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

**CONTENTS**

**Revision history of this document**

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

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

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

4 MW biomass based power generation project at Guntur, Andhra Pradesh.

Version 3, date - 24/03/2008

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

Velagapudi Power Generation Limited (hereafter the Project participant or VPGL) have set up a 4 MW biomass based power plant (hereafter the Project) at Nadimpalem village, Prattipadu Mandal, Guntur District, Andhra Pradesh in India (hereafter the, Host Country). Project has received all clearances and financial closure. Project has been commissioned on December 2006.

VPGL is promoted by Mr. Velagapudi Sambasiva Rao and his family members. Mr. Rao has held several positions in the Andhra Pradesh (AP) Rice Millers Association. He subsequently diversified into cold storage business and became a pioneer in the field in the state of AP. He along with his family members has successfully built seven cold storages in Vijayawada, Guntur and Khammam sites in AP and all the units are running successfully.

**Purpose of the Project Activity:**

The proposed 4 MW capacity plant is operating from January 2007 and power is being supplied to the grid. The gross power generation per year is estimated to be 27.38 MUs considering designed PLF and minimum of 330 days of service in year.

The project activity has been essentially conceived to generate GHG emission free electricity by making use of available biomass at the project site to meet the regional electricity demand. The project being a renewable energy project leads to sustainable development through efficient utilisation of available natural resources and generation of additional employment for the local stakeholders.

**Contribution of Project Activity to Sustainable Development:**

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

Government of India has stipulated following indicators for sustainable development in the interim approval guidelines[1] for CDM projects.

1. Social well-being
2. Economic well-being
3. Environmental well-being
4. Technological well-being

**1. Social well being:**

- The plant site is an isolated rural area where unemployment, poverty and other economic backwardness are prevailing; the project would lead to the development of the region.
- During civil works, a lot of construction work took place, which generated employment for local people around the plant site other than these there are various kinds of mechanical work, which generated employment opportunity.
- Since, the biomass resources are collected and transported to the plant site from the fields, opportunities are generated for the rural people to collect and transport biomass. This results in the enhanced employment of the people.

**2. Economic well being:**

- The project activity generates employment in the local area.
- It provides stable and quality power to the industry. The project creates a business opportunity for local stakeholders such as bankers, consultants, suppliers, manufacturers, contractors etc.
- In other words, the plant is generating commercial value to agricultural residues enabling the farmers to get better price out of their produce augmenting their income. The above benefits due to project activity ensure that the project would contribute to the social and economic well being in the region. Hence, the project contributes to the economic sustainability around the plant site, which is promotion of decentralization of economic power.

**3. Environmental well being:**

- A power plant based on renewable energy sources (biomass) as fuel, does not affect the ecology, provided a few precautions are taken in the design of the plant. Project also reduces pollution in general. All the necessary measures have been taken in the plant's design for minimizing the impact on the ecology of the environment.
- The project ensures the resource sustainability, which has been used. The fuel is residue of agricultural products and hence the project is friendly for biodiversity.

**4. Technological well being:**

- The technology selected for the project is a more energy efficient technology.
- This leads to a lot of fuel being saved and thus is helping in resource sustainability.

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

[1] Ministry of Environment and Forest, web site: http://envfor.nic.in:80/divisions/ccd/cdm_iac.html

## A.3. Project participants:

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

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

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

#### A.4.1.1. Host Party(ies):

India.

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

Andhra Pradesh.

#### A.4.1.3. City/Town/Community etc:

Village - Nadimpalem
Mandal - Prattipadu
District - Guntur

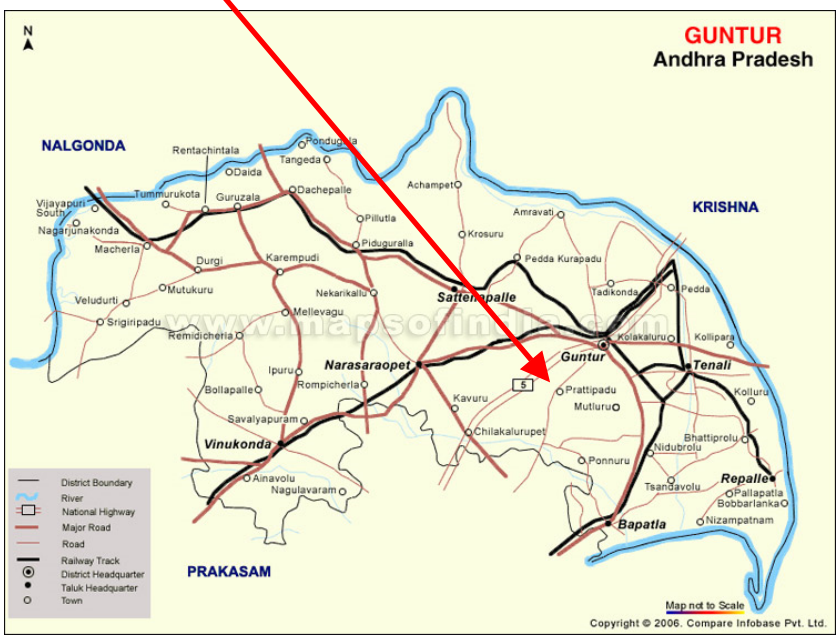
#### A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

- Project Site : Nadimpalem, Prattipadu Mandal
- District : Guntur
- State : Andhra Pradesh
- Lattitude : 16° 11' N
- Longitude : 80° 20' E

The plant is located at plot no. 67, 68, 70, 71, and 72 of the Nandimpalem village.

Fig. 1 – Location Map





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

As defined under Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project activity proposes to apply following project types and categories:

- Type : I – Renewable Energy Projects
- Project Category : Grid connected renewable electricity generation (I.D) (Version 11)

**Technical Specifications:**

The power generation scheme proposed envisages a single boiler with all its auxiliary systems and an extraction cum condensing turbo-generator with all its auxiliary systems, HV and EHV systems for the export of the power to the grid and the remaining balance of plant items to complete the power plant.

The scheme envisages a 20 TPH capacity steam generator with the outlet steam parameters of 66 ata and 485 °C, with the feed water inlet temperature of 116.3 °C. The turbo-generator is of 4 MW normal capacity bleed cum condensing type. The plant is designed with all other balance of plant systems like the fuel handling system, ash handling system, raw water system, cooling water system, de-mineralized water system, compressed air system, HV and EHV systems etc. for its successful operation. The scheme is configured to optimize the power generation, with one stage of feed water heating.

The power generation at turbo generator is at 11 kV, 50 Hz, 3 phases. The power will be supplied to the Andhra Pradesh Transmission Corporation of India Ltd. (APTRANSCO) grid at the near by 33/11 kV substation at Prattipadu, which is about 6 km from the generation plant.

The project activity uses state of the art technology having modern safety features and pollution control systems to ensure environmentally safe and sound operation.

No technology transfer is involved in the project activity, but the project does promote biomass power generation in a rural area.

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

| Years | Estimation of annual emission reductions in tonnes of CO2 e |
|---|---|
| 2008-09 (June onwards)[2] | 23123 |
| 2009-10 | 23123 |
| 2010-11 | 23123 |
| 2011-12 | 23123 |
| 2012-13 | 23123 |
| 2013-14 | 23123 |
| 2014-15 | 23123 |
| 2015-16 | 23123 |
| 2016-17 | 23123 |
| 2017-18 | 23123 |
| **Total estimated reductions (tonnes of CO2 e)** | **231230** |
| **Total number of crediting years** | **10** |
| **Annual average of the estimated reductions over the crediting period (tCO2 e)** | **23123** |

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

The project has neither received any public funding from the Annex I parties nor any Official Development Assistance (ODA). The project is a unilateral project.

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

Appendix C, paragraph 2 of the Simplified Modalities and Procedures for Small-Scale CDM project activities states:

"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."

On the basis of the above, the biomass power project cannot be considered as de-bundled component of a large project activity as:

- The project is first for VPGL and so far only generation plant;
- VPGL have not registered any other small-scale project activity within the previous two years; and the project boundary is not within 1 km radius.

[2] Start date will be from date of registration with CDM EB, which is expected as June 2008.

## SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline methodology for the project activity is:

***'AMS I.D. – Grid connected renewable electricity generation' (Version 11)***

The reference has been taken from the recent list of the small-scale CDM project activity categories contained in Appendix B of the simplified M&P for small-scale CDM project activities.

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

As defined under Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project activity proposes to apply following project types and categories:

- Type : I – Renewable Energy Projects
- Project Category : Grid connected renewable electricity generation (I.D) *(Version 11)*

Justification

For Type I : Project capacity is only 4 MW which is less the 15 MW

So project is a small scale project activity. There will be no addition in capacity of the project activity through out the crediting period so the project will be in limits of small scale project activity during every year of crediting period.

- **Requirements with respect to technology/measure under AMS I.D. – Grid connected renewable electricity generation.** ***(Version 11)***

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.
2. If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15 MW 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 15 MW.
3. Combined heat and power (co-generation) systems are not eligible under this category.
4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.
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.

**Justification:**

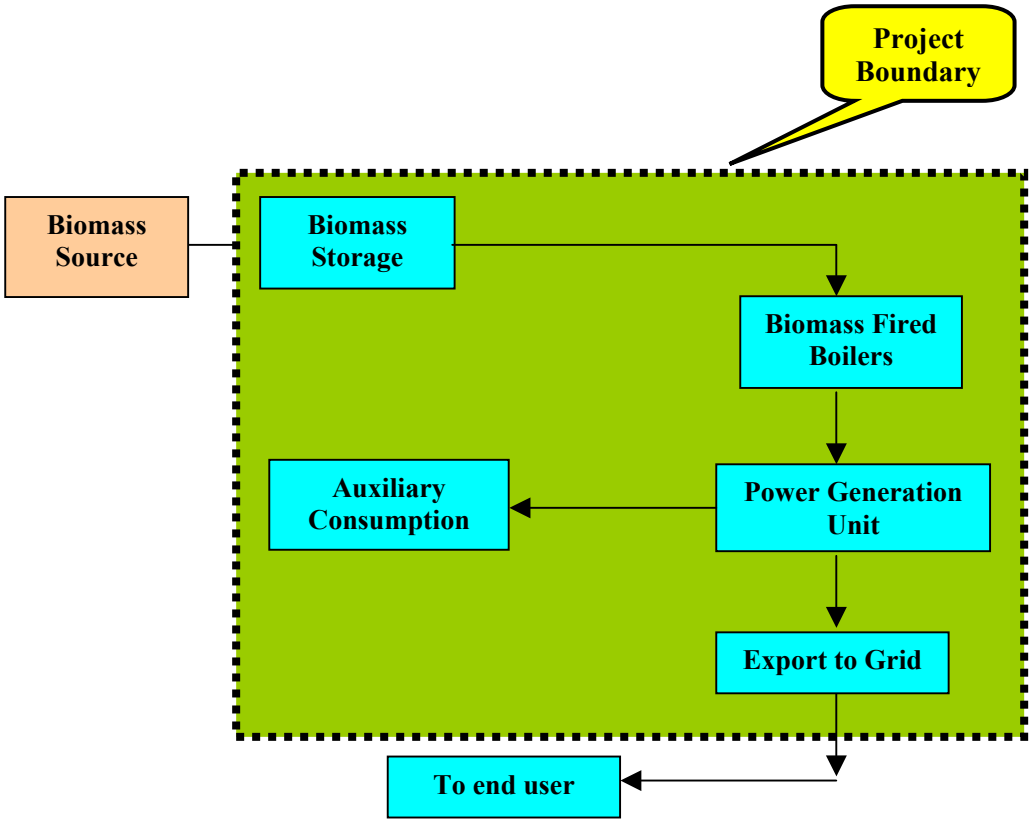
- This project activity is a 4 MW (< 15 MW) biomass power generation system that supply electricity to and/or displace electricity from a grid.
- There will be no addition in capacity during entire crediting period.

So, in light of the above, the applicability of this type & category of methodology to this project is justified.

## B.3. Description of the project boundary:

Project boundary specified in the Appendix B of simplified modalities and procedures is that encompasses the physical, geographical site of the renewable generation source. This includes the project installation, pooling and sub-stations. The proposed project activity evacuates the power to the Southern Region Grid. Therefore all the power plants contributing electricity to the Southern Grid are taken in the connected (project) electricity system for the purpose of baseline estimation.

Fig. 2 - Project Boundary




## B.4. Description of baseline and its development:

The project activity is aimed at providing electricity to southern grid, generated from renewable source i.e. biomass. The project will be exporting electricity to grid that otherwise would have been produced and exported to grid with current combination of power plants connected to respective grid. Thus the most appropriate baseline for the project activity is the displacement of southern grid.

**Baseline Estimation:**

Baseline methodology for project category *I.D* has been detailed in paragraphs 7-11 of the approved small scale methodology *AMS I.D*. (Version 11, date: EB31) Paragraph 9 of the approved methodology applies to this project activity, which states that:

'For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg $CO_2$equ/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. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use Simple OM and the Average OM calculations must be considered.

OR

b) The weighted average emissions (in kg $CO_2$equ/kWh) of the current generation mix.'

➢ Promoter opts for option (a) i.e 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.

In the proposed baseline, Southern Region grid is used as the reference region for estimating the current generation mix.

Note: Please note that Central Authority of India (CEA), Ministry of Power, Government of India now provides the database for the grid emission factor of various regional grids in India. The estimation of the Grid Emission coefficients (OM & BM) by CEA is based on the approved methodology ACM0002, Version 07. The applicable methodology AMS ID version 11 refers to ACM0002 version 6 and the CEA database version 2 is based on ACM0002 version 6. As ACM0002 refers to latest data available to use for emission reduction calculation, so CEA version 3 has been used and over and above it is also conservative of two choices.

Formulas used for calculation of the combined margin, (grid emission coefficient) and baseline have been elaborated in section B.6.1

Following information is used for baseline determination:

| Sr. No. | Key Information/data used for baseline | Source of data/information |
|---|---|---|
| 1. | Electricity generated | Monthly Energy Meter Reading & Invoices of State Electricity Board for electricity exported to the regional grid. |
| 2 | Grid Emission Coefficient (OM &BM) of Southern Region & Northern Regional grid. | $CO_2$ Baseline Database for the Indian Power Sector, User Guide (Version 3, Date December, 2007) http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm |

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:**

The project reduces anthropogenic emission of greenhouse gases by source below those would have occurred in absence of the registered CDM project activity.

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

The installed capacity of the project is 4 MW, which is less than the limiting capacity of 15 MW and is thus eligible to use small-scale simplified methodologies. Further, the project activity is generation of electricity for a grid system using renewable energy. Hence, the type and category of the project activity matches with I.D. as specified in Appendix B of the indicative simplified baseline and monitoring methodologies for small-scale CDM project activities.

**Justification for additionality of the project**

UNFCCC simplified modalities seek to establish additionality of the project activity as per Attachment A to Appendix B, which listed various barriers, out of which, at least one barrier shall be identified due to which the project would not have occurred any way. Project participants identified following barriers for the proposed project activity.

Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

- Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

- Technological barrier: a less technologically advanced alternative to the project activity involves lower risks 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: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

- Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

VPGL decided to set up the biomass based power project and accordingly got sanction from NEDCAP. At the time of decision making to set up the project, VPGL was aware about CDM benefits for these kinds of projects through publications and letters from agencies like Winrock International and MEDA in 2002 and 2003, respectively.

In order to achieve financial closure, VPGL approached to lending intuitions. At that time, getting financial assistance was difficult for such kind of new and risky sector. While undertaking financial appraisal, VPGL was facing problem with project's viability to get financial closure. To strengthen financial viability, VPGL also sought information on the amount of CERs and revenue from one of the service supplier in August 2003. Finally on 20/10/2004, VPGL entered into loan agreement with Indian Overseas Bank and started work on the project.

Though VPGL entered into agreement with NEDCAP in 2002, the actual work started very late, that indicates problem associated with these kind of projects. The timeline of the project activity is as follows –

| Events | Date | Justification |
|---|---|---|
| Publication from Winrock | September 2002 | Publication by Winrock International with information on CDM |
| Letter from MEDA | 01/01/2003 | Letter from MEDA for participation in a conference on Biomass Power including CDM. |
| Letter from VI-sa services | 12/08/2003 | Supplier offered services for CDM cycle |
| Letter to Vi-sa services from VPGL | 20/08/2003 | VPGL asked information on amount of CER and revenue that can be available to improve financial viability of the project. |
| Purchase order | 12/10/2004 | Purchase order was issued to Equipment supplier M/s. Thermodyne for supply of 1 no.20 TPH boiler |
| Loan agreement | 20/102004 | Loan sanctioned by IOB.<br>VPGL then started issuing POs to various vendors.<br>Project start date. |
| PPA | 12/11/2006 | PPA signed with State Electricity Board |
| Commissioning | 13/12/2006 | Project got commissioned in December 2006. |

- **Investment Analysis**

The Indian power market has recently been opened up for private investment. Previously, the market has been dominated by state-owned enterprises both in the generation and distribution. Lately, private Indian companies, such as VPGL, have started investments in the small-scale power generation sector. At the same time, the Government has initiated the deregulation of the power market. According to the Indian Renewable Energy Development Agency Ltd. (IREDA), the Indian power market has also been riddled with problems such as non-paying customers and bankrupt state electricity boards. If the developer/investor chooses to sell the electricity generated by the project to the state grid, the Government does not compensate the developer/investor in the event of grid failure, shut down, interruption in power supply etc. Developers such as VPGL have to absorb this risk. These risks fall more heavily on small-scale projects, which in any case are subject to greater technological risks, and have a higher installed cost per MW. Due to these problems, investment in small-scale projects of this nature is not very attractive to investors. The risks of non-payment have simply been too large for most investors. Thus, in spite of the reforms introduced in the Indian power sector, financial institutions are reluctant to expose themselves to the investment risks.

**Benchmark analysis –**

The benchmark returns for some of the investments in the Indian economy are shown below:

| | |
|---|---|
| Government Long Term Securities | Around 6 % p.a. |
| Commercial Banks Rates on Long Term Deposits | 8 to 10 % p.a. |
| Rated Company Debentures | More than 10 % p.a. |

The businesses with normal risk therefore reasonably expect an IRR of about 13 % to 14 %. Power generating projects have always been fraught with higher risks. This is because except coal based projects, the energy sources for generating electricity are not very dependable. This applies even more for a biomass based power project. Shortfall in rainfall leading to shortage of biomass fuel for the project and uncertainty of electricity tariff rates is another major risk factor. Looking to these circumstances, an IRR of at least 16% is the reasonable expectation.

A return on equity of 16 % mention also in APERC order dated 20th March 2004 for such projects has been selected as benchmark for the candidate project. So the chosen benchmark is appropriate to compare the project returns.

The project returns has been calculated according to assumption shown in table below.

| Parameter | Figure | Source | Justification |
|---|---|---|---|
| Project Size | 4 MW | DPR, Loan Sanction letter of SBI | -- |
| Total Project Cost | Rs. 1594.00 lacs | Loan Sanction letter of SBI | -- |
| Cost of Project per MW | Rs. 398.50 lacs | Calculated | = Rs. 1594 lacs / 4 MW |
| **Means of Finance** | | | |
| Debt | Rs. 1060.00 lacs | Loan Sanction letter | |
| Equity | Rs. 534.00 lacs | Calculated | = Total Project Cost – Debt |
| **Operating Parameters** | | | |
| Plant Load Factor | 95% | Assumed | The PLF considered in DPR is 80% but for conservative approach the maximum PLF possible has been considered. |

<table>
<tr><td>Net Billable Units</td><td>27,387 MWh/yr.</td><td>Calculated</td><td>
<table>
<tr><td>Gross Capacity</td><td>4 MW</td><td></td></tr>
<tr><td>Aux. Consumption</td><td>9%</td><td>As per APERC</td></tr>
<tr><td>Net Prod. Capacity</td><td>3.64 MW</td><td></td></tr>
<tr><td>PLF</td><td>95%</td><td>As per APERC</td></tr>
<tr><td>Net capacity to export</td><td>3.458 MW</td><td></td></tr>
<tr><td>Operating day</td><td>330 / yr.</td><td></td></tr>
<tr><td>Operating Hours</td><td>24 / day</td><td></td></tr>
<tr><td>Annual Generation</td><td>27387.36</td><td>MWh</td></tr>
</table>
</td></tr>
<tr><td>Life of the Plant</td><td>20 Years</td><td>Certificate Letter issued Chartered Engineers</td><td></td></tr>
<tr><td>O & M Cost</td><td>Rs. 67.60 lacs</td><td>Assumption made according to industry norms</td><td>According to industry norms, the O&M cost should be considered upto 5% of total project cost. Here, the O & M cost is considered as 4.2% of total project cost.</td></tr>
<tr><td>Escalation rate</td><td>5%</td><td>Industry norms</td><td>5% is the in line with industry norms.</td></tr>
<tr><td>Interest on term loan</td><td>12.25%</td><td>Considered</td><td>Though the average of actual interest rate is higher than 12.25%, VPGL considered 12.25% rate of interest during conceptualization stage of project.</td></tr>
<tr><td>Syndicate Bank</td><td>13.5%</td><td>Loan Sanction letter</td><td>Earlier the VPGL applied for loan of 560 lacs to by SBI and same was granted. In the financial calculation sheet under project scheme same was mentioned during calculation. Now that loan has been shifted to Syndicate bank.</td></tr>
<tr><td>Indian Overseas Bank</td><td>13.25%</td><td>Loan Sanction document</td><td></td></tr>
<tr><td>Tariff, Rs/unit</td><td>
<table>
<tr><th>Year</th><th>Fixed Cost</th><th>Variable cost</th></tr>
<tr><td>1</td><td>1.61</td><td>1.40</td></tr>
<tr><td>2</td><td>1.57</td><td>1.47</td></tr>
<tr><td>3</td><td>1.53</td><td>1.54</td></tr>
<tr><td>4</td><td>1.49</td><td>1.61</td></tr>
<tr><td>5</td><td>1.45</td><td>1.68</td></tr>
<tr><td>6</td><td>1.41</td><td>1.75</td></tr>
<tr><td>7</td><td>1.37</td><td>1.82</td></tr>
<tr><td>8</td><td>1.33</td><td>1.89</td></tr>
</table>
</td><td>As per APERC order 20th March 2004; page 41</td><td>The project shall be entitled to a tariff with the component of fixed charge based on the year of operation and variable charge corresponding to the financial year of the operation. After 11th year project will receive only variable cost that will be decided later. Here it has been assumed as 2.55 Rs with escalation of 0.07 Rs per year. Same escalation rate is for variable cost for 1st to 10th year.</td></tr>
</table>

| | | | | | |
|---|---|---|---|---|---|
| | 9 | 1.26 | 1.96 | | |
| | 10 | 0.87 | 2.03 | | |

| Item | Equity IRR |
|---|---|
| Expected minimum benchmark return | 16.00% |
| Equity IRR without CDM benefit | 11.39 % |
| Equity IRR with CDM benefit | 17.29 % |

The calculated equity IRR is significantly low in comparison to benchmark IRR while tariff offered was determined to yield 16% of equity IRR. The main reason of the difference is change in actual expenditure and one assumed during tariff determination. Few of the differences has been explained in table below –

| Parameter | As per APERC order | Actual |
|---|---|---|
| Interest Rate | 10% | 12.25% |
| O&M expenditure | 4% | 4.2% |
| Escalation in O&M | 4% | 5% |
| Tariff rate and period | The fixed tariff is determined for 10 years, and variable cost for three years | The equity IRR has been calculated for 20 years. |

Hence, the project clearly indicates lack of financial attractiveness without CDM revenue and thus convincingly claims eligibility for CDM benefits. The above shown IRR is with CDM benefits and the plant operating at 95 % PLF with the current cost of fuel and generation efficiency, all of which may vary to the disadvantage of the project, on the basis of the current biomass plants working scenario in Andhra Pradesh.

**Benchmark analysis – Sensitivity**

Increase in the fuel cost, loss in generation and decrease in PLF due to a shortage of biomass fuel or the grid failure restricting the export of power even though the plant is capable of exporting are the most significant risk factors for the project. The sensitivity analysis of the variation in equity IRR without CDM Benefit and with CDM Benefit is given below.

**Sensitivity Analysis Without CDM Benefit**

| Change in Fuel Cost by …. | +10 % | +5 % | 0 % | -5% | -10% |
|---|---|---|---|---|---|
| **IRR** | **4.21 %** | **8.58%** | **11.39%** | **13.62%** | **15.54%** |
| Change in PLF by … | -5 % | -2.5 % | 0 % | +2.5 % | +5 % |
| **IRR** | **9.76%** | **10.58 %** | **11.39%** | **12.17%** | **12.94%** |
| **Use of biomass from energy plantation** | **Average quantity 4800 MT/year*** | | | | |
| **IRR** | **15.48%** | | | | |

***** The Average biomass available from the 500 Acer plantations has been calculated as per the reference document (link http://www.rerc.in/rets/RETs%2016.pdf) by Renewable Energy Resource Center [RERC], Hyderabad, Andhra Pradesh. The average cost has also been calculated on same line. The cost of biomass from energy plantation has been calculated on the most conservative manner and does not include lease amount and transportation paid by VPGL, which will further reduce the IRR.

**Conclusion:** The project activity has financially more viable options available, which would have resulted in higher GHG emissions. Without CDM revenue the returns from the project as shown above are much lower than the expected returns of the project. With CDM revenue, the returns from the project are attractive and partly mitigate the risks involved in the Project. Thus, CDM benefits are necessary to make the project attractive.

- **Technological Barriers**

Although, recent policy changes by the Government of India encourage greater participation by the private sector in electricity generation, there still are Endogenous and Exogenous Technological, Regulatory, Institutional and Investment related Barriers that the project proponent has to face when setting-up a biomass based power project for supplying the electricity generated to the State Utility. These barriers are given in the following sections.

| Barrier | Reference Document | Narration |
|---|---|---|
| **Exogenous Barriers** | | |
| Barrier due to uncertainty of fuel supply | Variations in rainfall (Rainfall data for the last 5 years in Guntur area obtained from the Meterological Dept, Guntur) | In case of the project activity, one of the major risks is insufficiency of rainfall and consequent shortage in agro-residues as fuel for the project, especially in the near future due to global warming. This situation will lead to a drastic reduction in power generation, which will adversely affect the returns on the project. |
| Barriers due to loss in power sold due to grid failure | Discussions with Junior Engineer at Prattipadu Sub-station of APTRANSCO (Grid Failure Data obtained from the Asst. Elec. Engineer, Prathipada SS, Guntur District, giving the Grid Failure Data for 2000-01 to 2004-05 – 5 years due to various reasons) | The project proponent has set up the biomass based power generation facility and commenced supply of the electricity generated to the State Utility grid at Prattipadu sub-station. However, discussions with the authorized person of the State Utility at Prattipadu a sub-station on April 5, 2007 have revealed that there is frequent failure / load shedding of the grid at Prattipadu Sub Station. A random check of the records for grid failure for the last one year has shown that, apart from the scheduled load shedding, the grid has tripped 16 times in the month of January 2007, 8 times in February 2007 and 9 times in March 2007. Though the duration of each of the breakdown was negligible, it had a cascading effect on the VPGL power plant, which took considerable time to restore the normal power export to the grid resulting in export loss of about 4 to 5 %. This implies that the project proponent stands to lose more than 4 % of the power it can generate, due to the grid not being available for power evacuation, thus resulting in a loss of revenue.<br>The Past Grid Failure Data at the Sub Station |

| | | |
|---|---|---|
| | | collected from the authority shows that on an average the Grid fails about 180 times every year. As stated above, these multiple tripping will have a cascading effect on Velagapudi Power Plant, even though the tripping duration may be short. |

- **Barrier Due to Prevailing Practices**

In the Indian Power Sector, common practice involves investing mostly in medium or large-scale fossil fuel fired power projects, which generate higher emissions. This is mainly due to the assured return on investment, economies of scale and easy availability of finances. The same trend applies for state of Andhra Pradesh. This can be substantiated by the fact that out of 12129.04 MW of power being utilised in Andhra Pradesh as on September 30, 2007, about 64 % comes from fossil fuel including 11.23 % in the private sector. The share of the Mini Hydel, Wind, Cogen & Biomass, set up by the private sector is less than 5 %. (www.aptranscorp.com/pact01.pdf)

Privately financed, built and operated small biomass power plants are not common practice in Indian power sector. Furthermore, the rapid pace of industrialization in India has required huge amounts of power and necessitated the installation of large multi-purpose power projects vis-à-vis small biomass based power generation projects. Thus, the pace of growth in the small-scale biomass based power generation sector has been slow. This can be substantiated by the fact that NEDCAP has sanctioned in all 59 biomass plants in Andhra Pradesh besides additional 8 biomass plants exclusively on plantation, totaling to 67 units with a total installed capacity of 408.75 MW. This works out to hardly 3.37 % of the total power utilized in the State as on September 30, 2007.

The share of electricity from biomass based power generation projects in India's total installed capacity is still very negligible. According to the figures from the All India Electricity Statistics, General Review – 2006, published by the Central Electricity Authority, Ministry of Power, Government of India, New Delhi, published in March 2006, the total installed capacity of power generation from biomass is only 727.53 MW, whereas India's total installed capacity was 118,425.70 MW. Thus, the biomass power sector contributes to only 0.6 % of the total installed capacity in India. In Southern Grid, the total installed capacity of power generation from biomass power was 570.23 MW, whereas the total installed capacity was around 31,876.39 MW. Thus, the biomass power sector's contribution to the Southern grid's installed capacity was about 1.79 %. In Andhra Pradesh, out of the 67 biomass units sanctioned by NEDCAP with an installed capacity of 408.75 MW, as on March 2004, only 30 biomass units with an installed capacity of 160 MW have actually been commissioned.

The Ministry of New and Renewable Energy (MNRE) indicates that an estimated potential of about 19,500 MW of biomass power projects exists in India. However, the percentage of installed capacity of biomass power in India is still only 3.73 % of the potential. This indicates that investing in biomass power plants is not a common practice despite efforts by MNRE to promote biomass power in India.

- **Other Barriers**

**Institutional barriers**

| Barrier | Reference Document | Narration |
|---|---|---|
| 1. Project developer has to accept tariff fixed by APERC | APERC Order No. RP No.84 / 2003 in OP No. 1075 / 2000 dated March 20, 2004, Point No. 62 on page 40. | MNRE had recommended a uniform price for all renewable energy projects at Rs. 2.25 per unit with 1993-94 as the base year with an escalation of 5 % compounded every year for 10 years.<br><br>The Government of Andhra Pradesh vide its order Ms No.93 dated November 18, 1997, announced implementation of the same policy but with 1997-98 as the base year, but upto the year 2000 only. However, the AP Govt vide its order Ms No.112 dated December 22, 1998 informed that after the 3 year period, the tariff will be revised as recommended by the then Andhra Pradesh Southern Power distribution Company Limited (APSPDCL).<br><br>Andhra Pradesh Electricity Regulatory Commission (APERC) is the regulatory body instituted for governing generation of power and its purchase by the State Utility and was constituted on April 3, 1999. APERC in exercising its power under Sec 86(1)(a), (b) and (c) read with (e), and Section 62(1) of the Electricity Act 2003 (EA 2003), vide its order dated March 20, 2004, fixed the tariff rates of electricity when sold to State Utility for "Power from Biomass-based Generation Projects" at a much lower rate than recommended by MNRE. The rate at which electricity is to be sold to the State Utility was fixed by APERC and is binding on the project promoter. While the Fixed Rate has been given for the first 10 years of the Project, the Variable Rate has been given only for 5 years from 2004-05 to 2008-09. The Total Tariff as per this for the Project will be Rs. 1.61+1.40 = Rs. 3.01 per kWh.<br><br>This shows the policy changes can happen now and then and the Promoters have to simply abide by the order irrespective of their representations. |
| 2. Project developer has to accept APSPDCL or APERC tariff whichever is lower. | PPA signed with, APSPDCL Schedule- 1A, Page no. 22 | Though APERC fixed the tariff rate for all biomass power projects at Rs. 3.01 per kWh as shown above for the year 2006-07 for the first year of the project, APSPDCL has signed the PPA with VPGL for a lower tariff rate of Rs. 1.47 Fixed Cost + Rs. 1.38 Variable Cost = Rs. 2.85 per kWh. Reduction of Rs. 0.16 per kWh over APERC tariff and will result in lower sales value and hence lower returns to the project. |

| | | |
|---|---|---|
| 3. Further uncertainty in tariff rate | APERC Order No. RP No.84 / 2003 in OP No. 1075 / 2000 dated March 20, 2004, Point No. 64 on page 42. | In addition to the policy changes, there also exist regulatory barriers such as the cut-off of 410 MW of installed capacity, which is to be reviewed after 3 years of the order, which may see additional biomass based power plants being sanctioned. This may result in fuel shortage and / or their drastic increase in price. |
| 4. Tariff includes all taxes | PPA signed with APSPDCL, Article 2, point 2.3 & 2.4, Page no. 6 | The PPA states that the tariff fixed is inclusive of all taxes, duties & levies and also states that the future increase in such taxes, etc, on energy generated is to be borne by the Company. Though there are no such taxes, duties & levies applicable on the power tariff as on date, the Government may introduce such taxes, etc, in future to augment its resources. In such a case, the effective tariff gets reduced which will affect the project returns. |
| 5. Delay in payment | PPA signed with SPDCAP, Article 5, point 5.2, Page no. 12 | PPA provides for interest on delayed payment at the rate of 10 %. However, the interest payable on the term loan is 12%. Hence, any delay in receiving the payment from the APTRANSCO will result in a loss of 2 % to the project. |
| 6.No third party sale allowed in case of continued default by the State Utility | APERC Order No. RP No. 84 / 2003 in OP No. 1075 / 2000 dated March 20, 2004, Point No. 7.b.i & ii on page no. 5 and point No. 9 on page no. 6. | The APERC order does not permit the sale of power to a third party. Hence, during the grid outage, the project has to either be on home load or shut down its plant, resulting in a loss. |

As against Rs. 2.85 / KWh which Velagapudi is getting in Andhra Pradesh, their counterparts in Maharashtra is getting a power Tariff of Rs. 3.11 from MSEB.

**Managerial resources barriers**

The small scale power plant developers such as VPGL are normally self made promoters with limited exposure to the industry. They normally try to keep their overheads low in order to get the desired returns on investment. Hence, they will not be able to attract the best managerial personnel who are required to man the power plants.

**Organisational capacity barriers**

As stated above, the developers of small scale power plants are mostly first time entrepreneurs or setting up such projects for the first time and have limited exposure to the industry. Most of them

are with business background and may not have a professional background. This restricts their organisational capacities to run the plant in a professional way.

**Financial resources barriers**

As stated earlier, large scale projects always attract investments from various sources whereas small power projects, who are prone to several risks, face problems in getting the right finance at the right time. This delays the project commissioning which again normally results in cost escalation. Consequently, the returns on the project get reduced.

**Capacity to absorb new technology barriers**

Most of the biomass based power plants started by those who had professional exposure or those who had access to information on the latest technology have gone for higher pressure ratings of boilers with higher level of automation including operation and control of the power plant by DCS. This will require a higher calibre of the plant personnel but reduces the number of operators and manual operation. VPGL due to lack of awareness and financial resources barriers, have not opted for such a technology. Therefore, VGPL's actual cost of operations and maintenance has gone upto Rs. 69.75 Lakhs for about 8 to 9 months as against estimated cost of Rs. 68.79 Lakhs for the entire year.

**Summary**

The primary barriers within the Indian institutional and regulatory framework for biomass based power projects are the uncertainty of tariff beyond a certain point, inadequate security for power sold to the state utility, restrictions in the area from which biomass can be collected, etc. Technical or operational barriers are uncertainty of availability and price of biomass over a period of time and loss in generation due to non-availability of a stable grid to evacuate power. All these issues amount to enough uncertainty to deter many project developers from starting such projects and financial institutions from supporting projects that choose to do so. The low share of biomass power projects in the total installed capacity of the country confirms these prohibitive barriers. The approval and registration of the project as a CDM activity will help overcome some of the losses due to the identified barriers for the project. This may lead to such projects becoming more financially attractive to investors.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

*"Appendix B of the simplified modalities and procedures for small-scale CDM project activities",* provides indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity category. As per this document, the proposed CDM project falls under ***Type I.D – Grid connected renewable electricity generation.***

Baseline methodology for projects under Type I.D has been detailed in paragraphs 7-11 (Type I.D) of the above-mentioned document. Paragraph 8 & 9 (Type I.D) applies to this project activity.

The project activity supplies electricity to an electricity distribution system that is supplied by at least one fossil fuel or non-renewable biomass fired generating unit. So, Paragraph 9 (Type I.D) becomes the baseline, which states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission co-efficient (measured in kg $CO_2$equ/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. 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 $CO_2$equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The project activity chooses to use option (c) i.e. combined margin, consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002.

The baseline emission factor (EFy) is 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. Calculations for this combined margin must be based on data from an official source (where available) and made publicly available.

***Step 1: Calculate Operating Margin Emission Factor ($EF_{BL,OM}$)***

*The operating margin emission factor(s) ($EF_{BL,OM}$) is calculated based on one of the four following methods:*

*(a) Simple OM, or*
*(b) Simple adjusted OM, or*
*(c) Dispatch Data Analysis OM, or*
*(d) Average OM.*

As per the methodology (c) 'Dispatch Data Analysis' should be the first methodological choice.

*(a) 'Simple OM' method is applicable to a project activity connected to the project electricity system (grid) where the low-cost/must-run resources constitute less than 50% of the total grid generation in: 1) Average of the five most recent years, or 2) Based on long-term normal for hydroelectricity production.*

*The average emission rate method (d) can only be used where low-cost/must-run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and where detailed data to apply option (c) above is unavailable.*

*(b) Simple adjusted OM and (d) Average OM methods are applicable to project activity connected to the project electricity system (grid) where the low-cost/must-run resources constitute more than 50% of the total grid generation.*

*The Simple OM, simple-adjusted OM, and average OM emission factors can be calculated using either of the two following data vintages for years(s) y:*

- *(ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,*
- *the year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex-post monitoring.*

In this particular PDD, the first, *ex-ante* option is selected. As a consequence, the operating margin emission factor is calculated *ex-ante* and it is considered fixed for the entire crediting period.

'Dispatch Data Analysis' method is not selected for OM emission factor calculations due to non-availability of activity data.

The "Simple OM" method has been selected as per guidelines provided in ACM0002/version 06, since low-cost/must-run resources (hydro, wind and nuclear) in the chosen (Southern) grid constitute less than 50% of total grid generation in the five most recent years.

Furthermore, generation data for Southern grid from CEA for the last five years show that low-cost/must-run resources are less than 50 % of the grid generation. The contribution of low-cost/must-run plants to the southern grid in the last five years is:

**Contribution of Low-Cost/Must-Run Plants**

**Share of Must-Run (Hydro/Nuclear) (% of Net Generation)**

| | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 |
|---|---|---|---|---|---|---|---|
| North | 25.9% | 25.7% | 26.1% | 28.1% | 26.8% | 28.1% | 27.1% |
| East | 10.8% | 13.4% | 7.5% | 10.3% | 10.5% | 7.2% | 9.0% |
| South | 28.1% | 25.5% | 18.3% | 16.2% | 21.6% | 27.0% | 28.3% |
| West | 8.2% | 8.5% | 8.2% | 9.1% | 8.8% | 12.0% | 13.9% |
| North-East | 42.2% | 41.7% | 45.8% | 41.9% | 55.5% | 52.7% | 44.1% |
| India | 19.2% | 18.9% | 16.3% | 17.1% | 18.0% | 20.1% | 20.9% |

(Source: CEA )

Therefore, the present project activity can use *Simple OM method.* The simple OM is calculated following the ACM0002/version 06 methodology, using a 3-year average data, based on the most recent statistics available. This option does not call for updation based on *ex post* monitoring.

*The Simple OM emission factor ($EF_{OM,simple,y}$) is 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:*

$$EF_{OM,Y} = \frac{\sum_{i,j} F_{i,j,y} . COEF_{i,J}}{\sum_{j} GEN_{j,y}} \quad (1)$$

*Where,*

*Fi, j, y* — *is the 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,*

*COEFi,j y* — *is the $CO_2$ 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, and*

*GENj,y* — *is the electricity (MWh) delivered to the grid by source j.*

Fuel consumption data for generation is available in Annual Report of CEA[3] for each three years considered for calculation.

***Step 2: Calculate the Build Margin Emission Factor ($EF_{BM,y}$)***

According to methodology ACM0002/version 6, the Build Margin can be calculated *as the generation-weighted average emission factor ($tCO_2/MWh$) of a sample of power plants m, as follows:*

$$EF_{BM,Y} = \frac{\sum_{i.m} F_{i,m,y} . COEF_{i,m}}{\sum_{m} GEN_{m,y}} \quad (2)$$

*Where,*

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

*Project participants shall choose between one of the following two options. The choice among the two options should be specified in the PDD, and cannot be changed during the crediting period.*

*Option 1. Calculate the build margin emission factor $EF_{BM,y}$ ex-ante 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 either the five power plants that have been built most recently, or*

*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. Project participants should use from these two options that sample group that comprises the larger annual generation.*

*Option 2. For the first crediting period, the build margin emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1 above. The sample group m consists of either the five power plants that have been built most recently or 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. Project participants should use from these two options that sample group that comprises the larger annual generation.*

For the proposed CDM project activity, option 1 is selected to calculate BM *ex-ante*. A mix sample of plants that reasonably represents the recent trends in southern electric sector expansion approximates the system build margin. The generation of the five (5) power plants that have been built most recently is lower than the proposed mix, which is the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Provided this assumption, the baseline build margin emissions (BM) is calculated as the weighted average emission factor for the identified mix of plants comprising 20 % of the system generation.

***Step 3: Calculate the Combined Margin Emission Factor ($EF_{BL,CM}$)***

[3] Central Electricity Authority, www.cea.nic.in

The combined margin is calculated according to ACM0002/version 6, using a 50/50 OM/BM weight:

$$EF_{BL,CM} = 0.5 \times EF_{BL,OM} + 0.5 \times EF_{BL,CM} \quad (3)$$

Data of OM and BM has been used from the $CO_2$ database version 1.1 by CEA[4]. It is from official source. The methods and process used to calculate is discussed in details in user guide at CEA website. While calculating BM, it is found that the most recent 5 plants contribute less than 20 %, so 20 % of most recent added plants has been taken as sample for calculating BM.

As described in ACM0002, version 6, 50/50 weight of OM and BM has been considered while calculating CM.

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

*(Copy this table for each data and parameter)*

| **Data / Parameter:** | **EGy** |
|---|---|
| Data unit: | KWh |
| Description: | Electricity Generation. |
| Source of data used: | Calculated |
| Value applied: | 27.38 Million |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Value of generation has been calculated based on PLF and plant capacity. |
| Any comment: | No comments |

| **Data / Parameter:** | **$CEF_{grid}$** |
|---|---|
| Data unit: | t of $CO_2$/MWh |
| Description: | $CO_2$ Emission Factor |
| Source of data used: | CEA CDM data base |
| Value applied: | 0.86 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Value is calculated from data available at official source and is publicly available. |
| Any comment: | No comments. |

**B.6.3 Ex-ante calculation of emission reductions:**

Baseline emissions are calculated as the kWh produced by the project activity multiplied by an emission coefficient for the Southern Regional grid, calculated as the combined margin emissions (in t $CO_2$equ/kWh) of the current generation mix.

[4] CEA, Central Electricity Authority.
http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

$$BE = EGy * CEF_{grid}$$

Where EGy is the net quantity of electricity generated by the project in year y, and $CEF_{grid}$ is the combined margin emissions factor of the Southern grid.

$CEF_{grid}$ is calculated as Combined margin.

*The Simple OM emission factor ($EF_{OM,simple,y}$) is 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:*

$$EF_{OM,Y} = \frac{\sum_{i,j} F_{i,j,y} . COEF_{i,J}}{\sum_{j} GEN_{j,y}} \quad (1)$$

=

| Years | OM |
|---|---|
| 2004-05 | 1.00 t $CO_2$ /MWh |
| 2005-06 | 1.01 t $CO_2$ /MWh |
| 2006-07 | 1.00 t $CO_2$ /MWh |
| **Average** | 1.00 t $CO_2$ /MWh |

***Step 2: Calculate the Build Margin Emission Factor ($EF_{BM,y}$)***

According to methodology ACM0002/version 6, the build margin can be calculated *as the generation-weighted average emission factor ($tCO_2/MWh$) of a sample of power plants m, as follows:*

$$EF_{BM,Y} = \frac{\sum_{i,m} F_{i,m,y} . COEF_{i,m}}{\sum_{m} GEN_{m,y}} \quad (2)$$

= 0.72 t $CO_2$/MWh

***Step 3: Calculate the Combined Margin Emission Factor ($EF_{BL,CM}$)***

The combined margin is calculated according to ACM0002/version 6, using a 50/50 OM/BM weight:

$$EF_{BL,CM} = 0.5 \times EF_{BL,OM} + 0.5 \times EF_{BL,CM} \quad (3)$$

Data of OM and BM has been used from the $CO_2$ database version 1.1 by CEA[5]. It is from official source. The methods and process used to calculate is discussed in details in user guide at CEA

[5] CEA, Central Electricity Authority.
http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

website. While calculating BM, it is found that the most recent 5 plants contribute less than 20 %, so 20 % of most recent added plants have been taken as sample for calculating BM.

As described in ACM0002, version 6, 50/50 weight of OM and BM has been considered while calculating CM.

CM = 0.5 ×1.0 + 0.5 × 0.72

= 0.86 t $CO_2$ /MWh

| **Project Emission due to transportation of Biomass and Diesel consumed in DG set** | | | |
|---|---|---|---|
| Fuel used | | | |
| Rice Husk | 11550 | tons | DPR |
| Cotton stalks | 9360 | tons | DPR |
| Chilly stalks | 9360 | | |
| Wood chips | 6420 | | |
| Others | 8560 | | |
| | | | |
| Total | 45250 | tons | |
| No of trucks | 7541.67 | | |
| Av. Distance covered | 50 | km | Approx |
| Total distance | 377083.3 | km | |
| km / liter of diesel | 4 | | PCRA document |
| Total diesel consumed in transportation | 94270.83 | Liters | |
| Total Diesel consumed in DG set | 0 | | Will be taken from plant log book |
| Total diesel consumed | 94270.83 | Liters | |
| Total diesel consumed | 83901.04 | kg | |
| GCV of Diesel | 10500 | kcal/kg | CEA CDM database |
| Total ammount of energy consumed | 3.69 | TJ | |
| t of CO2/TJ | 74.10 | | IPCC 2006 |
| Total of t CO2 | 273.26 | | |
| | | | |

| **Project Emission due to use of Coal (If used)** | | | |
|---|---|---|---|
| | | Units | Source |
| Amount used | 0 | tones | Monitored |
| GCV | 3755 | kcal/kg | CEA CDM database |
| Total amount of energy consumed | 0 | TJ | |
| t of CO2/TJ | 11.9 | | IPCC 2006 |
| Total of t CO2 | 0 | | |

Total emission reduction = Baseline emission – project emission – Leakage

As there is no leakage is applicable

So,
Total emission reduction = Baseline emission – project emission

= Net electricity generation × $EF_{BL,CM}$

= 27387 MWh × 0.86 t $CO_2$ /MWh – 273 t $CO_2$

= 23123 t $CO_2$ /MWh

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

| Year | Project Emission (tonnes CO2e /yr.) | Baseline Emissions (tonnes $CO_2e$ /yr.) | Leakage (tonnes $CO_2e$ / yr.) | Emission Reductions (tonnes $CO_2e$ /yr.) |
|---|---|---|---|---|
| 2008-09 (June onwards) | 273 | 23397 | 0 | 23123 |
| 2009-10 | 273 | 23397 | 0 | 23123 |
| 2010-11 | 273 | 23397 | 0 | 23123 |
| 2011-12 | 273 | 23397 | 0 | 23123 |
| 2012-13 | 273 | 23397 | 0 | 23123 |
| 2013-14 | 273 | 23397 | 0 | 23123 |
| 2014-15 | 273 | 23397 | 0 | 23123 |
| 2015-16 | 273 | 23397 | 0 | 23123 |
| 2016-17 | 273 | 23397 | 0 | 23123 |
| 2017-18 | 273 | 23397 | 0 | 23123 |
| **Total (tonnes $CO_2e$)** | **2730** | **233970** | **0** | **231230** |

**B.7 Application of a monitoring methodology and description of the monitoring plan:**

**B.7.1 Data and parameters monitored:**

*(Copy this table for each data and parameter)*

| | |
|---|---|
| **Data / Parameter:** | Electricity Exported |
| Data unit: | KWh |
| Description: | Electricity exported by project plant to grid |
| Source of data to be used: | Monthly billing records of the Andhra Pradesh Southern Power distribution Company Limited (APSPDCL) for the electricity supplied to the grid. |
| Value of data | -- |
| Description of measurement methods and procedures to be applied: | The power will be recorded at the plant using meter to be installed in the control room in the plant. For applying monthly bill to Andhra Pradesh Southern Power distribution Company Limited (APSPDCL). The meter reading will be taken on 1st date of every month by APSPDCL officials in the presence of VPGL representative and reading will be jointly certified. |
| QA/QC procedures to be applied: | The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency. The meter will be calibrated as per standards. |
| Any comment: | The power exported would be cross checked using meters installed for power generation and for auxiliary consumption. The difference between reading for power generation and auxiliary consumption should be equal to the power exported. |

| | |
|---|---|
| **Data / Parameter:** | Electricity Generation |
| Data unit: | KWh |

| | |
|---|---|
| Description: | Electricity generated by project plant |
| Source of data to be used: | Meter to be installed in the control room in the plant. |
| Value of data | -- |
| Description of measurement methods and procedures to be applied: | The power will be recorded at the plant using meter to be installed in the control room in the plant. |
| QA/QC procedures to be applied: | The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency. The meter will be calibrated as per standards. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | Auxiliary Consumption |
| Data unit: | KWh |
| Description: | Electricity consumed by project plant |
| Source of data to be used: | Difference of Total Generation and total export |
| Value of data | --- |
| Description of measurement methods and procedures to be applied: | The power will be recorded at the plant |
| QA/QC procedures to be applied: | The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency. The meter will be calibrated as per standards. |
| Any comment: | For Ex-ante calculation the plant load factor is considered. |

| | |
|---|---|
| **Data / Parameter:** | Electricity Consumption |
| Data unit: | KWh |
| Description: | Electricity consumption project participant |
| Source of data to be used: | Meter to be installed in the control room or switch yard in the plant. |
| Value of data | -- |
| Description of measurement methods and procedures to be applied: | The power will be recorded at the plant using meter to be installed in the control room in the plant. |
| QA/QC procedures to be applied: | The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency. The meter will be calibrated as per standards. |
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | Biomass Quantity of different type including from Energy plantation |
| Data unit: | MT |
| Description: | Biomass consumed by project plant |
| Source of data to be used: | Plant Records |
| Value of data | ----- |
| Description of measurement methods | The quantity of biomass will be measured using weigh bridge to be installed at the plant. |

| | |
|---|---|
| and procedures to be applied: | |
| QA/QC procedures to be applied: | The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency. The weigh bridge will be calibrated as per standards. |
| Any comment: | The parameter is not used in ex-ante calculation but will be monitored and will be available for verification. |

| **Data / Parameter:** | Coal Quantity |
|---|---|
| Data unit: | MT |
| Description: | Coal consumed by project plant |
| Source of data to be used: | Plant Records |
| Value of data | ----- |
| Description of measurement methods and procedures to be applied: | The quantity of coal will be measured using weigh bridge to be installed at the plant. |
| QA/QC procedures to be applied: | The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency. The meter will be calibrated as per standards. |
| Any comment: | The parameter is not used in ex-ante calculation as assumed that no coal will be used, but as 30 % of generation based coal is permitted so if any quantity of coal used in project activity will be monitored and data will be available for verification. |

| **Data / Parameter:** | Calorific Value |
|---|---|
| Data unit: | Kcal/Kg |
| Description: | Calorific value of biomass used in project plant for power generation |
| Source of data to be used: | Periodic Analysis |
| Value of data | ----- |
| Description of measurement methods and procedures to be applied: | VPGL will undertake annual lab testing to estimate the value. |
| QA/QC procedures to be applied: | -- |
| Any comment: | The parameter is not used in ex-ante calculation, but will be monitored and will be available for verification. |

| **Data / Parameter:** | Calorific value of coal |
|---|---|
| Data unit: | Kcal/Kg |
| Description: | Calorific value of coal used in project plant for power generation |
| Source of data to be used: | CEA Report |
| Value of data | ----- |
| Description of measurement methods and procedures to be applied: | -- |

| | |
|---|---|
| QA/QC procedures to be applied: | -- |
| Any comment: | The parameter is not used in ex-ante calculation, but will be monitored and will be available for verification. |

| | |
|---|---|
| **Data / Parameter:** | Biomass survey of different type used in project activity |
| Data unit: | -- |
| Description: | Biomass survey of different type used in project activity |
| Source of data to be used: | Survey report done by third party. |
| Value of data | ----- |
| Description of measurement methods and procedures to be applied: | The annual biomass survey will be done by third party to check whether 25% surplus is available or not. It will cover biomass of all type used in project plant. |
| QA/QC procedures to be applied: | The survey will be done annually. |
| Any comment: | The parameter is not used in ex-ante calculation but will be monitored and will be available for verification. |

**B.7.2 Description of the monitoring plan:**

As per I.D. 13, the monitoring exercise should consist of:

*"Monitoring shall consist of metering the electricity generated by the renewable technology. In the case of co-fired plants, the amount of biomass and fossil fuel input shall be monitored."*

As project activity is not a co-fired plant, monitoring shall include electricity generated only. The methodology covers the monitoring of units of electricity generated along with the other parameters affecting the quantity of power export and $CO_2$ emissions.

**B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)**

Date of completion of baseline – 20/02/08
**Name of person/entity determining the baseline: Project proponent and their consultant. Refer Annex 1 for project proponents contact information.**

**M/s MITCON Consultancy Services Ltd**.
Dr. Rajendra Prasad Road
Kubera Chambers, Shivajinagar,
Pune (Maharashtra) – 411005.
E-mail: deepak@mitconconsultancy.org
Telephone: +91 – 20 – 2553 3309, 2553 4322
Fax: +91 – 20 – 2553 3206

**M/s MITCON Consultancy Services Ltd**. is not a project participant.

## SECTION C. Duration of the project activity / crediting period

### C.1 Duration of the project activity:

#### C.1.1. Starting date of the project activity:

12/10/2004 (Based on Purchase order PO-001/2004 dated 12/10/2004 issued to Thermodyne Technologies Pvt. Ltd., for supply of 1 no. 20 TPH agro-waste fired boiler )

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

20 years & 0 months.

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

#### C.2.1. Renewable crediting period

Not opted for.

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

Not applicable.

##### C.2.1.2. Length of the first crediting period:

Not applicable.

#### C.2.2. Fixed crediting period:

Opted for.

##### C.2.2.1. Starting date:

01/06/2008 or date of registration whichever is later.

##### C.2.2.2. Length:

10 years & 0 months.

## SECTION D. Environmental impacts

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

The project being a renewable energy biomass based power project, it does not fall under the purview of the Environmental Impact Assessment (EIA) notification, 1994 of the Ministry of Environment and Forest, Government of India. . Subsequently, as per the Government of India notification dated June 13, 2002 based on environment protection rule, 1986, public hearing and

EIA is required for those industries/projects which are listed in the predefined list of Ministry Of Environment And Forest. Thermal power projects with investment of less than Rs. 100 carore have been excluded from the list.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

The emergence of the concept of sustainable development in the recent years has brought in the general realization that environmental issues are inexorably linked with development objectives and policies. Any project activity can cause impact on environment either positive or negative depending on the type of the activity, throughout the project lifetime. As per party regulations, the Environmental Impact Assessment does not require for the project activity. But an extensive Environment Management Plan has been prepared for taking care of all aspect related to environmental well being of project activity.

Over and above all applicable environmental clearances such as consent to operate and consent to establish has been acquired by the project plant. The project plant will ensure that all environmental pollution parameter will be kept well under the limit, otherwise the consent to operate will be withdrawn by state pollution control board. The pollution control board authority will be taking periodical test as required by governing laws.

## SECTION E. Stakeholders' comments

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

A meeting was organized on 23/09/2006 by the project proponent at the project site to get the comments and suggestions of the local stakeholders on their project activity. Invitation was sent in the form of individual letters addressed to the different stakeholders identified for the project. Representatives of a wide cross section of the society of the local inhabitants were invited to express their views. Representatives of the project proponent were present to clarify queries and receive feedback on the project activity. The venue of the meeting was the 'Factory office" of VPGL Plant at Village - Nadimpalem, Mandal - Prattipadu, District – Guntur. To get an organized and structured feedback from the stakeholders, the meeting was designed in a question answer format, where social, economic and environmental issues were put up in the form of questions and comments were invited on them. Project proponent replied to their queries appropriately and suggestions came up in this meeting have been given due consideration and future actions were planned accordingly.

– **Stakeholder Consultation:**

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

- Gram Panchayat
- The rural population living in the neighborhood of the plant
- Licensing and regulatory authorities

- **Rural Local Population:**

The rural population is directly involved with the project. First of all, they will be confronted with the construction and operation of a biomass plant in their vicinity. During construction of the plant at the selected site and designing the project, attention was given to maintain a very good relationship with the local population. The project depends on the supply of biomass from the rural farmers and therefore a good and mutually beneficial relation is essential. In addition to this, the project would also lead to local manpower working at the plant site. Since, the project will provide good direct and indirect employment opportunities; the local populace is encouraging the project.

The project did not require displacement of any local population. Thus, the project will not cause any adverse social impacts on local population rather helps in improvising their quality of life.

The project has also secured a no – objection certificate (NoC) from the Gram Panchayat, for establishing the power project.

The project has been given a green signal by the rural people as it aims towards and will empower them, socially & economically.

- **Licensing and Regulatory Authorities:**

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

The project has sought all the requisite legal and regulatory clearances for establishing this project.

## E.2. Summary of the comments received:

No negative comments have been received in context of the project. All stakeholders welcome the project as it is environmentally benign, it generates income and jobs, it supports the development of the nearby rural areas and the state, and it helps bridging the gap between the demand and supply of electricity and empowers the local community.

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

No negative comments were received and hence, there was no need to take due account of the comments

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Velagapudi Power generation Limited |
| Street/P.O.Box: | 74-2-12A, Bundar Road, Ashok Nagar |
| Building: | Velagapudi Cold Complex Building, |
| City: | Vijayawada |
| State/Region: | Andhra Pradesh |
| Postfix/ZIP: | 520 007 |
| Country: | India |
| Telephone: | + 91 – 866 – 2554801 |
| Fax: | + 91 – 866 – 2554018 |
| E-Mail: | power@velagapudi.com |
| URL: | -- |
| Represented by: | |
| Title: | Director |
| Salutation: | Mr. |
| Last Name: | Rao |
| Middle Name: | Venkateswara |
| First Name: | Velagapudi |
| Department: | Management |
| Mobile: | +91-9849218585 |
| Direct Fax: | Not Available |
| Direct tel: | Not Available |
| Personal E-Mail: | VSRao@velagapudi.com |

## Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

- The project has not received any public funding and Official Development Assistance (ODA).
- **The project is a unilateral project.**

## Annex 3

## BASELINE INFORMATION

Baseline emissions are calculated as the kWh produced by the project activity multiplied by an emission coefficient for the Southern Regional grid, calculated as the combined margin emissions (in t $CO_2$equ/kWh) of the current generation mix.

$$BE = EGy * CEF_{grid}$$

Where EGy is the net quantity of electricity generated by the project in year y, and $CEF_{grid}$ is the combined margin emissions factor of the Southern grid.

$CEF_{grid}$ is calculated as Combined margin.

Combined margin emissions factor (CM) is a combination of operating margin (OM) and build margin (BM) emissions factors and is determined by Sub-steps 2 a.1, 2 a.2, and 2 a.3 of section B.6.1, repeated below as Steps 1 to 3.

***Step 1: Calculate Operating Margin Emission Factor ($EF_{BL,OM}$)***

*The Operating Margin emission factor(s) ($EF_{BL,OM}$) is calculated based on one of the four following methods:*

*(a) Simple OM, or*
*(b) Simple adjusted OM, or*
*(c) Dispatch Data Analysis OM, or*
*(d) Average OM.*

For reasons explained in section B.6.1, Simple OM is applicable for this grid and was selected here. Moreover, according to ACM0002, version 6, the Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

- *(ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,*
- *the year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex-post monitoring.*

In this particular PDD, the first, *ex-ante* option is selected. As a consequence, the operating margin emission factor is calculated *ex-ante* and it is considered fixed for the entire crediting period.

*The Simple OM emission factor ($EF_{OM,simple,y}$) is 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:*

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad (7)$$

*Where,*

$F_{i,j,y}$ *is the 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,* |
| $COEF_{i,j\,y}$ | *is the $CO_2$ 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, and* |
| $GEN_{j,y}$ | *is the electricity (MWh) delivered to the grid by source j.* |

Fuel consumption data for generation are available in Annual Report of CEA[6] for each three years considered for calculation. These data are used to calculate emissions for each of the three most recent years for which data have been published, see Table 3.1.

Table1 : Generation and total $CO_2$ emissions 2004-05 to 2006-07.

| Year | Generation Excluding LLCMR plants | Total Emissions t $CO_2$ |
|---|---|---|
| 2004-05 | 105,568 | 105,603,624 |
| 2005-06 | 105,568 | 105,603,624 |
| 2006-07 | 105,568 | 105,603,624 |

Note that India uses a fiscal year from 1 April to 31 March. Thus 2004-05 refers to the one-year period from April 2004 to March 2005.

Table2: OM from 2004-05 to 2006-07.

| Years | OM |
|---|---|
| 2004-05 | 1.00 t $CO_2$ /MWh |
| 2005-06 | 1.01 t $CO_2$ /MWh |
| 2006-07 | 1.00 t $CO_2$ /MWh |
| **Average** | 1.00 t $CO_2$ /MWh |

***Step 2: Calculate the Build Margin Emission Factor ($EF_{BM,y}$)***

According to methodology ACM0002/version 6, the Build Margin can be calculated *as the generation-weighted average emission factor ($tCO_2$/MWh) of a sample of power plants m, as follows:*

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (8)$$

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

As stated in ACM0002, and in section B.6.1, there are two options for calculating the Build Margin:

*Option 1. Calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante 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 either the five power plants that have been built most recently, or*

[6] Central Electricity Authority, www.cea.nic.in

*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. Project participants should use from these two options that sample group that comprises the larger annual generation.*

*Option 2. For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1 above. The sample group m consists of either the five power plants that have been built most recently or 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. Project participants should use from these two options that sample group that comprises the larger annual generation.*

For the proposed CDM project activity, option 1 is selected to calculate BM *ex-ante*. A mix sample of plants that reasonably represents the recent trends in southern electric sector expansion approximates the system build margin. The generation of the five (5) power plants that have been built most recently is lower than the proposed mix that are 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. Provided this assumption, the baseline build margin emissions (BM) is calculated as the weighted average emission factor for the identified mix of plants comprising 20 % of the system generation. See Table 3.2 for data used for the calculation of the Build Margin.

***Step 3:*** **Calculate the Combined Margin Emission Factor ($EF_{BL,CM}$)**

As described in ACM0002, version 6, 50/50 weight of OM and BM has been considered while calculating CM.

$$EF_{BL,CM} = 0.5 \times EF_{BL,OM} + 0.5 \times EF_{BL,BM} \quad (9)$$

| Years | OM | BM | CM |
|---|---|---|---|
| 2004-05 | 1.00 t $CO_2$ /MWh | -- | -- |
| 2005-06 | 1.01 t $CO_2$ /MWh | -- | -- |
| 2006-07 | 1.00 t $CO_2$ /MWh | -- | -- |
| **Average** | 1.00 t $CO_2$ /MWh | 0.71 t $CO_2$ /MWh | 0.85 t $CO_2$ /MWh |

| | | | | | |
|---|---|---|---|---|---|
| **Baseline Emission** | | | | **0.85** | **tCO2/MWh** |
| **Project Emission** | | | | **0** | **tCO2/MWh** |
| **Leakage** | | | | **0** | **tCO2/MWh** |
| **Baseline Emission Reductions** | | | | | |
| **Year** | **Generation Units (MWh)** | **Baseline Emission** | **Project Emission** | **Leakage** | **Emission Reduction tCO2** |
| 2008-09 (May onwards) | 27387 | 23397 | 273 | 0 | 23123 |
| 2009-10 | 27387 | 23397 | 273 | 0 | 23123 |
| 2010-11 | 27387 | 23397 | 273 | 0 | 23123 |
| 2011-12 | 27387 | 23397 | 273 | 0 | 23123 |
| 2012-13 | 27387 | 23397 | 273 | 0 | 23123 |
| 2013-14 | 27387 | 23397 | 273 | 0 | 23123 |
| 2014-15 | 27387 | 23397 | 273 | 0 | 23123 |
| 2015-16 | 27387 | 23397 | 273 | 0 | 23123 |
| 2016-17 | 27387 | 23397 | 273 | 0 | 23123 |
| 2017-18 | 27387 | 23397 | 273 | 0 | 23123 |
| | | | | | |
| **Total** | **273874** | **233966** | **2730** | **0** | **231230** |
| | | | | | |
| **Annual Average** | **27387** | **23397** | **2730** | **0** | **23123** |

## Annex 4

## MONITORING INFORMATION

Monitoring parameters have been detailed in B.7 and as well as in CDM manual attached as appendix – 1.

Appendix – 1

**CDM MANUAL**

**VELAGAPUDI POWER GENERATION LIMITED**

Velagapudi Cold Complex Building,
74-2-12A, Bundar Road, Ashok Nagar, Vijayawada - 520 007, INDIA

Village - Nadimpalem, Mandal - Prattipadu, District - Guntur, Andhra Pradesh

CDM Manual for 6 MW Biomass Based Power Project

**CDM TEAM:**

**The CDM team comprises of operation and maintenance personnel like (Mechanical, Electrical & Instrumentation), Engineering department (Stores In charge), Manufacturing Department (lab In Charge) and from Accounts Department (Accounts Dept. In charge). The team is headed by Director (Technical). The organization structure of the CDM team is given in Fig - 1.**

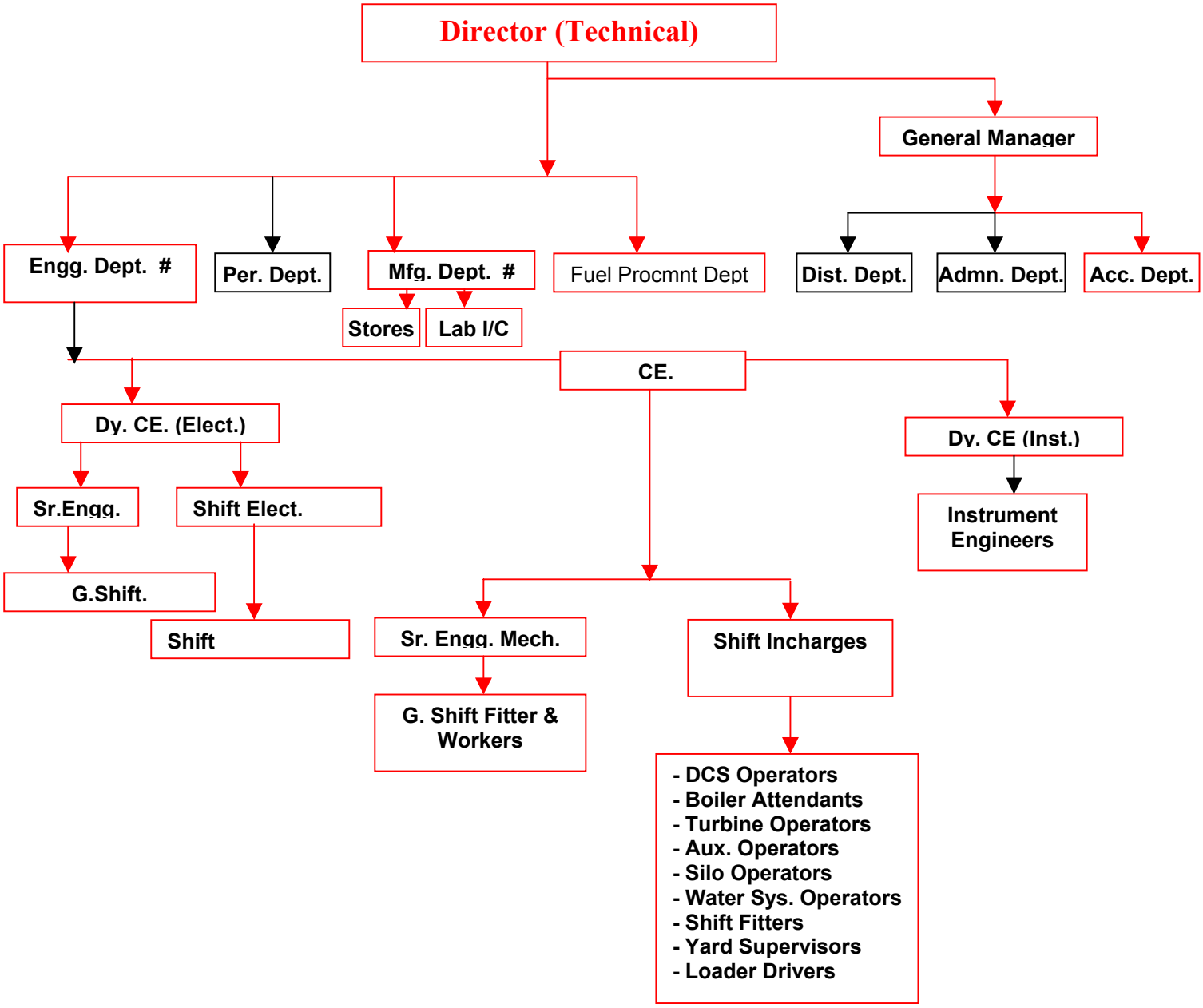



**Figure I: CDM Team**

# - In Engg. Dept. and Mfg. Dept. only concerned to the CDM project is indicated.

CDM – Executive Board

**FUNCTIONS OF THE CDM TEAM:**

- **Operate the Energy Generation Plant comprising of 1 x 20 TPH boiler with 4.0 MW Turbine Generator in compliance with the CDM Project Design Document**
- MONITOR EMISSION REDUCTIONS GENERATED BY THE PROJECT ACTIVITY
- **Maintain records of relevant data for verification of CERs.**
- **Ensure accuracy of data by proper maintenance and calibration of monitoring equipment**
- **Take the necessary permission from Assistant Vice President before changing any monitoring equipment related to project activity.**
- **Take all preventive measures to ensure plant availability at all times**

*DATA MONITORING:*

***Monitoring methods of process parameters and equipments are as below:***

***Online Monitoring***

***Local / Field Monitoring***

*Local or Field Monitoring:*

***The monitoring instruments used in the Field level monitoring generally consist of gauges and meters with a local display/output at the measuring point. Certain critical data are manually recorded in logbooks by field operators.***

*Equipments Used:*

***Operator stations of DCS, Digital and Analog Panel Indicators are used for online monitoring of process and equipments. Energy meters, flow meters, pressure gauges, temperature gauges, vacuum gauges and level gauges are used for local/field monitoring purpose. DCS acts as the "window" to the entire process. It is used to monitor, display, control, collect, store the process data and for generating reports. Following is the list of monitoring equipments to be used:***

Details of list of Monitoring Instruments / Equipment is as per the Excel Sheet , enclosed.

*Frequency of Monitoring:*

***The monitoring frequency of a parameter depends on its significance to the process. Critical process parameters are generally monitored on a continuous basis. Apart from monitoring the process online in DCS, all critical process parameters of Boiler, Turbine and Equipments are monitored every hour and recorded. Other parameters are monitored in appropriate intervals.***

*ENERGY PARAMETERS:*

***All energy related parameters like steam generation, energy production, auxiliary consumption are monitored in digital energy meters and logged. Following is the list of existing instruments being used for monitoring energy parameters.***

| Sl.No. | List of Monitoring Instruments | Proposed Equipment | Proposed Location |
|---|---|---|---|
| **1** | **Gross electricity Gen. 4 MW TG** | **Main Meter** | **Generator Bus bar** |
| **2** | **Gross electricity Gen. 4 MW TG** | **Main Meter** | **Generator Bus bar** |
| **3** | **Energy Export to APSPDCL Grid Line-1** | **Main Meter: Check Meter:** | **Substation** |
| **4** | **Energy Export to APSPDCL Grid Line-2** | **Main Meter: Check Meter:** | **Substation** |
| **5** | **Auxiliary electricity for plant** | **By inferential Method** | |

Fuel parameters:

**Quantity of fuel to be purchased is monitored on daily basis and its calorific value is monitored annually once.**

*DATA RECORDING:*

*Methods of recording project data:*

***Logbooks consisting of all critical parameters of Boiler and Turbine are prepared and maintained for recording the process data. Trained Operators/Technicians are assigned the responsibility of monitoring and recording the process parameters in logbooks. Energy related parameters (like kWh generated, exported etc) are continuously recorded by respective energy meters and recorded in log books by the respective shift Electrical Engineers. Fuel consumption in the boilers is calculated based on inferential methods by using steam generated readings from flow meters and the same is recorded in the computer manually by the respective shift Engineers.***

*Recording Frequency:*

***All critical parameters of Boiler and Turbine are monitored on an hourly basis and recorded in logbooks meant for the purpose. Energy related parameters are monitored continuously on a real time basis. Fuel is recorded on daily basis and calorific value is monitored once in a month.***

*Data Archiving:*

***DCS is used to collect, store the process data and for generating reports. History of process data can be viewed in DCS as Trend display and Log file list. Process data Log books of the previous two years are stored.***

*Review Procedures & Frequency:*

***Shift in charges reviews the progress of the implementation of documented procedures and quality system records on a daily basis.***

*CALIBRATION METHODS:*

***Calibration procedures are adopted to maintain accuracy of equipments/instruments of the plant.***

**The Calibration of Monitoring Equipment for CDM is as per standard procedures.**

***Scheduled training is given for personnel on calibration of equipments and Instruments.***

*Calibration Frequency:*

***Periodic calibration schedule which spreads over the year for all electrical and electronic instruments are prepared and maintained. As per the schedule, calibration of instruments and equipments are being carried out and recorded in calibration reports. Electrical relays and meters are calibrated by APSPDCL and external approved agencies.***

**Potential Risks:**

WE AT VPGL, 4 MW PLANT AT PRATTIPADU, GUNTUR BELIEVE IN IDENTIFYING AND REDUCING THE RISK. ON SAME POLICY THE VARIOUS POTENTIAL RISKS ARE IDENTIFIED WITHIN OUR PLANT.

**Electrical and Instrumentation Maintenance Procedure:**

***Maintenance procedures are adopted as below to ensure trouble free running of the plant to get optimum level of output.***

- **Regular Maintenance procedures**
- **Maintenance and breakdown reports for analysis**
- **Stock critical spares**
- **Training on equipments and instruments**

***Preventive and Breakdown maintenance procedures are prepared and documented for various types of equipments like Boiler, Turbine, High/ low capacity motors, HT/LT panels, HT/LT Transformers, Alternator, Exciter, Control panels in the respective areas.***

*Maintenance Frequency:*

***Periodic maintenance schedule that spreads over a year for all electrical equipments and Instruments are maintained and as per the schedule, works are being executed and recorded in maintenance reports.***

EMERGENCY PREPARED NESS:

**Emergencies which can lead to unintended GHGs can be countered with the various documents referred herewith**

1. **Onsite Emergency Plan**
2. **Emergency Team has to follow the directions indicated in the Onsite Emergency Plan in case of any Emergency.**
3. **Emergency Team.**
4. **Situation has to be controlled by Emergency Teams identified by VPGL.**
5. **For reporting any emergency the intercom communication Network has to be used.**

CDM TEAM INCUMBENTS AND THEIR RESPONSIBILITIES:

**The following are the members in the CDM committee**
**Director (Technical)**
**Materials Controller (to be recruited)**
**Accounts Dept. In charge**
**Dy. Chief Engineer (to be recruited)**
**Dy. Chief Engineer (Inst.)- to be recruited**
**Dy. Chief Engineer (Electrical) -to be recruited**
**Lab-In charge (to be recruited)**

**The Roles and responsibilities of the committee members**

**Director(Technical):**

- **He is Unit Head and overseeing the jobs of the all other members in the committee.**

- **He will ensure that all CDM related parameters are monitored.**
- **Stores the reports for CDM Verification**
- **Reviews and guides the departments in terms of their functions related to CDM**
- **Prepares a monitoring report at the end of the year to be submitted to the UNFCCC.**

**Material Controller:**

- **He is responsible for monitoring fuel weighment system and day-to-day accounting of receipts and issues of the fuels.**

**Accounts Manager:**

- **He is responsible for monitoring Sugarcane weighment system and records specifically maintained for the CDM activity.**

**Dy. CE. :**

- **The team will ensure the required quality and quantity of Steam is supplied for Turbines.**
- **The team should co-ordinate with the Electrical and Instrumentation team for the calibration of CDM monitoring equipments.**
- **The team will organise to send fuel samples to reputed laboratories to get fuel analysed to get the annually average calorific value of the Fuel and the same will be sent to the Director (Technical).**
- **The team will ensure on a daily basis that flow meters are functioning properly and that data is logged properly in the computer on daily basis.**
- **The team will obtain data from the concerned inter departmental teams, verify, compile and send a daily and monthly report to the Director (Technical), giving details of steam generation and distribution, energy generation and distribution and Fuel consumption.**

**Dy. CE. (Inst.):**

- **The main CDM responsibility of this team is to ensure that all CDM parameters of the boiler & STG are monitored & calibrated as and when required.**
- **The team will ensure that all the instruments related to the project activity will be working properly.**

- **The team will ensure that any change of the monitoring equipment if needed is taken through Director (Technical) and should be recorded.**

**Dy.CE. (Elect.):**

- **The team will ensure on a daily basis that all energy meters are functioning properly.**
- **The team will arrange for the calibration and certification of all energy meters by a reputed agency on an annual basis**
- **The team will verify, compile and send a daily report of energy generation and distribution to the Director (Technical).**

**Lab In charge:**

- **He is responsible for preparing Daily Report on water used for Boiler as per relevant standards and confirming the water usage and maintenance of records.**

CDM COMMITTEE MEETING:

**The committee meets once in a month to review the CDM performance of the plant. The CERs generated are compared with the expected CERs and corrective actions are taken.**

UNCERTAINTIES RELATED TO GHG EMISSIONS:

**Prevention of Pollution:**

**The primary fuel for project activity is Cotton stalks, Red gram stalks and woody biomass. To contain pollution an electro static precipitator has been installed. The Standards provided by the State Pollution Control Board of the Project activity for Suspended Particulate Matter (SPM) level is less than 150 mg/Nm3. A wet scrubber has been installed to achieve the above standard.**

TRAINING OF PERSONNELS:

**Various member of the CDM team will be trained time to time according to the departmental needs**