiled a database containing the necessary data on CO_2 emissions for all grid-connected power stations in India. The database currently covers the five fiscal years 2000-01 to 2004-05. The database is an official publication of the Government of India for the purpose of CDM baselines. It is based on the most recent data available to the Central Electricity Authority. India is the first country in the world to have ventured to take up the complex task of developing such an official baseline for the power sector as a whole.

The calculations are based on generation, fuel consumption and fuel quality data obtained from the power stations. Typical standard data were used wherever precise information was not available. Inter-regional and cross-border electricity transfers were also taken into account for calculating the CO_2 emission baseline.

For the baseline emission factor, the calculations of CEA have been adopted without any modifications. The CEA website includes calculations of weighted average emission rate (including and excluding imports) and combined margin (including and excluding imports).

For our project activity we have utilized the combined margin calculation (including imports) which is based on ACM0002, Version 6, the latest version. The details of the baseline calculations are hosted on the website:

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

According to the CEA calculations, the baseline emission factor for southern grid is 0.850 tCO_2/MWh. The excel sheets and the calculation details have been enclosed for reference.

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