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. 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:

ETA 10 MW Renewable Energy Biomass Power Project

PDD Version 01 Dated 04/08/2010

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

ETA PowerGen Private Limited (ETAPPL) is constructing a 10 MW renewable energy biomass based power plant at village Perayam Patti, Virudunagar District, Tamil Nadu. Located close to the National Highway connecting Madurai & Tuticorin it proposes to use mainly Prosopis Juliflora available surplus in the region, and also Cotton Stalk, Maize Stalk and Morinda Tintonia as primary fuels and other bio-mass fuels including coconut residues and Maize shanks are considered as supplementary fuel. As the biomass based power is CO_2 neutral, power produced will have zero emissions and will be replacing fossil fuel dominated power generation by TNEB.

Combustion technology route is selected for the power plant, wherein bio-mass is burnt as fuel in a steam generator to produce high pressure steam which is then expanded in a steam turbine to generate power.

The proposed power plant will have one condensing type steam turbo generator unit with a matching boiler of travelling grate design.

Travelling grate type is selected primarily due to its flexibility in fuel firing in terms of its capability to burn fuels of practically any type and size and high moisture content. This type of boiler has other incidental advantages like lower power consumption, reduced dust emissions in flue gas, etc.

The plant is configured with a boiler of Maximum Continuous Rating of 45 tons/hr, at a steam pressure 67 atmosphere[1] (atm.), steam temperature 495^0 C to cater to the steam requirements of turbo-generator set of installed rating of 10 MW. The plant will be completed with all associated auxiliary systems.

The net power available for export from the 10 MW Power Plant after meeting its auxiliary power requirements is estimated to be around 64 million units per annum.

The project activity would reduce the Green House Gas (GHG) emissions produced by the state grid generation mix, which is mainly dominated by fossil fuel based power plants.

Availability of biomass

A survey has been made by the promoter's consultant to assess the biomass potential. The biomass available from the nearby area will be 0.2 Million tons per annum. With the biomass requirement as 79716 tons per annum, the plant can be run 365 days per year and hence there is surplus biomass available for the project activity.

[1] 1 atmosphere = 1.033 kg/cm2

Baseline Scenario:
The base line for the project activity is given by paragraph 10 in methodology AMS I.D /Version 16 is "If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources."

The project activity is a renewable electricity generation that displaces fossil fuel dominated electricity generation.The Project activity is located in the state of Tamil Nadu which is a part of southern regional grid. Considering the available guidelines and the present project scenario, **Southern Regional grid** has been chosen for baseline analysis by selecting "The combined margin (CM) consisting of combination operating margin and the build margin" for baseline calculations. The operating margin estimates the effect of the project activity on the operation of existing power plants and the build margin estimates the effect of the project activity on the building of future power plants. There is a gap between demand and supply in the Southern Regional grid so there is likely addition of more power plants in the grid mix. Combined margin is calculated as average of operating and build margin, which takes into account the trend of the types of power plant coming up in the grid, thus the uncertainties get addressed by taking the said approach for baseline calculation

Also refer Annexure 3 for more details on Baseline

Project activity's contribution to sustainable development:
Government of India has stipulated social, economic, environmental and technological well-being as indicators for sustainable development in the interim approval guidelines[2] for CDM projects. ETAPPL believes that the project activity has beneficial effect on agriculture, rural industries and employment in the region and has the potential to shape the economic, environmental and social life of the people in the region, specially unemployed educated/uneducated youth with meager resources.

Social well being:
• The project being in a rural area, will lead to overall development of the region.
• The project apart from generating direct employment to local people will also be generating job opportunities indirectly for the local uneducated and economically backward people as the biomass is to be collected and transported to the plant site from the fields.
• Preference will be given to employment of local people during operation of project site thereby creating opportunities in the area for skilled and unskilled labor.

Economical well being:
• The project activity will create business opportunity for local stakeholders such as suppliers, manufacturers, contractors *etc*.
• Crop residues are collected from the farmers and brought to the project site, which otherwise would have remained under-utilized or just burnt. In other words, the project activity is generating commercial value for crop residues enabling the farmers to get better price out of their produce augmenting their income substantially thereby creating a positive impact on purchasing capacity of the individuals.
• Project activity has helped to reduce the demand-supply gap in the power deficit state grid.

• Project activity has helped to reduce transmission losses due to generation of decentralized power close to load points. This has resulted in availability of quality power to nearby villages and industrial units.

Environmental well being

• Since, the project activity uses only biomass (carbon neutral fuel) for electricity generation it would eliminate an equivalent carbon dioxide which would have been otherwise generated to produce electricity.

• This electricity generation from the project activity would substitute the power generation by thermal power plants, which supply electricity to the state grid. It would contribute towards the reduction in (demand) use of finite natural resource like coal, natural gas etc. minimizing depletion or else increasing availability to other important processes.

Technological well being

• The technology selected for the power plant is a modern and energy efficient one using a steam turbo generator with matching boiler capable of firing multiple fuels.

• Project activity serves a small demonstrative project for clean renewable energy generation in the state, especially in the area where biomass is available in abundance. In view of the above arguments, ETAPPL considers that the project activity contributes to the sustainable development.

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

A.3. Project participants:

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	ETA PowerGen Private Limited	No

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

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

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A.4.1.1. Host Party(ies):

>> INDIA

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

>> South India/Tamil Nadu/

A.4.1.3. City/Town/Community etc:

>> Village Perayam Patti, Sattur Taluk, District Virudunagar.

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

The project activity is located in Khatouni Nos. 745 (Survey nos. 141/7,143/3,143/5,144/1-5,144/7-9,145/13, 146/1-4, 147/1-4, 147/8, 147/10, 148/1-3, 181/1-5, 182/1-5, 186/2-7, 187/1-8, 188/1-3, 189/1-5, 190/1, 190/4-8, 199/1-3, 199/5-6,200/1-2,200/4 of Village Perayam Patti, Sattur Taluk, Virudunagar District,Sattur taluk is located at 77° 55' E longitude and 9° 21' N latitude . The Project activity is located close to the National Highway connecting Madurai & Tuticorin. The geographical location of Sattur Taluk is detailed in the maps below.

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

Sectoral Scope: 1 (Energy Industries renewable/ non-renewable resources)
Scale : Small scale (< 15 MW)
Type: I – Renewable energy projects
Category: D – Electricity Generation for a system

Hence, the approved small scale methodology that will be applicable to this project activity is AMS I.D/Version 16, Scope: 01, EB 54

Reference: http://cdm.unfccc.int/methodologies/SSCmethodologies

As per the provisions of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities, (AMS.I.D, Version 16) Type I.D "This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

The project activity displaces an equivalent quantity of electricity, which would have otherwise been generated by fossil fuel based power plants from Tamil Nadu Electricity Board (TNEB) that is part of the southern regional grid. The contribution of renewable energy sources, comprising of wind, small hydro, biomass power & biogas, urban & industrial waste water and solar at national level is approximately 9%. The total installed capacity of the thermal sources of power (coal, diesel and gas) was 86014.9 MW. In the eleventh plan, as of Mar 31, 2009, the share of the thermal sources has risen to 93725.3 MW. The Government has planned to add approximately 78700.4 MW power in the eleventh five year plan (2007-20012), out of which the thermal sources would account for 59693.4 MW. Clearly, the trend indicates the allotment and provision for thermal energy sources given the demand for power and sustenance of the growth rate at around 7-8%. While the Government encourages renewable energy based power generation, there is no mandate to curb the use of fossil fuel based thermal energy plants for supplying the growing need for energy. Hence in the absence of the project activity the required demand would have been met mostly through fossil fuel based generation.

The project activity is a new activity of Renewable energy project as it is a Biomass Based power plant of 10 MW which shall be supplying electricity to the Tamil Nadu state grid hence it's a Grid connected Renewable energy generation project. The project activity does not comprise any electricity generation from non-renewable energy sources. Hence the activity as per the provisions qualifies under Type I D project activity

The primary biomass resource that will be utilized for power production will be surplus biomass residue from local firewood production. Prior to the project activity pruning and sale of wood for firewood purposes was the only use of the available biomass in the area. The wood used for this purpose is Prosopis Juliflora. The firewood generated is exposed to uncontrolled burning for domestic purposes.

The installed/rated capacity of the turbine generator set is 10 MW which is much lower than the limit of 15 MW and the total heat rating capacity of the boiler is also less than 45 MW thermal . Hence the renewable energy project activity qualifies under Type ID project activities.

Considering the above justification, the Type I.D. is the most appropriate category for the project under discussion.

Technology

The project activity is a 10.0 MW (gross) capacity grid-connected biomass based renewable energy power plant with high-pressure steam turbine configuration. On an annual average basis, the project exports around 9.0 MW power to the TNEB grid by considering auxiliary power consumption of 10%. The power plant has boiler sized to produce a maximum of 45 TPH of steam and, 10 MW multistage bleed cum condensing type steam turbine. The steam conditions at the boiler heat outlet are a pressure of 67 ata., and temperature of 495 ^{0}C. All the necessary auxiliary facilities for the power plant have been provided for the power plant. The plant and equipment facilities have been designed to comply with the applicable stipulations / guidelines of statutory authorities such as State Pollution Control Board etc.

The power plant will generate power at 11 kV. The Plant itself at 11 kV will consume 10% of the generated power. The Power plant will be hooked up with SEB grid at 110kV through a 12.5/16 MVA 11 kV Generator Transformer. Nearest sub-station110/11 KV of TNEB is located at Subbaiah Puramarn Sattur Taluk, Virudhunagar District, Tamil Nadu, which is around 2.5 km away from the project activity. The power plant efficiency is estimated at 24%.

There is no transfer of technology to the host country since the technology is available in India from reputed manufacturers.

The technology used in the plant minimizes the pollution emanating from the plant to negligible level. The project proponent has planned various preventive and precautionary steps which are mentioned in section D, to control all forms of pollutants so as to safeguard the environment.

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

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Years	**Estimation of Annual emission Reductions in tonnes of CO2 e**
2011	**38,360**
2012	**47,999**
2013	**54,425**
2014	**54, 425**
2015	**54, 425**
2016	**54, 425**
2017	**54, 425**
2018	**54, 425**
2019	**54, 425**
2020	**54, 425**
Total estimated reductions (Tonnes of CO2e)	**521,759**
Total no of Crediting years	10 years
Annual average of the estimated reductions over the crediting period	52,176

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

>> No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

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

The project activity is not a de-bundled component of a large project activity as the project proponents have not registered or applied to register any small scale project activity:
- With the same project participants;
- In the same project category and technology/measure;
- 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.

SECTION B. Application of a baseline and monitoring methodology

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

Title of approved baseline and monitoring Methodology energy generation	: Grid Connected Renewable
Reference	: Approved small scale methodology AMS.I.D
Type I	: Renewable Energy Project
Category: I.D.	: Grid Connected Renewable electricity generation
Version	: 16, EB 54

Complementary Methodological Tools:

1. "Tool to calculate the emission factor for an electricity system" (Ver. 02), EB 50 Report, Annex 14.

2. "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"(Ver. 02) EB 41, Annex 11.

3. "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01.1), EB 39, Annex 7.

4. "General guidance on leakage in biomass project activities" (Version 03) EB 47, Annex 28.

For additional info on tools available vide web link
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

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

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 categories. As per this document the project activity falls under Category I.D.- Grid Connected Renewable electricity generation. (Version 16)

Para No.	Technology/Measure as per AMS.I.D	Measure of the Project activity
1.	This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to a national or a regional grid	The project activity is a renewable energy generation unit based on biomass. The generated energy will be supplied to TNEB Grid, part of southern regional grid
2.	This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition[1]; (c) involve a retrofit[2] of (an) existing plant(s); or (d) involve a replacement[3] of (an) existing plant(s).	The project activity is a new activity and there is no addition of units and there was no renewable energy power plant operating prior to the implementation of the project activity
3.	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	Not applicable
4.	In the case of biomass power plants, no other biomass types than renewable biomass[4] are to be used in the project plant.	Its a renewal biomass based power plant and the primary biomass used is Prosopis Juliflora
5.	If the new unit 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 new unit co-fires fossil fuel[5], the capacity of the entire unit shall not exceed the limit of 15 MW.	The project activity has only renewable component based on biomass and the total capacity of the plant is 10 MW. Further, There is no provisions in the plant for enhancing the capacity of the plant nor any plans of the management to increase the

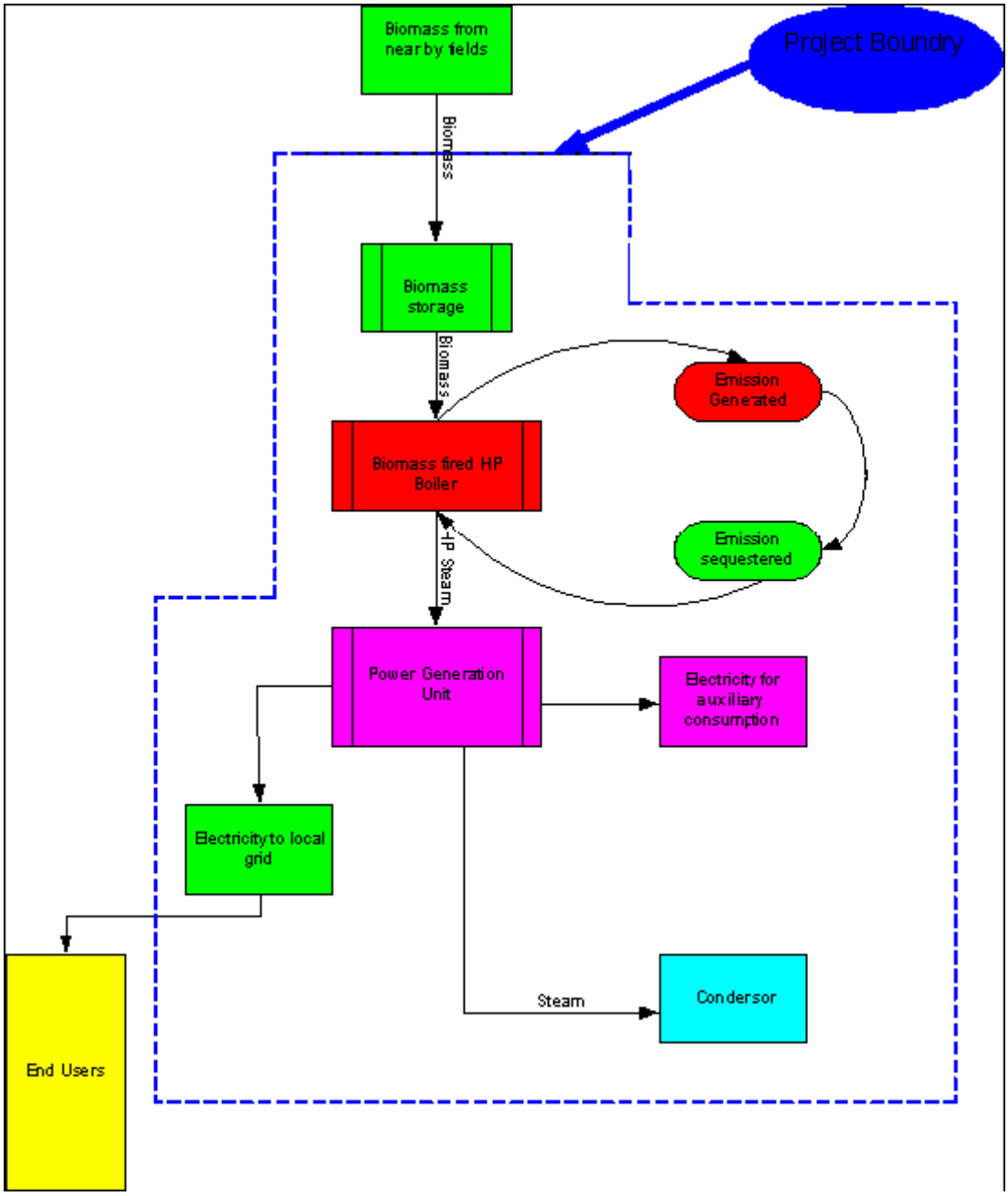
		same. Hence the project will remain under the limits of SSC during every year of the crediting period
6.	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[6] from the existing units.	Not applicable as the project activity is a new activity
7.	Combined heat and power (co-generation) systems are not eligible under this category.	Not Applicable
8.	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable as the project activity is a new activity

As is evident from the above table the small scale project activity meets all the applicable conditions laid down in the latest version of approved small scale methodology AMS I D – Grid connected renewable electricity generation Version 16 as specified in Annex B of the simplified modalities and procedures for small-scale CDM project activities.

B.3. Description of the project boundary:

As mentioned under paragraph 9 of AMS I.D. The physical, geographical site of the renewable generation source delineates the project boundary.

Thus, project boundary covers fuel storage, boiler, steam turbine generator and all other accessory equipments. However, for the purpose of calculation of baseline emissions, Tamil Nadu state electricity grid is also included in the boundary. Flow chart and project boundary is illustrated in the following diagram:


Biomass from near by fields
Project Boundry
Biomass
Biomass storage
Biomass
Emission Generated
Biomass fired HP Boiler
Emission sequestered
HP Steam
Power Generation Unit
Electricity for auxiliary consumption
Electricity to local grid
End Users
Steam
Condersor

B.4. Description of baseline and its development:

Description of Base Line

The project activity is a renewable electricity generation that displaces fossil fuel dominated electricity generation. The base line for the project activity is given by paragraph 10 in methodology AMS I.D /Version 16 which is "If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources."

As per para 11 of AMS ID "The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO,grid,y}$$

Where:

BE_y : Baseline Emissions in year y (t CO_2)

$EG_{BL,y}$:Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO,grid,y}$: CO_2 emission factor of the grid in year y (t CO_2/MWh)

The Emission Factor can be calculated in a transparent and conservative manner as follows:
(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the .Tool to calculate the Emission Factor for an electricity system.
OR
(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations shall be based on data from an official source (where available) and made publicly available.

Development of Base Line

Using the methodology available in paragraph 12 of Type I.D. described in Annex B of the simplified modalities and procedures for small-scale CDM project activities, **the average of the approximate operating margin and the build margin** (in kgCO2equ/kWh) of current generation mix of Southern Regional grid is used for the calculation of baseline.

Carbon Emission factor of the Grid

The data published (Available publicly at **www.cea.nic.in** **)** by CEA (Central Electricity Authority, India, A Statutory organization under Government of India)(an official source) is used for base line calculations.

The Project activity is located in the state of Tamil Nadu which is a part of southern regional grid. Considering the available guidelines and the present project scenario, **Southern Regional grid** has been chosen for baseline analysis by selecting "The combined margin (CM) consisting of combination operating margin and the build margin" for baseline calculations. The operating

margin estimates the effect of the project activity on the operation of existing power plants and the build margin estimates the effect of the project activity on the building of future power plants. There is a gap between demand and supply in the Southern Regional grid so there is likely addition of more power plants in the grid mix. Combined margin is calculated as average of operating and build margin, which takes into account the trend of the types of power plant coming up in the grid, thus the uncertainties get addressed by taking the said approach for baseline calculation

Combined Margin

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected grid and the baseline emission factor would therefore incorporate an average of both these elements.

Operating Margin

The "approximate operating margin" is defined as the weighted average emissions (in kg CO2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, and nuclear and solar generation; The project activity would have some effect on the operating margin of the Southern Regional Grid. The carbon emission factor as per the operating margin takes into consideration the power generation mix of 2007-2008 excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation of the selected grid, thermal efficiency and the default value of emission factors of the fuel used for power generation.

A. Carbon Emission Factor of grid as per OM is 0.90 kg CO2/kWh electricity generation. Details of which are given in Annexure -3 table A-3-2

Build Margin

The "build margin" emission factor is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants. The project activity will have some effect on the build margin of the Southern Regional Grid. The baseline factor as per the build margin takes into consideration the delay effect on the future projects and assumes that the past trend will continue in the future. Capacity additions of 20% most recent plants is greater than (in MWh) most recent 5 plants hence, for the build margin calculation we would take into consideration 20% of most recent plants built in Southern Regional grid are taken into consideration and the data available at. **www.cea.nic.in** for southern regional grid has been taken .Carbon Emission Factor of grid as per build margin is 0.71 kg CO2/kWh electricity generation.

Net Carbon Emission Factor Grid for 2007-08 as per combined margin = (OM + BM)/2 = 0.85 kg of CO2 / kWh generation respectively. (Refer Annexure 3).

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:

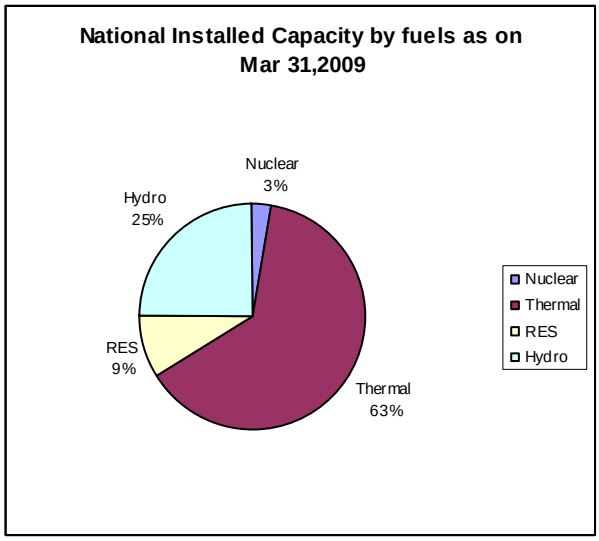
The implementation of the biomass based project activity is a voluntary step undertaken by ETAPPL. with no direct or indirect mandate by law. The main driving forces to this 'Climate change initiative' have been:

- GHG reduction and subsequent carbon financing against sale consideration of carbon credits.
- Rural Development of the region by creating job opportunities for the local people.
- Demonstration of developing such projects to the other entrepreneurs.

However, the project proponent was aware of the various barriers associated to project implementation. But it was felt that the availability of carbon financing against a sale consideration of carbon credits generated due to project activity would help to overcome these barriers. Although it is well known fact that, power generation with biomass fuels has various advantages, however, it is still not widely applied, particularly in the developing countries like India. For private parties to venture into such an unexplored area, it is a steep diversification from their core industrial economics to power sector economics, where the project proponents needs to meet requirements and challenges of power policies, delivery/non-delivery of power, techno-commercial, social, environmental problems etc. associated with the power project.

National Scenario:

The Indian power sector as on Mar 31, 2009 presents the following picture where there is heavy reliance on thermal energy:



The contribution of renewable energy sources, comprising of wind, small hydro, biomass power & biogas, urban & industrial waste water and solar are approximately 9%. The Ministry of Power, Government of India has an ambitious plan of providing power for all by 2012. At the end of the tenth plan (2002-2007), the total installed capacity of the thermal sources of power (coal, diesel and gas) was 86014.9 MW. In the eleventh plan, as of Mar 31, 2009, the share of the thermal sources has risen to 93725.3 MW. The Government has planned to add approximately 78700.4 MW power in the eleventh plan, out of which the thermal sources would account for 59693.4 MW. Clearly, the trend indicates the allotment and provision for thermal energy sources given the demand for power and

sustenance of the growth rate at around 7-8%. While the Government encourages renewable energy based power generation, there is no mandate to curb the use of fossil fuel based thermal energy plants for supplying the growing need for energy.

Additionality of the Project Activity

As per the attachment A to Appendix B of the simplified Methodologies and Practices for small-scale CDM project activities, to prove that the project is an additional, explanation regarding the project activity would not have occurred anyway due to at least one of the following barriers is required:

(a) Investment barrier
(b) Technological Barrier
(c) Barrier due to prevailing practice
(d) Other barriers

The barriers faced by the project activity are discussed below:

a) Investment Barrier to project implementation

Investment Analysis

An investment analysis of the project was carried out with the IRR on equity as financial indicator, one of the known indicators used by project developers, banks and financial institutions for making investment decisions.

Based on the following basic inputs IRR was estimated:

Total project cost	: INR 463.1 Million
Operating Expenses	: INR 97.86 Million (In 3rd year at 85 PLF)
Rate of Interest	: 12%
Price/KWH	: INR 3.15/KWH

The detailed calculations of IRR workings are annexed with this PDD in a spreadsheet and have been forwarded to the DOE. It indicates the post tax IRR as 11.88 % which is not attractive for investing in a project in the country's investment scenario

An IRR of 14-16 % is the standard returns in the Indian market .CERC (Central Electricity Regulatory Commission), Govt. of India vide its order dt.16/01/04 had specified the IRR for Independent electricity generation projects to be post tax IRR of 16% which is the most commonly used benchmark value. This value was fixed by CERC after an elaborate consultation process from all the stake holders including public and private sector electricity utilities, private sector organization, NGOs etc. This shows 16 % is the standard returns in the Indian market.

The post tax IRR of the project activity which is 11.88 is far lesser than the project proponent's expectation for Investment and standard returns in the market. However, project proponent went ahead with the implementation of the project activity to produce and cause "GREEN ELECTRICITY Generation" and with the expectation of realizing the revenues from the sale of CERs.

Considering the revenues from the sale of CERs the IRR of the project would improve to post tax of 16.07 % .This is at par with the industry average considering other barriers like appreciation in biomass prices does not influence much to the project activity.

Setting up infrastructure for Transportation and Storage of Biomass:
Biomass based power projects need implementation of a new infrastructure necessary for transportation and storage of biomass. This infrastructure is not necessary in case of fossil fuel based power projects since, all the fuel linkages and associated infrastructure is already established within the command areas from where this (surplus) biomass is made available. ETAPPL has faced the barrier of fuel handling at project activity site and fuel processing. Often such investment is not in terms of money alone but also involves investment in terms of efforts and time, which is not needed in terms of existing fossil fuel, based power plants

b) Technological Barriers
The most important equipment that has bearing on the smooth operation of the power plant is the boiler. The boiler is a travelling grate type capable of using various fuels unlike the more efficient fluidized bed boiler. A travelling grate boiler normally is subject to mechanical troubles due to usage of varieties of fuels. The performance of the boiler depends on the uniform material used as fuel. In respect of a biomass plant the fuel used depends on type of biomass available whose characteristics are not uniform. The biomass conversion efficiency is very low compared to fossil fuel energy conversion efficiencies.

As the project is located in a rural area where power is supplied to agricultural purposes generally by rotation, the plant may face frequent fluctuations in grid voltage due to which the power evacuation equipment would be affected and some times leading to tripping of the plant.

Varying characteristics of biomass fuels:
The project's operation and performance is of highly uncertain because of the poor characteristics of biomass material such as high moisture content, etc. The fuel characteristics differ from fuel to fuel as each type of biomass has different calorific values, moisture content, form and shape, and ash content etc. Due to the varied properties of various biomass fuels it is difficult to maintain operating parameters such as pressure and temperature, which effects the continuous generation.

c) Prevailing practice barrier:
The prevailing and the common practice in the Indian power sector have been investments in the fossil fuel based power plants. This is mainly due to assured return on investments, economies of scale and easy availability of finances. For over a decade since 1994, grid connected biomass power projects have not been implemented regularly in the state of Tamil Nadu. The total estimated potential of 670 MW from biomass, the installed capacity as on date has been only to the tune of 88.35 MW. This installed capacity of biomass power plants as compared to total installed capacity of 10122 MW apart from 3668 MW of private wind mills is a very small fraction. The biomass based power projects is not a common practice in Tamil Nadu (Ref http://www.tneb.in)

Current investments in the power sector of the State of Tamil Nadu portrays the fact that majority of the power generation capacity has been added based on fossil fuels such as coal and gas which are feasible options, leading to high emissions. Thus in the absence of the proposed grid connected biomass power project activity, other and alternative investments would be made in coal or gas based power plants in Tamil Nadu resulting in high carbon intensity based power generation with more GHG emissions.

d) Other Barriers

Fluctuations in price of biomass:

The success of biomass based power plant depends on the price of biomass material required for power generation. Price of biomass depends on the following, on which the project proponent has no control.

- Biomass prices unlike fossil fuel are not regulated by any agency. The farmers at times sell the residues, by taking their own decision on fixing price. The price of biomass fluctuates continuously due to creation of commercial value for the product which has no market value early to establishment of Power plant, making the cost of generation unstable.

- It has been witnessed in other states, where the biomass plants are established that price variation is substantial, ranging from 25% and even up to 50%. Evidence is also found from some of the registered biomass projects under CDM, the fluctuation in price of biomass after the plants commence operations.
  Due to this lack of price stability, the cost of power generation is unpredictable.

Problem of storage:

The availability of biomass during rainy season is very scarce. The storage of biomass is much problematic as its characteristics changes within short period and it may results in less calorific value due to loss of volatiles, high moisture content and deterioration of biomass, which affects the performance of the plant and machinery. Hence, biomass fuels should be consumed on first come first basis and stocking of biomass for non-seasons/low availability periods is uneconomical. The low bulk density of biomass fuel makes it difficult to transport, handle and store.

Above barriers are strong enough to affect the decision of project implementation and in case if due to any of the above reason project implementation cancels, the proposed grid to which the project will feed power will alternatively get the power from the project alternatives as discussed above. Since, these alternatives are more GHG emissive, project option only can reduce the GHG emissions. Although there is a good potential for implementation of such power projects in India very few have adopted for the similar project activity due to above strong barriers. Therefore, the proposed renewable energy project is an additional activity as it over comes the above barriers by taking up additional risk of implementation. In absence of the project proponent's initiative to implement the project, the state grid mix dominated by fossil fuel based power plants would have generated the equivalent electricity.

Early consideration of CDM

When ETAPPL decided to set up a biomass based power plant in Tamilnadu it had considered CDM revenues right at the planning stage. As the board was aware of the problems faced by biomass based projects during implementation stage and operations it considered CDM revenues for sustainable operations. It was decided by the board that the project is renewable and carbon neutral in nature hence can be developed under CDM to mitigate the adverse effects of uncertainty related to Biomass prices, availability, storage, tariff policies and also to ensure financial viability of the project.

The chronology of events of the project activity is furnished below:

CDM – Executive Board

Board resolution considering CDM---------- 04-07-06
Order placed for Plant and machinery--Between------- 2006-07
EPC Contract awarded for Civil Work----------30/10/06
Approval from TEDA for 10 MW---------- 17-04-07
Term loan sanction from Financial Institutions/Bank—- 17-04-07
Proposal for Appointment of Consultant for CDM------- 28-05-07
Date of contract with the consultant ---------- 26-07-07
Proposals for Validation received in---------- Aug-2007
Date of contract with the DOE ---------- 23-10-07
Signing of EPA with TNEB for 10 MW ---------- 07-03-08
Date of Trial Run---------- 04-04-09
Date of start-up ---------- 22-05-09
Synchronizing with TNEB grid---------- 22-05-09
Commercial Production---------- 25-07-09

As the chronology indicates the decision to consider CDM revenues was taken in the board meeting held on 04-07-06. Soon after the decision to consider the project for CDM efforts were made to identify a CDM consultant. This indicates that the company has made necessary efforts to take the project activity for registration with UNFCCC.

Minutes of the meeting of the Board held on 04-07-06 where CDM was considered is available for verification of the DOE.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Type: AMS.I.D. - Renewable energy technologies that supply electricity to a grid.
Version – 16

Since the project is a grid connected renewable energy project, emission reduction quantity depends on the units of energy (generated only from biomass) exported to the grid (in kWh) and the baseline emission of the state grid. The methodology covers the monitoring of units exported and the other parameters affecting the quantity of power export and CO2 emissions thereof. The project fires biomass hence the methodology also includes monitoring the quantum of biomass input and their energy availability from the same. The net emission reductions will result from the units of power available from the biomass power plant exported to the grid.

Estimation of the emission reductions due the project activity = amount of electricity displaced from the grid multiplied with the grid emission co-efficient.

$$ER = \sum_{n} E_{WEG} * EF_{CO,grid,y}$$

$\sum_{n} E_{WEG}$ = Amount of electricity supplied to the grid

$EF_{CO,grid,y}$ = Grid Emission co-efficient

Grid Emission co-efficient = Combined margin of the Southern grid calculated as given below

$$EF_{CO,grid,y} = w_{OM} * EF\_OM_y + w_{BM} * EF\_BM_y$$

Where

EF_OM_y = emission factor of Operating Margin

EF_BM_y = emission factor of Build Margin

w_{OM} = weight factors of Operating Margin

w_{BM} = weight factors of Build Margin

with respective weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$), and by default, are weighted equally ($w_{OM} = w_{BM} = 0.5$).

The baseline emission factor (EFy) is calculated as a combined margin (EFgrid,CM,y), consisting of the combination of operating margin (EFgrid,OM,y) and build margin (EFgrid,BMy,) factors according to the following steps defined in the "Tool to calculate the emission factor for an electricity system". Version 02 The baseline data have been taken from the Baseline Carbon Dioxide Emission Database with reference to Version 4.0 & User Guide prepared by the Central Electricity Authority (CEA), vide web link :
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Step 1: Identify the relevant electricity systems.
The project activity is located in the Southern Region of India and the electricity generated by this project displaces the electricity from southern regional grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. For the baseline calculation combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) are used. The Combined margin derived figures as shown below

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional).
Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.
Following the calculations of the CEA , and the statistical data available, Option I is chosen.

Step 3: Select a method to determine the operating margin (OM)
According to the tool, four various methods are provided for calculating the operating margin Emission factor (*EFgrid,OM,y*), including:
a) Simple OM;
b) Simple Adjusted OM;
c) Dispatch data analysis OM;
d) Average OM
According to the tool, the Simple OM method (a) is applicable to the project if the low-cost resources constitute less than 50% of total grid generation
In the Southern regional grid average of last 5 years power generation share of Must-Run resources including is 24 % which is less that 50% limit of total grid generation. Hence the use of the Simple OM method is justified

"Ex-ante" option for its operating margin calculation where in and EFgrid,OM,y is fixed for the duration of the first crediting period.

Step 4: Calculate the operating margin emission factor according to the selected method.
On the basis of data available the three-year average Operating Margin for the Southern Regional Grid is 0.99
Source : CDM - Carbon Dioxide baseline database Ver 4.0 Sep 2008 Published by CEA

Step 5: Identify the group of power units to be included in the build margin
The sample group of power units "m" used in the referred CEA's CO2 baseline database to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently. Project participants can choose in terms of vintage of data among the two options as given in too and the option 1 has been chosen for the project activity:

Option 1
Calculate the Build Margin emission factor EFBM,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.

Step 6: Calculate the build margin emission factor

Build Margin (BM)
The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units m during the most recent year y for which power generation data is available.

The build margin emission factor for the year 2007-2008, latest as available was used for an exante estimation of emission reduction estimates for the first crediting period.

Build Margin for the Southern Regional Grid is 0.71

Source : CDM - Carbon Dioxide baseline database Ver 4.0 Sep 2008 Published by CEA

Step 7: Calculate the combined margin emissions factor
EFgrid,CM,y = EFgrid,BM,y x wBM + EFgrid,OM,y x wOM

EFgrid,BM,y = Build margin CO2 emission factor in year *y* (tCO2/MWh)
EFgrid,OM,y = Operating margin CO2 emission factor in year *y* (tCO2/MWh)
wOM = Weighting of operating margin emissions factor (%)
wBM = Weighting of build margin emissions factor (%)

EFgrid,CM,y = (0.99 x 0.5) + (0.71 x 0.5) = 0.85 t CO2/MWh

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

Data / Parameter:	Grid Emission factor *(Operating Margin)*
Data unit:	tCO_2/MWh
Description:	Emission factor of Regional grid, Southern Grid
Source of data used:	Central Electricity Authority data, Version 4 www.cea.nic.in
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Emission Factor is estimated and officially published by Central Electricity Authority, Government of India.*
Any comment:	Simple Operating Margin is used, by including Imports

Data / Parameter:	Grid Emission factor *(Build Margin)*
Data unit:	tCO_2/MWh
Description:	Emission factor of Regional grid, Southern Grid
Source of data used:	Central Electricity Authority data, Version 4 www.cea.nic.in
Value applied:	0.71
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Emission Factor is estimated and officially published by Central Electricity Authority, Government of India.*
Any comment:	Value is calculated based on ex-ante data and the data does not call for reworking every year

Data / Parameter:	Grid Emission factor *(Combined Margin)*
Data unit:	tCO_2/MWh
Description:	Emission factor of Regional grid (Southern Grid)
Source of data used:	Central Electricity Authority data, Version 4 www.cea.nic.in
Value applied:	0.85
Justification of the	*The emission factor is calculated by Central Electricity Authority for Indian CDM project activities the* version is designed to be consistent with version 1.1 of the Tool to calculate the emission factor for an electricity system published by CDM Executive Board.. *The data used*

	in determination of grid emission factor is of high accuracy since the generation data is being directly monitored for all power generating sources in grid system by CEA. *As explained in section B.6, the value is applied directly from the CEA baseline data for the most recent year 2007-2008, as a fixed ex ante emission Factor*
choice of data or description of measurement methods and procedures actually applied :	*Electricity Authority, Government of India.*
Any comment:	Value is calculated based on ex-ante data and the data does not call for reworking every year .

B.6.3 Ex-ante calculation of emission reductions:

>>The formula for emission reduction calculation is given below:
Formula used to calculate the net emission reductions achieved from the project activity is

$$ER_{Base} = BE_{electricity} - PE - L \quad \text{..... (i)}$$

Where,

ER_{Base} - Net Emission Reduction in tCO2/year

$BE_{electricity}$ - Baseline Emission due to displacement of electricity in tCO2/year

PE - Project emissions in tCO2/year

L - Emissions due to leakage in tCO2/year

Project emissions (PE) Calculation:

The project activity leads to GHG on-site emissions in the form of CO2 emissions from combustion of biomass. The project activity uses an environmentally renewable resource as fuel for power generation. Hence there would be zero emissions from the project activity.

The plantations, representing a cyclic process of carbon sequestration, will consume the CO2 emissions from biomass combustion process. Since the biomass contains negligible quantities of other elements like Nitrogen, Sulphur etc. release of other GHG emissions are considered negligible.

GHG emissions during on-site construction work are negligible compared to GHG reductions in the project lifetime and are not accounted for. Similarly emissions associated with transportation of construction materials are ignored.

Hence in the proposed power plant, biomass is fired and GHG emissions from biomass combustion is not estimated since biomass is considered to be CO_2 neutral

(a) Project Emission due to operation of tractors for effective and proper mixing and handling the Biomass

To ensure proper and effective mixing of the biomass fuels, ETAPPL will be running tractors. On an annum about 15 KL of diesel will be used. The GHG emissions due to the operation of tractors are about 32 tons, which is also considered as project emissions.

(b) Project Emission due to operation DG Set for Emergency purposes.

Emissions due to operation of DG Set in emergency is considered as negligible and cannot be ascertained at this point. However the consumption of diesel shall be monitored and its emissions will be calculated and added to net project emissions

PE = (a) + (b) = 32 tons of CO2 e /year …… (ii)

Emissions due to leakage (L):

As prescribed in Appendix B of the Simplified Modalities and Procedure for small-scale CDM project activities, for Category I.D leakage estimation is only required if renewable energy technology is equipment transferred from another activity. This does not apply to the project case.

However, the only source of leakage activity identified, which contributes GHG emissions outside the project boundary is transportation of biomass from the areas at an average distance of 30 km from the proposed power plant.

Also for ensure proper and effective mixing of the biomass fuels, ETAPPL will be running tractors. The GHG emissions due to the operation of tractors, is also considered as project emissions.

Hence the leakage activity identified, which contributes GHG emissions outside the project boundary is CO_2 emission due to

(a) Biomass transportation

(a)CO_2 emission due to biomass transportation:

The main feedstock for the power plant is biomass - Prosopis Juliflora, Cotton Stalk, Maize Stalk, Morinda Tintonia, coconut residues and Maize shanks sourced directly and through agents available within 30 KM Radius from the project site

Calculations

Description	Unit	Value
Total biomass required	Ton/year	65000
Biomass transported by truck	Ton/year	65000
Biomass load per tractor truck	Ton	10
Total No. Of trips	Nos.	6500
Average distance between project site and collection centres	Kms.	30
Consumption of diesel per trip (to and fro)(@5km/lit)	Ltrs.	12
Total diesel consumption	Ltrs.	78000

Calorific value of diesel	TJ/Ltrs.	0.0000283
Emission factor for diesel	t CO2/TJ	74.1
Emissions due to transportation of biomass	**t CO2 /year**	164

Hence the total emission due to leakages outside the project boundary is :
= 164 Tonnes CO2/Year.

Baseline Emission due to displacement of electricity ($BE_{electricity,}$):
Baseline Emission is calculated by multiplying the net quantity of electricity generated through the proposed project activity (*EG*) with the CO2 baseline emission factor for the electricity displaced due to the project (*EF electricity,*) as follows:

$BE_{electricity} = EG * EF_{electricity}$ ……(iv)

$EF_{electricity}$ = Baseline emission factor

= 0.85 tCO_2/MWh

$ER_{Base} = BE_{electricity} – PE - L$

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

>>

Year	Estimated project activity emissions (tCO2e)	Estimation of Baseline Emissions (tCO2e)	Estimation of leakages (tCO2e)	Estimation of overall Emission Reductions, (tCO2e)
2011	32	38556	164	**38,360**
2012	32	48195	164	**47,999**
2013	32	54621	164	**54,425**
2014	32	54621	164	**54, 425**
2015	32	54621	164	**54, 425**
2016	32	54621	164	**54, 425**
2017	32	54621	164	**54, 425**
2018	32	54621	164	**54, 425**
2019	32	54621	164	**54, 425**
2020	32	54621	164	**54, 425**
Total (tCO2e)	**320**	**523719**	**1640**	**521,759**

Therefore a conventional energy equivalent of 616.14 GWh for a period of 10 years would be saved by exporting power from the project activity, which in turn would reduce **521,759** tons of CO2 emissions considering baseline calculations.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{biomass,y}$
Data unit:	MT
Description:	Quantity of biomass residue of each type consumed in the project plant during year y
Source of data to be used:	On-site measurements (weighbridge records)
Value of data	65000
Description of measurement methods and procedures to be applied:	Each type of biomass deliveries will be weighed with a weighbridge. The data will be recorded separately for each type of biomass on a monthly basis and will be equal to the quantity of biomass consumed.
QA/QC procedures to be Applied:	Weighbridge is calibrated as per defined industry standards. This data will be cross checked against purchase receipts and inventory data
Any comment:	The data on quantity of fuel purchased will be collected, recorded and archived separately for all types of Biomass. Data archived : Crediting period + two years. Instruments : Weighbridge

Data / Parameter:	$EG_{gross,y}$
Data unit:	*GWh*
Description:	Total quantity of Electricity generated form the project activity during the year *y*
Source of data to be used:	On-site measurements. Daily/Monthly Meter reading records of the Plant.
Value of data	71.4 from 3rd year (50.4 - 1st yr, 63 – 2nd yr)
Description of measurement methods and procedures to be applied:	Measured continuously using calibrated meters and aggregated monthly.
QA/QC procedures to be applied:	The consistency of metered electricity generation will be cross-checked with the quantity of Biomass fuel and Fossil fuel (if any) fired. The Meters used for reading the Gross electricity generation will be calibrated as per Industry standards of host country (India).
Any comment:	Data archived: Crediting period + two years. Instruments : kWH meter

Data / Parameter:	EGy
Data unit:	*GWh*
Description:	Net electricity generated and exported to the grid in the year y
Source of data to be used:	Meter reading records at interconnection point recorded jointly by the project proponent and TNEB.
Value of data	45.36 – I year (anticipated) 56.7 – II year on wards (anticipated)
Description of measurement methods and procedures to be applied:	Measured monthly using calibrated meters sealed by TNEB meters and aggregated annually.
QA/QC procedures to be applied:	Meters will be calibrated as per industry standards/PPA. Sales records to The grid and other records are used to ensure consistency.
Any comment:	

Data / Parameter:	$EG_{aux,y}$
Data unit:	*GWh*
Description:	Auxiliary consumption of electricity of the project activity during the year y
Source of data to be used:	On-site measurements. Plant Daily/Monthly meter reading records
Value of data	10% of the electricity generated (approximately)
Description of measurement methods and procedures to be applied:	Measured hourly using calibrated meters and aggregated annually.
QA/QC procedures to be applied:	Meters will be calibrated as per industry standards. Sales records to the grid and other records are used to ensure consistency.
Any comment:	

Data / Parameter:	F_y
Data unit:	*Liters*
Description:	Quantity of Diesel used for running tractors in the project plant for proper and effective mixing of the biomass fuels in the year y
Source of data to be used:	On-site measurements– fuel issuance log books
Value of data	15 KL
Description of measurement methods and procedures to be applied:	The total quantity of Diesel consumed will be measured on regular basis using dip stick/ level gauge or store issues. Hence, the total quantity of Diesel Procured and quantity of Diesel consumed is considered for estimation of

	Project emissions.
QA/QC procedures to be applied:	The data recorded can be cross checked against the fuel purchase receipts.
Any comment:	The data on quantity of Diesel procured would be collected separately. Data archived: Crediting period + two years. Instruments : Level gauge

Data / Parameter:	$NCV_{biomass,x}$
Data unit:	*Kcal/Kg*
Description:	Gross Calorific value of biomass x
Source of data to be used:	Measured values recorded in Lab testing records
Value of data	4255 for Julie Flora
Description of measurement methods and procedures to be applied:	Measured by sample testing every quarter for each type of biomass
QA/QC procedures to be applied:	Data archived: Crediting period + two years.
Any comment:	

Key Project Parameters affecting Emission Reductions

Total Power generated by the project: The power exported by ETAPPL. would be monitored to the best accuracy and as per the table given in section B.7.1

Auxiliary consumption: The power imported by ETAPPL. would also be monitored to the best accuracy and as per the table given in section B.7.1. The total quantum of power consumed by the auxiliaries would affect the net power exported to the grid and therefore the amount of GHG reductions. Therefore any increase in the consumption pattern of the auxiliary system would be attended to.

Net Power exported to the grid: The project revenue is based on the net units exported by ETAPPL The general principles for monitoring above parameters are based on:

- Frequency
- Data recording
- Reliability
- Experience and training

Frequency
Monthly joint meter reading of main meters installed at interconnection point are taken and signed by authorised officials of ETAPPL and TNEB on the first day of every month. Hourly data recording by the shift in-charge of ETAPPL will be there at generation end.

Data recording
Records of this joint meter reading would be maintained by ETAPPL and TNEB. Daily and monthly reports stating the generation and net power export are prepared by the shift in-charge and verified by the plant manager.

Reliability
For measuring the delivery of energy by ETAPPL, one main meter and check meter is maintained at interconnection point. Main meter reading would form the basis of billing and emission reduction calculations, so long the meter is found to be within prescribed limits of error during half yearly check.
Monthly joint meter reading of main meters installed at interconnection point are taken and signed by authorised officials of ETAPPL. and TNEB. Records of these joint meter readings are maintained by ETAPPL. and TNEB. ETAPPL would keep requisite sets of metering equipment, duly tested/calibrated, as spares, for replacement as and when required. Main or Check meter would be replaced by spare set of meter with, mutual consent of the parties when a faulty meter is required to be removed. The Main and Check meter installed at interconnection point would be jointly inspected and sealed on behalf of the parties and shall not be interfered with, by either party except in presence of the other party. The main and check meter would be test checked for accuracy every six months at TNEB's laboratory and sealed by TNEB and ETAPPL jointly.

B.7.2 Description of the monitoring plan:

As mentioned in paragraph 15 of AMS.I.D. Version 16, Monitoring shall consist of metering the electricity generated by the renewable technology. This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the ETAPPL 10 MW biomass-based power project, Tamil Nadu.

The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data.

Prior to the start of the crediting period, the organisation of the monitoring team will be established. Clear roles and responsibilities will be assigned to all staff involved in the CDM project. The Project Developer will have a designated CDM Team Coordinator on site that will be responsible for monitoring emissions reductions of the project activity. Staff will receive some basic CDM training to ensure that they understand the importance of complete and accurate data and records for CDM monitoring. All staff involved in the collection of data and records will be coordinated by the CDM Team Coordinator. In addition to these qualified personnel will be designated to handle and operate equipment and machinery at the project site according to the statutory requirements of the country.

A formal set of monitoring procedures will be established prior to the start of the project. These procedures will detail the organisation, control and steps required for certain key monitoring system features, including:

a) CDM staff training
b) CDM data and record keeping arrangements
c) Data collection
d) CDM data quality control and quality assurance
e) Equipment maintenance
f) Equipment calibration
g) Equipment failure

Please refer to Annex 4 for further information on the procedures.

This will ensure that high quality data is obtained. Specifically, data and records will be checked prior to being stored and archived. Data from the project will be checked to identify possible errors or omissions.

All data required for verification and issuance will be kept for at least two years after the end of the crediting period or the last issuance of CERs of this project, whichever occurs later. Data will be archived electronically and data backup will be maintained. Paper data back up will also be available.

All equipment will be calibrated and maintained in accordance to the manufacturer's recommendations to ensure accuracy of measurements. Records of calibration and maintenance will be retained as part of the CDM monitoring system.

In addition to this, the project has formalized plans for emergency and accident preparedness. A fire protection system, designed according to the guidelines laid down by the Tariff Advisory Committee and Loss Prevention Association, will be implemented.

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

>> ETAPPL. has determined the monitoring methodology and they are project proponent as listed in Annex 1 of this document.

Date of Completion of application of Baseline and monitoring methodology: 04/08/2010

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:

>>30/10/06
(Sub Contract awarded for Civil and erection work of the Plant on this date)

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

>>25 yrs and 0 months.

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

>> Fixed Crediting Period

C.2.1. Renewable crediting period

>>Not Applicable

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:

C.2.2.1. Starting date:

01/01/2011

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 participants have conducted a Rapid Environmental Impact Assessment (REIA) in accordance with the Ministry of Environment and Forests, Government of India. The objective of the REIA is to review the current environmental status of the plant site and its surrounding areas, the impact of the project on the environment, to plan for environmental management plan which should also meet the requirements of local pollution control board. However, the rapid environmental impact assessment recommended implementing the necessary environmental management measures to mitigate the certain negative impacts on the environment.

Project proponent has approached the State Level Environment Impact Assessment Authority, Tamilnadu (SEIAA) for necessary evaluation and approval and obtained the Environmental Clearance which reveals that no
negative impacts are possible due to the project activity.

The possible type of pollutants emanating from a normal biomass plant are Air Pollution, Water Pollution, Thermal pollution, Noise Pollution etc. which are also common to the proposed plant, but it is negligible. The project proponent has planned various preventive and precautionary steps to control all forms of pollutants so as to safeguard the environment.

Control methods for air pollution
Dust and particulate matters
The pollution control norms stipulates a maximum dust concentration of 100 mg//N.cu.mt. The proposed biomass plant will have an Electrostatic Precipitator (ESP), which will separate the dust from the flue gas and has an efficiency of 99.2%. The dust concentration is the flue gas leaving the ESP wil be maximum 50 mg/N.cu.mt.
The dust concentration level in the chimney will be periodically monitored. Corrective steps will be taken, if the concentration is not within the acceptable limits.

Sulphur-di-oxide and Nitrogen-di-oxide
The main fuel proposed in the power plant is Julie flora which contains 0.3% Sulphur. Hence, the stack height will be as per the local pollution control board stipulations. The nitrogen di-oxides produced in biomass firing is very low since the furnace temperatures are low.

Fly Ash and Bottom Ash
As the wood has an ash composition of 2%, the total ash generated will be 4.79 ton/hr. Ash collected from the bottom of furnace (bottom ash) and the ash collected in the air heater hoppers

and ESP hoppers are taken to an ash silo through a set of conveyors / pneumatic conveying system. The ash from the silo will be disposed off to farmers, who can use the ash as manure for the crops and to local industries, who will utilize the ash for manufacture of bricks and for road building material.

Control methods for water pollution
Effluents from Water Treatment Plant
The water drained from the water treatment plant will have to be treated so that the water let out is neutral (pH 7.0). To achieve this effluent from the water treatment plant is pumped to a neutralisation pit.
The neutralisation pit will have acid resistant brick lining. Depending on the quality of water collected in the pit, either an alkaline medium or acidic medium will be pumped into the pit to neutralise the water.

Boiler Blowdown
In order to maintain the solid concentration in the boiler feed water, two types of blow down are emplo1yed in the boiler. One type is continuous blow down and the other intermittent blow down.
The blowdown water will be at a temperature of 100 Deg.C. The quantity of blowdown will be around 1.65 tph. This water can be taken to the effluent ponds, where it will get cooled naturally.

Sewage from the Power Plant Buildings
The sewage from the various power plant buildings will be taken to a common septic tank through trenches. The sewage from the septic tank will be disposed off through concrete trenches. As the sewage is taken in trenches the soil will not get contaminated.

Control Methods For Thermal Pollution:
The water used in the heat exchangers, will be cooled in a cooling tower of either induced or forced draft type. The water let out from the cooling tower will have a temperature very close to the ambient.

Control Methods for Noise Pollution:
The major source of noise pollution in the biomass power plant is from the following:
Rotating equipments like ID, FD and SA fans
Feed pumps
Boiler and super-heater safety valves
Start up vent
Steam turbine
DG sets
As per OSHA standards, the sound level from the rotating equipments shall be 85 to 90dBA. The rotating equipments will be designed to achieve this.

The start up vent, safety valve outlets and the DG sets will be provided with silencers to reduce the noise level to the acceptable limits.

The power house building will be constructed with sound proof walls to keep the noise level within the acceptable limits.

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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:

>> No significant environmental impacts considered due to implementation of project activity by the host
party, Hence, no references or procedures specified here.

SECTION E. Stakeholders' comments

>>

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

>> **Requirement of Stakeholder comments**

No specific public consultation / participation requirements are specified in Indian statutes for setting up of small-scale industries. However, there are certain procedural requirements, which every project investor needs to follow before implementing any project. Before implementing any project, project investors / developers need to identify the stakeholders, prepare necessary documents, approach the identified stakeholders directly and obtain required clearances /approvals. The stakeholders after review of documents and investment profile, will accord approvals / licenses or send comments in writing to project investors for further clarifications / corrections. In case they are not satisfied with the project design or they feel that the project impacts any of the local environment / social / economical environments, they will not issue clearances / approvals and stop the implementation of the project.

Identification of stakeholders

The project participants, as required for setting up the project, have identified the following stakeholders.

Tamilnadu Energy Development Agency (TEDA) (www.teda.gov.in**)**

Tamilnadu Energy Development Agency (TEDA), the state nodal agency to promote the use of new and renewable sources of energy (NRSE) and to implement projects therefore, to promote energy conservation activities, & to encourage research and development on renewable sources of energy.

Tamilnadu Electricity Board (TNEB) (www.tneb.in)

Tamilnadu Electricity Board, (TNEB) is a statutory body formed under the Electricity Supply Act, 1948 as a successor to the erstwhile Electricity Department of the Government of Madras**.** The main objective of TamilNadu Electricity Board is to generate, transmit and distribute electricity efficiently and to supply quality power in the state of Tamilnadu.

Tamilnadu Electricity Regulatory Commission (TNERC) (www.tnerc.tn.nic.in)

Tamilnadu Electricity Regulatory Commission (TNERC) has the role of tariff fixation, licensing, grievance redressing, regulating power purchase and procurement processes of the transmission and distribution utilities throughout the state of Tamilnadu.

Tamilnadu Pollution Control Board (TNPCB) (http://www.tnpcb.gov.in)
Tamilnadu Pollution Control Board (TNPCB), a regulatory body to monitor environmental impacts and environmental management of industries, accords clearances for setting up of industries in the state after ensuring adherence to the statutory regulations. Also gives Consent for Establishment (CFE) and Consent for Operation (CFO) for the project if it satisfies with the environmental management and pollution control measures.

Village Panchayat
Village panchayat, is a village level elected local governing body which issues the plan approval for a project.

Other stakeholders such as Inspector of Factories, fire and health, Chief Electrical Inspectorate General etc., but the role of these stakeholders is limited to examination of certain issues such as plant layout, equipment designs, etc. These stakeholders are to be approached during the project implementation stage, and there would be no obstruction to the implementation of the project as long as the designs are according to the stipulated regulations. The project participants prepared necessary documentation before implementation of the project activity and approached the above stakeholders individually.

A meeting of local stake holders was organized at the project site on 7/10/2008, for which invitation were sent in person a week before i.e. on 30/9/2008, to receive comments on the project activity. This included prominent members of the society, like members of the local governing body, traders, farmers etc. The stake holders were briefed about the project activity and a questionnaire in vernacular language was circulated among them for receiving their comments thereafter. The comments received were recorded, and is available for verification by the DOE.

E.2. Summary of the comments received:

>> A majority of stake holders called for the meeting were of the opinion that the project activity will contribute to overall development of the region and will be generating direct employment to local residents and also will be generating job opportunities indirectly for the local uneducated and economically backward people as the biomass is to be collected and transported to the plant site from the fields.

They were also of the opinion that the project activity will also contribute to availability of quality power in the area.

Apart from the above no specific or adverse comments were received on the project activity, which is evident from the licenses /Approvals / clearances accorded to the project activity by the stakeholders

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

>> No adverse comments received; hence, no actions are applicable.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ETA Powergen Pvt. Ltd.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

Annex 3
BASELINE INFORMATION

The project activity is a renewable electricity generation that displaces fossil fuel dominated electricity generation. The base line for the project activity is given by paragraph 10 in methodology AMS I.D /Version 16 which is "If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources."

As per para 11 of AMS ID "The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO,grid,y}$$

Where:
BE_y : Baseline Emissions in year y (t CO_2)

$EG_{BL,y}$:Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO,grid,y}$: CO_2 emission factor of the grid in year y (t CO_2/MWh)

The Emission Factor can be calculated in a transparent and conservative manner as follows:
(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the .Tool to calculate the Emission Factor for an electricity system.
OR
(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations shall be based on data from an official source (where available) and made publicly available.

Hence, Electricity baseline emission factor of the applicable grid has to be determined for estimating the emission reductions due to the grid electricity generation that is displaced by the project activity.

Electricity emission factor from CEA (Central Electricity Authority, India) Data

The Central Electricity Authority (CEA) (www.cea.nic.in) is a statutory organization constituted under Section 3 of the repealed Electricity (Supply) Act, 1948.

As per section 73 of the Electricity Act, 2003, the Central Electricity Authority shall perform such functions and duties as the Central Government may prescribe or direct, and in particular to -

a) Advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and coordinate the activities of the planning agencies for the optimal utilization of resources

to sub serve the interests of the national economy and to provide reliable and affordable electricity to all consumers;

b) Specify the technical standards for construction of electrical plants, electric lines and connectivity to the grid;

c) Specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines;

d) Specify the Grid Standards for operation and maintenance of transmission lines;

In addition to above functions and duties, CEA has to perform the many other related functions as mentioned in various sections of the Electricity Act, 2003

The Baseline Carbon Dioxide Emissions from Power Sector have been worked out by CEA based on detailed authenticated information obtained from all the operating Power Stations in the country.

The baseline information is dynamic in nature and data will have to be updated every year based on the new generating capacity added in the country. This Version 4.0 of the database represents the first update of this kind. It incorporates the data for the Fiscal Year 2007-08, thereby extending the scope of the database to Eight years (2000-01 – 2007-08).

The baseline emissions for all the five regional grids are given at http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm. The complete updated CO2 Database (Microsoft Excel File) and this User Guide along with all the previous versions is available on the website of Central Electricity Authority: **www.cea.nic.in**

Estimation of Base Line Emission factor of Southern Regional Grid (Source CEA data)

The updated data as published by CEA , India (Available at www.cea.nic.in) is given in Table A 3.1

Description	2005-06	2006-7	2007-8
Gross Generation Total (GWh)	147355	161897	167379
Net Generation Total (GWh)	138329	152206	157315
20% of Net Generation	27666	30441	31463
Share of must run(Hydro/Nuclear) in % of Net Generation	27%	28.3%	27.1%
Net Generation in Operating Margin (GWh)	100978	109116	114702
Net Generation in Build Margin (GWh)	28158	30442	31613

20% of Gross Generation (GWh)	29471	32379	33476
Absolute Emission Total(tCO2)	101551293	109020456	113626240
Absolute Emissions OM (tCO2)	101551293	109020456	113626240
Absolute Emissions BM (tCO2)	19947080	21348182	22550310
Net Imports (GWh) – Net exporting grids are set to Zero	0	0	0
Share of Net Imports as a % of Net Generation	0%	0%	0%

The values for Operating Margin and Build Margin estimated from the above data in conservative and transparent manner are given in the table A.3.2

Table A-3-2 Baseline Emission Factor of Southern Regional Grid for Various Approaches

Year	Approach	Value	Reference
2007-08	Simple Operating Margin Excluding imports from other grids	0.99 tCO2/MWh	www.cea.nic.in
2007-08	Build Margin Excluding imports from other grids	0.71 tCO2/MWh	www.cea.nic.in
2007-08	Simple Operating Margin Including imports from other grids	0.99 tCO2/MWh	www.cea.nic.in
2007-08	Build Margin Including imports from other grids	0.71 tCO2/MWh	www.cea.nic.in

Since the values of Operating Margin and Build Margin are same with and without considering Imports from other grids hence Operating Margin is taken as 0.99 tCO2/MWh and Build Margin as 0.71 tCO2/MWh for calculating **the baseline emission factor** $EF_{CO,grid,y}$ as the weighted average of the Operating Margin emission factor (*EFOM,y*) and the Build Margin emission factor (*EFBM,y*):

$$EF_{CO,grid,y} = W_{OM} * EF_{OM,y} + W_{BM} * EF_{BM,y}$$

Where

$EF_{CO,grid,y}$ *is the baseline emission factor of the grid in the year 'y' in tCO2/MWh*
$EF_{OM,y}$ *is the Simple Operating Margin Emission Factor in the year 'y' in tCO2/MWh*
$EF_{BM,y}$ *is the Build Margin Emission factor in the year 'y' in tCO2/MWh*
W_{OM} *is the weight for Operating Margin*
W_{BM} *is the weight for Build Margin*

where the weights *wOM* and *wBM*, by default, are 50% (i.e., *wOM* = *wBM* = 0.5), **as per the tool to calculate the emission factor of an electrical system Annex 12 Ver 1.1**

Calculating the Baseline Emission Factor using the above values

Emission Factor $EF_{CO,grid,y}$ = 0.5* 0.99 + 0.5 * 0.71
In tCO2/MWh

= **0.85 t CO2/MWh**

Annex 4

MONITORING INFORMATION

The monitoring methodology applied for this project activity is "Grid connected renewable electricity generation", AMS – I D, Version 16

CDM Monitoring System Procedures

Procedure name	Description
CDM Staff training	This procedure outlines the steps to ensure that staff receives adequate training to collect and archive complete and accurate data necessary for CDM monitoring.
CDM data and record keeping arrangements	This procedure provides details of the sites data and record keeping arrangements. The arrangements ensure that complete and accurate records are retained by the CDM Team Coordinator within the quality control system. Data and records will be stored and archived according to this procedure.
Data collection	This procedure will outline the steps to collect the data from the various measurement equipments.
CDM data quality control and quality assurance	Data and records will be checked prior to being stored and archived. Data from the project will be checked to identify possible errors or omissions.
Equipment maintenance	This procedure outlines the steps to provide regular and preventative maintenance to the monitoring equipment.
Equipment calibration	This procedure details the process of organising and managing the calibration process.
Equipment failure	This procedure details the steps to be taken in case of equipment failure.

Since the project is a grid connected renewable energy project, emission reduction quantity depends on the units of energy generated from biomass based power plant and exported to the grid (in kWh) and the baseline emission of the state grid. The methodology covers the monitoring of units exported and the other parameters affecting the quantity of power export and CO2 emissions thereof. The net emission reductions will result from the units of power supplied to the grid.

Annex 5

ABBREVIATIONS

BAU	Business As Usual
BM	Build Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CO2	Carbon dioxide
DPR	Detailed Project Report
EIA	Environment Impact Assessment
ETAPPL	ETA Powergen Private Ltd.
GHG	Greenhouse gas
Hz	Hertz
IPCC	Inter Governmental Panel On Climate Change
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
Kg	Kilogram
Km	Kilometer
kW	Kilo watt
kWh	Kilo watt hour
MoEF	Ministry of Environment and Forest
MW	Mega watt
OM	Operating Margin
PDD	Project design document
PPA	Power Purchase Agreement
TEDA	Tamil Nadu Energy Development Agency
TNEB	Tamil Nadu Electricity Board
TNERC	Tamil Nadu Electricity Regulatory Commission
TNPCB	Tamil Nadu Pollution Control Board
TPH	Tons per hour
UNFCCC	United Nations Framework Convention on Climate Change

ANNEX 6
LIST OF REFERENCES

Sl. No.	Particulars of the references
1	United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
2	Ministry of Power (MoP), Govt. of India, www.powermin.nic.in
3	Central Electricity Authority (CEA), Govt. of India, www.cea.nic.in
4	Ministry of Environment and Forest, http://envfor.nic.in/cdm/host_approval_criteria.htm
5	Central Electricity Regulatory Commission http://cercind.gov.in/
6	Ministry of New and Renewable Energy http://mnes.nic.in/
7	DNA CDM India
8	Detailed Project Report for ETA Powergen Private Limited
9	Tamil Nadu electricity Board (TNEB) http://tneb.in
10	Tamilnadu Energy Development Agency (TEDA) (www.teda.gov.in)
11	Tamilnadu Electricity Regulatory Commission (TNERC) (www.tnerc.tn.nic.in)
12	Tamilnadu Pollution Control Board (TNPCB) (http://www.tnpcb.gov.in)
13	Maps of India http://www.mapsofindia.com/