CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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23.75MW grid connected electricity generation project at Tirunelveli in Tamil Nadu.
Version: 01
Date: 04/12/2007

A.2. Description of the project activity:

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The proposed activity is a bundled project, which involves the establishment of a wind farm of 23.75 MW installed capacity enabling generation of electricity by state-of-art 1.25 MW Wind Electricity Generators (WEGs) (One of the latest available technologies in the country developed by Suzlon Energy Limited), in Devarkulam and Sankaneri, Tirunelveli District in the State of Tamil Nadu in Southern India. The details of multiple investors are furnished in Annex 5. Approximately 84% of the electricity generated will be sold to the state electricity utility - Tamil Nadu Electricity Board (the “TNEB”) and the remaining 16% will be put to captive use thereby reducing the dependence of investors over the diesel generation units installed in their respective industrial premises.

The electricity generation from this wind park will contribute to annual GHG reductions estimated at 52265 (tonnes of carbon dioxide equivalent). Although the project life is envisaged as 20 years (designed life of wind turbines), it is proposed that the project activity needs to mitigate the risks involved in Renewable Energy Technology for the first 10 years. The project activity will replace approximately 56.24 Million units of renewable power to the power deficit southern region grid.

Purpose of the project activity

The principal purpose of the project activity is to generate electrical energy through sustainable means using wind power resources, to utilize the generated output for selling it to the grid and/or using the generated output for self consumption and to contribute to climate change mitigation efforts. This renewable energy will substitute the electricity currently supplied into the grid by the thermal power plants.

Apart from generation of renewable electricity, the project has also been conceived for the following:

- To enhance the propagation of commercialisation of MW class wind turbines in the region
- To contribute to the sustainable development of the region, socially, environmentally and economically
- To reduce the prevalent regulatory risks for this wind park through revenues from the CDM

View of the project participants on the contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects:

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

The proposed project activity leads to alleviation of poverty by establishing direct and indirect employment benefits accruing out of ancillary units for manufacturing lattice towers for erecting the WEGs and for maintenance during operation of the project activity. The project provides revenue to villagers from sale of land to wind park developers on whole land or points[1] sale basis. The infrastructure in and around the project area will also improve due to project activity. This includes development of road network and improvement of electricity quality, frequency and availability as the electricity is fed into a deficit grid.

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

The project activity leads to an investment of about Rs.1045 Million to a developing region which otherwise would not have happened in the absence of project activity. The generated electricity is fed into the Southern regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development. The project activity also leads to diversification of the national energy supply, which is dominated by conventional fuel based generating units.

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

The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. As wind power projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power. Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. The project does not cause any impact on Flora and Fauna including visual impact, noise impact, and migration of birds' etc.Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

d >Technological well being - *The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewable sector or energy efficiency projects that are comparable to best practices in order to assist in upgradation of technological base.*

The project activity leads to the promotion of 1.25 MW Wind Electric Generators (WEGs) into the region, demonstrating the success of large sized wind turbines, which feed the generated power into the nearest sub-station, thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well-being.

A.3. Project participants:

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[1] The farmers sell their total land (*whole*) in their possession to the wind project developers or even sell against the actual requirement of land (*points*) for installations of the wind mills

Table 1: 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)
Government of India (Host Country)	Senergy Global Private Limited	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

>>
Government of India

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

>>
State – Tamil Nadu

A.4.1.3. City/Town/Community etc:

>>
District – Tirunelveli
Villages – Irrukanthurai, Vadakkukaval Kurichi, Melilanthikulam, Ukkirankottai, Balabathiraramapuram, Dhanakkarkulam

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The location of the project is at two sites namely Sankaneri and Devarkulam, which fall in the south eastern part of Tirunelveli district of the state of Tamil Nadu. The project sites are located on a land not suitable for any agricultural activities.
The Tirunelveli District is located in the world map, between **08° 0 8' and 09° 23' latitude and 77° 09' and 77° 54' longitude**. The total geographical area of the district is 6,823 sq. km.

Figure 1: Location of Tamil Nadu in India

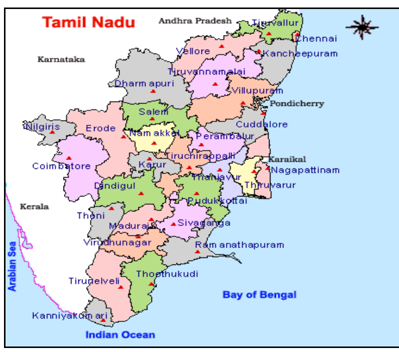

Figure 2: District map of Tamil Nadu

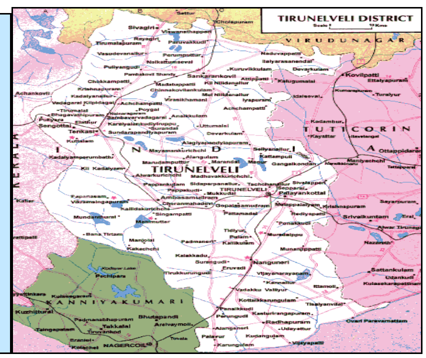

Figure 3: Tirunelveli district map

A.4.2. Category(ies) of project activity:

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The project activity is considered under "Zero emissions grid-connected electricity generation from renewable sources", the project activity has a capacity more than 15 MW and generates electricity in excess of 15 MWh per year (limit for small scale project). Therefore as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies', the project activity may principally be categorised in:

Scope Number 1
Sectoral Scope – Energy Industries (renewable/non-renewable sources).

A.4.3. Technology to be employed by the project activity:

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In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. For generation of electricity both wind velocity and wind density play significant role. The kinetic energy (carried by wind) when passes through the blades of the wind turbines make them rotate and gets converted into mechanical energy. This mechanical energy is transferred into electrical energy through the coupled generator unit. The technology is a clean technology since there are no GHG emissions associated with the electricity generation.

The technology to be employed, converts wind energy to electricity using a Wind Electric Generator. The product that is employed is of MW class, i.e. 1.25 MW size. Until recent past, the Indian WEG industry was using kW class turbines for conversion of wind energy into electricity. The use of kW category WEGs was occupying same space whereas the generation of electricity was comparatively less and the wind energy potential of the site was not harnessed to its optimum extent. The new state-of-art MW class WEGs are more efficient and technologically sound. Also, the fact that Indian wind regime is of a moderate nature in comparison to what exists in European countries; there is a requirement of higher rotor swept area. Further, it has been found that the power law index has been positive (increase in wind speed with increase in height), thus increased height results into higher generation. The salient features of the technology are as follows:

5. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (Cp)
6. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
7. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
8. Intelligent Control - Next generation technologies applied by extensive operational experience maximizes yield
9. Maximum Power Factor - High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99
10. Climatic Shield - Hermetically sheltered, advanced over-voltage and lightning protection system
11. Unique Micro-Pitching Control - Unmatched fine pitching with 0.1° resolution to extract every possible unit of power
12. Grid-friendly - Grid friendly design generates harmonics-free pure sinusoidal power

The technical description of the S-66 turbines used in the project activity is furnished in Annex 5.

Technology transfer:
No technology transfer from other countries is involved in this project activity.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Table 2: Estimated amount of emission reductions

Year	Annual Emission Reduction (tCO2e)
2008 – 2009	52265
2009 – 2010	52265
2010 – 2011	52265
2011 – 2012	52265
2012 – 2013	52265
2013 – 2014	52265
2014 – 2015	52265
2015 – 2016	52265

2016 – 2017	52265
2017 - 2018	52265
Total emission reductions (tCO2e)	**522650**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tCO2e)	**52265**

A.4.5. Public funding of the project activity:

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There is no public funding involved in the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Sectoral Scope : **Energy Industries (renewable/non-renewable sources)**
Scope Number : **01**
Approved consolidated methodology: **"Consolidated baseline methodology for grid connected electricity generation from renewable sources", ACM0002**

Version : **07, EB 36**

The methodology ACM0002 refers to the latest approved versions of the following tools:

- **Tool to calculate the emission factor for an electricity system, Version 01**
- **Tool for the demonstration and assessment of additionality, Version 04**

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Grid connected electricity generation from renewable source (wind energy) has been considered as the project activity, for which geographic and system boundaries for the relevant grid (Southern) can be clearly defined and information on the characteristics of the grid are also available. The other conditions that favour the application of the selected methodology are as follows:

- The project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- Sufficient publicly available information is available to document in a transparent and conservative manner the nature of prohibitive barriers to the project activity.
- The Southern Region Electricity Grid is not dominated by generating sources with zero or low operating costs such as hydro, geothermal, wind, and solar, nuclear and low cost biomass.

This baseline methodology has been used in conjunction with the approved monitoring methodology ACM0002 ("Consolidated monitoring methodology for grid-connected electricity generation from renewable sources").

B.3. Description of the sources and gases included in the project boundary

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The project boundary is defined as the notional margin around a project within which the project's impact (in terms of GHG reduction) will be assessed. According to ACM0002 the spatial extent of this project activity includes the project site and all the power plants connected physically to the electricity system that the CDM power project is connected to. Thus, it essentially is the zone encompassing the WEG installations to the nearest grid interconnection point, which is available at a distance of 1.5 km from the project site.

Table 3: Main Emission Sources

	Source	Gas		Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	On-site fossil fuel consumption due to the implementation of the project	CO_2	Excluded	This source is not required to be estimated under ACM0002 for wind energy projects.
		CH4	Excluded	Estimates not required
		N2O	Excluded	Estimates not required

There are three choices available for choosing the grid system for the project activity, viz. national grid, regional grid or state grid. In India, electricity is a concurrent subject between the State and the Central Governments. The perspective planning, monitoring of implementation of power projects is the responsibility of Ministry of Power, Government of India. At the state level the state utilities or State Electricity Boards (SEBs) are responsible for generation, transmission, and distribution of power. With power sector reforms there have been unbundling and privatisation of this sector in many states. Many of the state utilities are engaged in power generation also. In addition, there are different central / public sector organizations involved in generation like National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), etc. in transmission e.g. Power Grid Corporation of India Ltd. (PGCIL) and in financing e.g. Power Finance Corporation Ltd. (PFC).

Description of the project boundary:

There are five regional grids: Northern, Western, Southern, Eastern and North-Eastern. Different states are connected to one of the five regional grids as shown in the Table below:-

Table 5: States connected to different regional grids

Regional grid	***Northern***	***Western***	***Southern***	***Eastern***	***North Eastern***
States	Haryana, Himachal Pradesh, Jammu &	Gujarat, Madhya	Andhra Pradesh,	Bihar, Orissa,	Arunachal Pradesh,

	Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, Delhi, Chandigarh	Pradesh, Maharashtra, Goa, Chhattisgarh	Karnataka, Kerala, Tamil Nadu, Puducherry	West Bengal, Jharkhand, Sikkim	Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

The management of generation and supply of power within the state and regional grid is undertaken by the state load dispatch centres (SLDC) and regional load dispatch centres (RLDC). Different states within the regional grids meet the demand from their own generation facilities plus generation by power plants owned by the central sector i.e. NTPC and NHPC etc. Specific quota is allocated to different states from the Central sector power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. Thus there is an exchange of power among states in the regional grid. Similarly there exists imports and export of power between regional grids.

The proposed project falls under the Southern Grid in the state of Tamil Nadu, which is currently facing huge Demand Supply deficit. Since the CDM project would be supplying electricity to the Southern regional grid this regional grid has been taken as project boundary.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The baseline for the project has been identified according to ACM0002 (version 07) where in for the project activities which involve the installation of a new grid-connected renewable enrgy power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

Moreover, the detailed analysis of the alternatives available to project proponent (given in section B.5) also reveals that the only alternative left to the project proponent was to continue with the existing situation and not invest into the present project.

The "tool to calculate the emission factor for an electricity system", version 01 calculates the CM in the following steps:

STEP 1. Identify the relevant electric power system.

STEP 2. Select an operating margin (OM) method.

STEP 3. Calculate the operating margin emission factor according to the selected method.

STEP 4. Identify the cohort of power units to be included in the build margin (BM).

STEP 5. Calculate the build margin emission factor.

STEP 6. Calculate the combined margin (CM) emissions factor.

STEP 1: Identify the relevant electric power system – The tool defines the *electric power system* as the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. Keeping this into consideration, the Central Electricity Authority (CEA)[2], Government of India has divided the Indian Power Sector into five regional grids (see table below).

Northern	Western	Southern	Eastern	North-Eastern
Chandigarh	Chhattisgarh	Andhra Pradesh	Bihar	Arunachal Pradesh
Delhi	Gujarat	Karnataka	Jharkhand	Assam
Haryana	Daman & Diu	Kerala	Orissa	Manipur
Himachal Pradesh	Dadar & Nagar Haveli	Tamil Nadu	West Bengal	Meghalaya
Jammu & Kashmir	Madhya Pradesh	Pondicherry	Sikkim	Mizoram
Punjab	Maharashtra	Lakshadweep	Andaman-Nicobar	Nagaland
Rajasthan	Goa			Tripura
Uttar Pradesh				
Uttaranchal				

Since the project supplies electricity to the Southern grid, emissions generated due to the electricity generated by the southern regional grid as per CM calculations will serve as the baseline for this project. The detailed CM calculations have been provided in the Section B.6 (STEP 2 onwards) of the PDD.

Description of the identified baseline scenario:

The approach adopted for selecting the baseline scenario for the project is based on 48(a) called "existing actual or historical emissions, as applicable", against the baseline approach of "Emissions from a technology that represents an economically attractive course of action". The state of Tamil Nadu, at present is drawing up electricity from the Southern Grid to meet its energy demands. Only a small proportion of power in the grid is made available from clean sources of energy like wind, biomass, hydro etc.

Table 6: Summary of regional energy generation of southern region during 2005-06. (Figure in Gross MUs.)

[2] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver3.pdf

AGENCY	HYDRO	THERMAL	GAS/DIESEL	WIND/OTHERS	NUCLEAR	TOTAL
ANDHRA PRADESH	3586.36	2962.5	272	2	--	6822.86 (18.6%)
KARNATAKA	3389.25	1470	127.8	4.55	--	4991.6 (13.6%)
KERALA	1835.1	--	234.6	2.025	--	2071.725 (5.6%)
TAMILNADU	2137.35	2970	422.88	19.355	--	5549.585 (15.1%)
PONDICHERRY	--	--	32.5	--	--	32.5 (0.1%)
CENTRAL SECTOR	--	8090	359.58	--	880	9329.58 (25.4%)
IPP	278.13	387.01	2997.46	4308.865	0	7971.465 (21.7%)
TOTAL	11226.19 (30.5%)	15879.51 (43.2%)	4446.82 (12.1%)	4336.795 (11.8%)	880 (2.4%)	36769.315 (100.0%)

Note:
i). NTPC, 1000MW capacity at Simhadri, 359.58MW capacity at Kayamkulam and NLC's 600MW capacity at Neyveli Stage I which are fully dedicated to Andhra Pradesh, Kerala &Tamil Nadu respectively have also been included under the Central Sector.
ii). The statewise bifurcation of IPP's is as follows:

Therefore for the baseline, it will be unrealistic to assume that in the near future this share of power coming from the cleaner sources will increase manifold, thereby decreasing the baseline emissions considerably, because investment in cleaner technologies involves large financial capital and therefore not feasible to introduce on a massive scale. For the proposed project is not the most financially lucrative option as it involves large capital investment and human resource. Thus, it can be stated with confidence that approach (b) for baseline estimations is ruled out in the present context, and that the existing emissions, occurring as a result of energy intensive fossil-fuel based power plants, is the most plausible baseline for the proposed project activity.

Furthermore, according to ACM0002, for project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:
"Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined-margin calculations".

The fact that the present total installed capacity of the power sector in India is 1,27,925 MW with Thermal contributing the highest around 65.7% (84,024 MW) followed by Hydro 26.4% (33,810 MW), Nuclear 3% (3,900 MW), renewable 4.8% (6,191 MW) proves that the power sector in India is highly dependent on thermal power plants.

Focussing on the southern grid, the total installed capacity has been growing since 2003-2004 at 30,794 MW to 32,734 in 2004-2005 to 36,769 in 2005-2006. Southern Regional (SR) grid is a large system comprising of 6,51,000 sq.kms.of area encompassing 4 states system viz Andhra Pradesh, Karnataka, Tamil Nadu and Kerala and Union Territory of Puducherry. The following figure shows a map of the states comprising the southern grid.

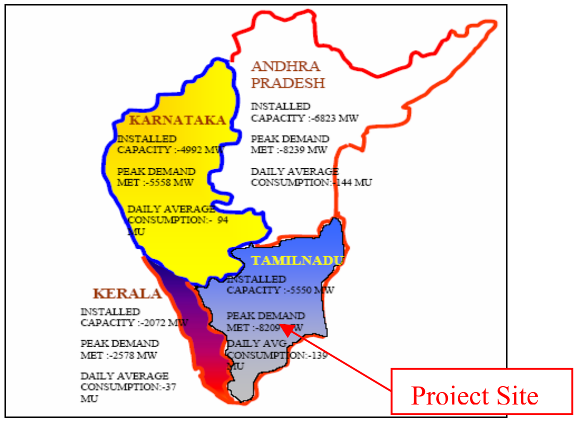
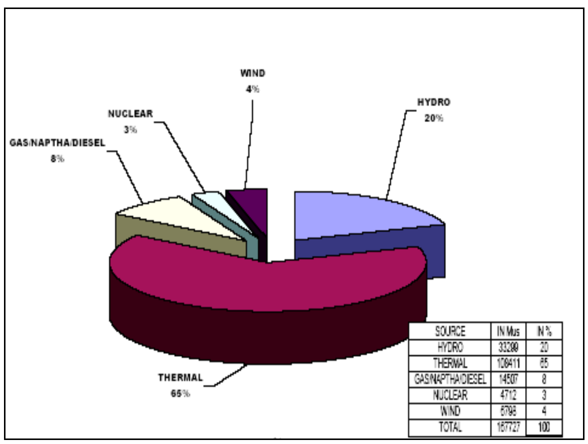


Figure 6[3]: States comprising the southern grid

Thermal power plants are the greatest contributor to the Southern grid (Table 1.). Though there is a healthy contribution from other energy sources as well in terms of generation capacity, the actual energy generated by them is much lower (Fig.5)



SOURCE	IN Mus	IN %
HYDRO	33299	20
THERMAL	108411	65
GAS/NAPTHA/DIESEL	14507	8
NUCLEAR	4712	3
WIND	6798	4
TOTAL	167727	100

Figure 7: Source-wise contribution to energy generated during 2005-06

Temporally, as the figure below shows, it is the thermal sources which have been the highest contributors to the grid. Sources like wind, nuclear and other renewable have not been properly tapped.

[3] Annual report of Southern Grid 2005-06

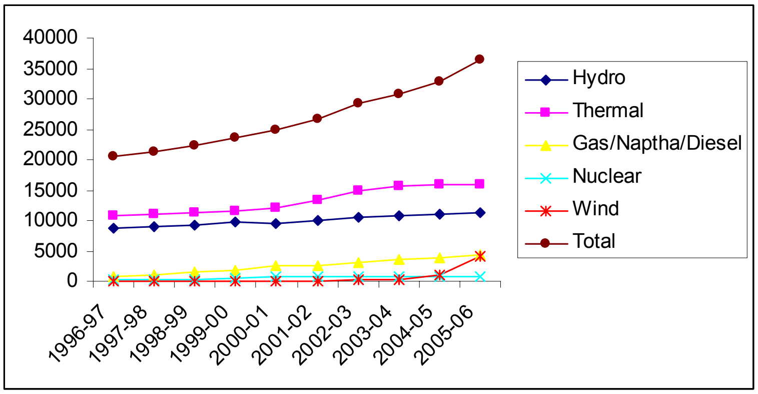


Figure 8: Contribution of various sources in the past ten years in the southern grid

Given the above background, the baseline scenario would comprise of emissions mainly from thermal power plants with a small proportion from other relatively clean sources of energy.

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 CDM project activity (assessment and demonstration of additionality):

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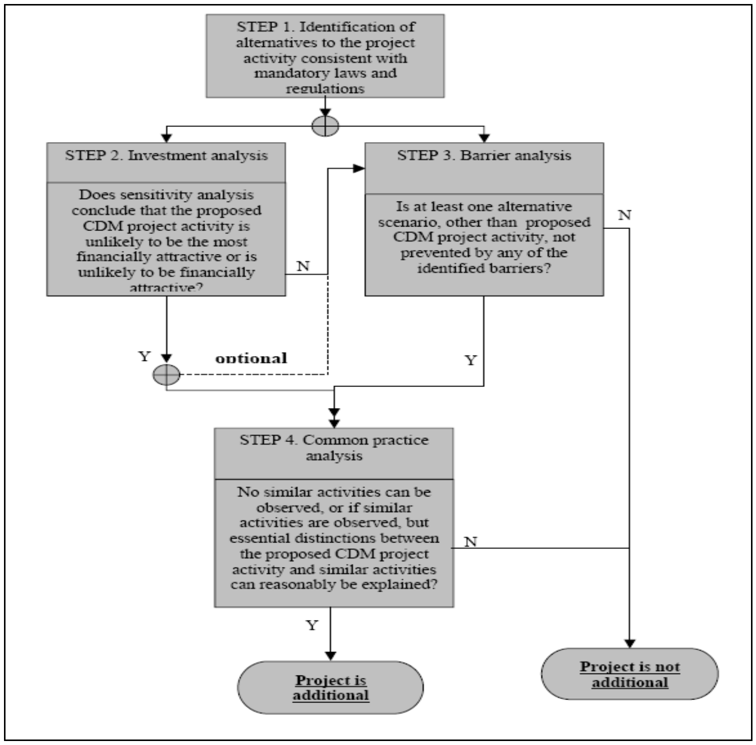
Additionality of the project activity is demonstrated using the “Tool for the demonstration and assessment of additionality”, Version 04, EB 36 as specified by the approved methodology ACM0002 as described below:



Step 1. Identification of alternatives to the project activity consistent with current laws and regulations Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:		
Sub-step 1a. Define alternatives to the project activity:	The realistic and credible alternative(s) available to the project participants that provide outputs or services comparable with the proposed CDM project activity are: Captive portion: (16% of the generated electricity) 1. The captive generation consumer continues to draw electricity from the grid 2. The captive generation consumer invests in available fossil fuel based electricity generation technologies. (the available technologies are gas based IC engines coupled with generators) Sale to State Electricity Utility: (84% of the generated electricity) 1. Continuing with the available grid connection and meeting the electrical demand through existing grid. 2. Investing in wind energy, but not as a CDM project	The options, which were possible / available in place of the candidate CDM project, provide the same end product – electricity, and they all are permitted under the current Indian laws. Additionally, investment in WEG installation is not

	activity	mandatory and thus project proponent carried out voluntary investment in RE technologies.
Sub-step 1b. Consistency of mandatory laws and regulations:	1. Usage of grid electricity – Permitted 2. Fossil fuel based captive electricity generation - Permitted 3. Renewable energy based installation – Permitted 4. The candidate CDM project without additional revenue stream of CDM – permitted	All the available options were open for the project proponents, and none of them has been made mandatory by the State or Union Government of India.
Step 2: Investment analysis - Determine whether the proposed project activity is the economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps:		
Sub-step 2a. Determine appropriate analysis method *Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (sub-step 2b). If the CDM project activity generates no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).*	The project generates financial benefits other than CDM revenue also therefore option I cannot be used. Between investment comparison analysis and benchmark analysis we chose benchmark analysis (Option III) as alternatives available are not sufficient enough to carry out investment comparison analysis so option III is being used for the project activity.	
Sub-step 2b – Option III. Apply	The central electricity regulatory commission (CERC) has fixed the tariff for the power sold to electricity board by IPPs on the basis of 14% post-tax Return on Equity[4]. Hence, 14% post tax	

[4] Reference: Central Electricity Regulatory Commission, petition no 67/2003, order hearing dated 12.11.2003, in matter of determination of terms and conditions of tariff.

<table>
<tr>
<td>benchmark analysis</td>
<td>return on equity (or equity IRR) is used as a benchmark for projects in public or private sector. (Source: Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2004 dated 26th March 2004).</td>
<td></td>
</tr>
<tr>
<td>Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):</td>
<td>Financial analysis has been done taking the generation guarantee provided by EPC contractor in the purchase order for each investor. The IRR calculated with and without CDM by the investor at the time of project inception is as follows.
<table>
<tr><th>Name of Investor</th><th>Equity IRR without CDM Revenue</th><th>Equity IRR With CDM Revenue</th></tr>
<tr><td>Muthoot Fincorp Limted</td><td>9.98%</td><td>12.38%</td></tr>
<tr><td>Revathi Equipment Limited</td><td>10.01%</td><td>12.3%</td></tr>
<tr><td>Utkal Investments Limited</td><td>8.97%</td><td>10.68%</td></tr>
<tr><td>Thiagarajar Mills Limited</td><td>12.93%</td><td>14.53%</td></tr>
<tr><td>Kamal Engineering Corporation</td><td>9.87%</td><td>12.44%</td></tr>
<tr><td>Subhash B Muttha</td><td>9.03%</td><td>10.75%</td></tr>
<tr><td>Global Calcium Private Limited</td><td>12.53%</td><td>14.12%</td></tr>
<tr><td>Suzlon Infrastructure Limited</td><td>8.65%</td><td>10.23%</td></tr>
<tr><td>Markdata Power and Engineering Limited</td><td>11.44%</td><td>14.24%</td></tr>
<tr><td>Sastha Paper Mills Private Limited (sale to EB)</td><td>12.80%</td><td>16.37%</td></tr>
<tr><td>Sastha Paper Mills Private Limited (Captive)</td><td>12.57%</td><td>15.02%</td></tr>
</table>
The above table shows that the IRR for each investor is much lesser than the benchmark i.e 14% without CDM revenue. With CDM revenue the IRR has increased to certain extent as CDM will bring in additional revenue to the project and thus increase the financial attractiveness of the project.</td>
<td>The project IRR is less than the benchmark of WACC and hence the CDM project is not financially attractive. The additional CDM revenue will help mitigate some of the risks to the project and increase the financial attractiveness of the project.</td>
</tr>
<tr>
<td>Sub-step 2d. Sensitivity analysis (only applicable to options II and III)</td>
<td>A sensitivity analysis was also carried out for the equity IRR of the project for an increase in electricity generation from the project. In the analysis the investor which had the highest IRR among all the investors has been considered for doing sensitivity analysis. In this project Thiagarajar Mills Limited with equity IRR of 12.93% without CDM has been considered for the analysis.
5% increase in generation has been done. The results are tabulated below:</td>
<td>The sensitivity analysis shows that the project is financially unattractive without CDM revenue and is robust to reasonable variations in the</td>
</tr>
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<table>
<tr><th>Increase in Generation</th><th>Equity IRR without CDM</th><th>Equity IRR with CDM</th></tr>
<tr><td>+ 0%</td><td>12.93%</td><td>13.00%</td></tr>
<tr><td>+ 2.5%</td><td>13.40%</td><td>15.00%</td></tr>
<tr><td>+ 5%</td><td>13.87%</td><td>15.46%</td></tr>
</table>
The sensitivity analysis clearly indicates that the returns remain below the benchmark even with a 5% increase in electricity generation. The proponents hence considered CDM revenue as an extra income stream to increase the financial attractiveness of the project.
</td>
<td>critical assumption and the CDM revenue could help mitigate some of the barriers to the project activity and help sustain the project activity.</td>
</tr>
<tr>
<td colspan="3">Step 3: Barrier Analysis (Either of Step 2 and Step 3 has to be carried out)</td>
</tr>
<tr>
<td>Sub-step 3a: Identify the barriers that would prevent the implementation of type of the proposed project activity</td>
<td><u>Regulatory barriers:</u>

The policy status in the state of Tamil Nadu is briefly indicated below:

September 2001- March 2002:
Purchase of electricity at Rs 2.70 /kWh (US$ 0.06 /kWh) without any annual escalation by TNEB from the existing and future wind mill projects. However, there is no change in the tariff in respect of wind mill projects which are installed accepting the rate of Rs 2.25/ kWh with 5% annual escalation for a period of five years vide B.P (FB) No. 26 dated 3.3.2001. The wheeling and banking charges were increased to 5% from 2%. The banking period has been increased from 1 month to 2 months. The state government reverted back to the previous tariff of Rs 2.70, but by that time half of the financial year was over leading to just 44.9 MW of installations.

March 2002- May 2006:
Purchase of electricity at Rs 2.70 /kWh (US$ 0.06 /kWh) without any annual escalation by TNEB. The above-mentioned purchase price is applicable to existing and future wind mill projects, vide B.P. (FB) No.99 dated 27.9.2001, along with the wind mill projects which are installed accepting the rate of Rs 2.25/kWh</td>
<td>(Source: Clauses (i) - (viii), Page 2-3, Permanent B.P. (FB) No. 99 dated 27.9.2001)

(Source: Clauses (i)- (ii), Page 1-2, Permanent B.P. (FB). No. 20 dated 1.3.2002).</td>
</tr>
</table>

[5] http://www.blonnet.com/2006/05/22/stories/2006052203701500.htm

[6] http://www.windpowerindia.com/govtinc.html

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):	and approved during March 2001 as per B.P. (FB) No.26 dated 3.3.2001. The wheeling and banking charges were kept as previous policy. The banking is allowed for a period of 1 year commencing from 1st April of every year. *May 2006 - Onwards* Purchase of electricity at Rs. 2.90/kWh[5] (US$ 0.064/kWh) without any escalation by TNEB. The above mentioned purchase price is applicable to the wind mill projects after May 2006 onwards. For the existing wind mill projects the purchase price has been increased by Rs 0.05/kWh to Rs 2.75/kWh. The wheeling charges[6] has been kept same as 5 % and the baking charge is 5 % (12 month financial year April to March) It has to be understood that the realisable cash-flow/profits from wind energy projects are a function of the legal/regulatory risks on one side, and long term project performance trends on the other. Particularly, in case of wind energy, these risks are eminent, particularly on the regulatory side, has been showed above with the inconsistency shown in the policy regime. From the above it is clear that investment made in wind turbines for generation of electricity was not the most profitable option available to the investors and the installations carried out by private sector had faced the barriers. The main alternatives for the project activity are already mentioned. The realistic and credible alternative(s) available to the project participants that provide outputs or services comparable with the proposed CDM project activity are: Captive portion: (16% of the generated electricity) • The captive generation consumer continues to draw electricity from the grid • The captive generation consumer invests in available fossil fuel based electricity generation technologies. (the available technologies are gas based IC engines coupled with generators) Sale to State Electricity Utility: (84% of the generated electricity)	The non conducive environment for investment in renewable energy would be immaterial in case the investor continued to take electricity from the grid as all the onus of sustained generation of electricity would be on the grid and its sources of energy. No reactive power charges and evacuation facilities would be required as the project will not take place. Similarly, the various other risk associated with wind energy will not act as a barrier in thermal power plant. .

<table>
<tr><td></td><td>

Continuing with the available grid connection and meeting the electrical demand through existing grid.
Investing in wind energy, but not as a CDM project activity

</td><td></td></tr>
<tr><td colspan="3">Step 4. Common practice analysis</td></tr>
<tr><td>Sub-step 4a. Analyze other activities similar to the proposed project activity:</td><td>
The state of Tamil Nadu has the following installed capacity as on 30.09.2006
<table>
<tr><td colspan="7">2. INSTALLED CAPACITY AS ON 30-09-2006</td><td colspan="3">(FIGURES IN MW)</td></tr>
<tr><td>Sector</td><td>Hydro</td><td colspan="4">Thermal</td><td>Nuclear</td><td>Wind/ RES.$</td><td>Total</td></tr>
<tr><td></td><td></td><td>Coal</td><td>Gas</td><td>Diesel</td><td>Total</td><td></td><td></td><td></td></tr>
<tr><td>STATE</td><td>2175.8</td><td>2970.0</td><td>431.0</td><td>0.0</td><td>3401.0</td><td>0.0</td><td>1069.9</td><td>6646.7</td></tr>
<tr><td>PRIVATE</td><td>0.0</td><td>250.0</td><td>503.1</td><td>411.7</td><td>1164.8</td><td>0.0</td><td>1652.0</td><td>2816.7</td></tr>
<tr><td>CENTRAL</td><td>0.0</td><td>2448.0</td><td>0.0</td><td>0.0</td><td>2448.0</td><td>432.0</td><td>0.0</td><td>2880.0</td></tr>
<tr><td>TOTAL</td><td>2175.8</td><td>5668.0</td><td>934.1</td><td>411.7</td><td>7013.8</td><td>432.0</td><td>2721.8</td><td>12343.4</td></tr>
</table>
Source: www.Infraline.com
The table above clearly depicts that wind energy for power generation is not very actively being used in state of Tamil Nadu for power generation; thermal power is still the most preferred source of power generation in the state. As can be seen from the above table, wind energy has only 22.05 % of the installed capacity as compared to 56.82 % of Thermal. Thus clearly, investing in wind energy is not a common practice in the state.
Most of the power generated by WEG's set in Tamil Nadu is used for captive utilization than for sale to the grid. The practice of sale to grid is quite uncommon in the state.
For instance, upto June 2005 out of the total installations in Tamil Nadu by Enercon, sale to EB constitutes of only 15 % where as, Captive use consists of almost 85 %.
Similarly trend is seen up to March 2005 also, out of all the installations by Suzlon, only 36 % is used for sale to EB, while, 64 % is used for captive use.
Thus trend clearly shows that captive use of electricity generated is a more common practice than sale to EB in
</td><td>It can be clearly seen that investment in wind electricity is not a common practice in the state of Tamil Nadu as compared to thermal power generation. But now intiative from the central and state government in terms of lucrative incentives and various policies has helped in generating comfort and interest of private sector investors for investment in wind power generation activities.</td></tr>
</table>

<table>
<tr><td></td><td>the state of Tamil Nadu.</td><td></td></tr>
<tr><td>Sub-step 4b. Discuss any similar options that are occurring:</td><td>The investment in wind electricity sector was not a common practice because of availability of this additional interest subsidy (for captive installations under TUF scheme) and accelerated depreciation (for sale to EB). The wind energy penetration trend of Tamilnadu is detailed below:

Table 5: Year wise installation of WEG up to 2001
<table>
<tr><th>Year</th><th>Annual Installation MW</th><th>Remarks</th></tr>
<tr><td>Till 1992</td><td>22.3</td><td>Starting of implementation of WEG</td></tr>
<tr><td>1992-1993</td><td>11.1</td><td rowspan="4">The market picked up with an assumption that the installation of WEGs can be viable without any external support</td></tr>
<tr><td>1993 - 1994</td><td>50.5</td></tr>
<tr><td>1994 – 1995</td><td>190.9</td></tr>
<tr><td>1995 – 1996</td><td>281.7</td></tr>
<tr><td>1996 – 1997</td><td>119.8</td><td rowspan="5">The installation / market penetration declined after actual performance of the installed WEGs have shown critical reductions in cash flows and financials.</td></tr>
<tr><td>1997 – 1998</td><td>31.1</td></tr>
<tr><td>1998 – 1999</td><td>17.8</td></tr>
<tr><td>1999 – 2000</td><td>45.6</td></tr>
<tr><td>2000 - 2001</td><td>41.9</td></tr>
</table>

The market again picked up because of possibility of available additional revenue through Kyoto Mechanism. Here it can be clearly seen that from 1999 till 2002, the market penetration of wind electricity generation was almost stagnant, it was ratification of Kyoto Protocol by India that added to the possibility of mitigating the associated risks with RE technologies through additional benefits.

The table 6 clearly indicates that the market is driven by availability of CDM revenue.</td><td></td></tr>
</table>

Table 6: Year wise installation of WEG up to 2006

Year	Installation MW	Remarks
2001 - 2002	44.9	Starting of implementation of WEG
2002 - 2003	132.8	The market picked up because of CDM
2003 - 2004	371.2	
2004 - 2005	675.4	
2005 - 2006	857.6	

Source: Indian Wind Power Director (Edition 5, 2005) Article 5.2 and http://www.windpowerindia.com/statstate.html

From the above, it can be inferred that the project activity is not a common practice.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The project uses ACM0002, version 07 for the purpose of calculating the Emission Reductions. The methodological choices considered in order to calculate the Emission Reductions has been explained below**.**

A. Project emissions (PE_y)

The methodology clearly states that for all renewable projects other than geothermal power plants and Hydro power plants, Project emissions (PE_y) = 0.

Therefore, (PE_y) for the project = 0

B. Baseline emissions (BE_y)

The baseline emissions which include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity is calculated with the help of the following equation:

$$BE_y = \left(EG_y - EG_{baseline}\right) \cdot EF_{grid,CM,y}$$

Where:

BEy = Baseline emissions in year *y* (tCO2/yr).

EGy = Electricity supplied by the project activity to the grid (MWh).

EGbaseline = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (since this is not the case in this project this can be considered as zero)

(MWh). For new power plants this value is taken as zero.

EFgrid,CM,y = Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

Since this project is not a case of modified or retrofit facility is not the case in this project this can be considered as zero. Therefore, as a result the equation stands to be:

$$BE_y = EG_y * EFgrid,CM,y$$

Procedure to calculate Emission Factor EFgrid,CM,y

For calculating the emission factor the Methodological tool "Tool to calculate the emission factor for an electricity system". This methodological tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "Build Margin" (BM) as well as "Combined Margin" (CM) through a step wise approach. The steps required are as follows:

STEP 1. Identify the relevant electric power system.

STEP 2. Select an operating margin (OM) method.

STEP 3. Calculate the operating margin emission factor according to the selected method.

STEP 4. Identify the cohort of power units to be included in the build margin (BM).

STEP 5. Calculate the build margin emission factor.

STEP 6. Calculate the combined margin (CM) emissions factor.

STEP 1: Identify the relevant electric power system.

Refer to section B.4

STEP 2. Select an operating margin (OM) method.

As per the tool, the calculation of Operating Margin emission factor ($EF_{grid,OM}$,y) should be based on any one of the four following methods:

(a) Dispatch Data Analysis OM

(b) Average OM
(c) Simple Adjusted OM
(d) Simple OM

Since the "Tool to calculate the emission factor for an electricity system", version 01, gives the freedom to choose any of the four options of calculating the OM, Simple OM has been chosen to be the most appropriate method of calculating the emission reductions in the project. Since the low cost/ must run resources constitute less than 50% of the total grid generation in the average of the five most recent years.(refer table below)

Table B.5: Share of Must-Run (% of Net Generation)[7]

	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%

The above table clearly shows that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) for the southern regional grid is only 22.28% which is much lesser than 50% of the total generation. Thus, Simple OM method can be used for calculating the emission factor.

STEP 3. Calculate the operating margin emission factor according to the selected method. ($EF_{grid,OM,y}$)

<u>Simple OM</u>

The calculation for Simple OM has been taken from the *CO_2 Baseline Database published by the Central Electricity Authority (CEA)*, Government of India, where the calculations have been done as per the methodology ACM0002.

As per the *tool to calculate the emission factor for an electricity system* Simple OM should be calculated using any one of the two following data vintages for years(s), *y*:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

[7] 'CO_2 Baseline Database', Version 3, 15th December 2007, Central Electricity Authority, Govt. of India.

- Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y,

Out of the above two options, the Ex-ante vintage is opted and the Simple OM selected will remain same through out the entire crediting period of the project activity.

In this project, the operating margin emission factor has been calculated (E*x-ante*) using the full generation-weighted average for the most recent 3 years i.e. 2004-05, 2005-06, 2006-07 for which data are available at the time of PDD submission. The data has been taken from the CO_2 Baseline Database published by the Central Electricity Authority (CEA).Refer Annex 5.

Emision Factor (tCO2/MWh) - Including Imports	**2004-05**	**2005-06**	**2006-07**	**Average Values**
Simple Operating Margin ($EF_{grid,OM,y}$)	1.0008	1.0078	1.0030	1.0039

STEP 4. Identify the cohort of power units to be included in the build margin (BM).

The value of the data has been taken from the data published by CEA as referred in earlier step. The CEA Baseline Database has been calculated as per the methodology ACM0002 and the details of the key assumptions considered to calculate the figure can be found in the User Guide[8] of the same.

Two following options for years(s) *y* are present, in terms of vintage of data:

Option 1.

For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2.

For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which Out of the above two, Option 1 is selected. The Build margin emission factor has been calculated *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 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 as this sample group comprises larger annual generation than the generation of the sample group *m* consisting of

[8] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf

the five power plants that have been built most recently. information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The BM is calculated using latest year data calculated by Central Electricity Authority (CEA) in their CO_2 Baseline Database (Refer Annex 5).

STEP 5. Calculate the build margin emission factor ($EF_{grid, BM,y}$)

As per the CEA CO_2 Baseline Database, the BM for the 2006-07 has been calculated to be :

$EF_{grid, BM,y}$ = 0.7054 tCO_2e/GWh

STEP 6. Calculate the combined margin (CM) emissions factor ($EF_{grid, CM, y}$)

The CM can be calculated as per the following:

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

Where:

$EF_{grid, OM,y}$ = Build Margin CO_2 emission factor in the year *y* (tCO_2/MWh)

$EF_{grid, BM,y}$ = Operating Margin CO_2 emission factor in the year *y* (tCO_2/MWh)

W_{OM} = Weighting of operating margin emission factor (%)

W_{BM} = Weighting of build margin emission factor (%)

Owing to their intermittent and non-dispatchable nature, the default weights for wind and solar projects are as follows:

w_{OM} = 75% and w_{BM} = 25%

Thus, the CM emissions factor ($EF_{grid, CM, y}$) for the project has been calculated to be:

$EF_{grid, CM, y}$ = 0.9293 tCO_2/MWh

Baseline emissions for the project are:

$BE_y = EG_y$ * EFgrid,CM,y

Where,
EG_y = 56240 MWh

EFgrid,CM,y = 0.9293 tCO_2/MWh

Therefore,

BE_y = 56240 MWh * 0.9293 tCO_2/MWh = 52265 tCO_2

C. Leakage Emissions (LE_y)

The proposed CDM project activity engages neither transferring the energy generating equipment from another activity, nor is the existing equipment transferred to another activity. The project is installation of 17 WTG units of 1.25 MW each. So the leakage emissions are not applicable and hence not considered.

$$L_y = 0$$

Where,

L_y - Leakage Emissions in the y^{th} year

D. Emission Reductions (ER_y)

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction *ERy* by the project activity during a given year y is the difference between baseline emissions (*BEy*), project emissions (*PEy*) and emissions due to leakage (*Ly*), as follows:

$$ERy = BEy - PEy - Ly$$

Since, both PEy and Ly are 0,

ER_y = BEy = 52265 tCO_2 (Calculation of estimated emission reductions have been done along with the methodology explained above)

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

>>

a) EF_y

Data / Parameter:	$EF_{grid, CM, y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data to be used:	Calculated as weighted sum of the OM and BM emission factors. The formulae for this are as per "*Tool to calculate the emission factor for an electricity system"*
Value applied	0.9293 tCO_2/MWh Details of the calculations have been shown in the section B.6.1
Justification of the choice of data or description of measurement methods and procedures actually	- Emission factor is used in the calculation of emission reductions. - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically

applied :	
Any comment:	Calculated as weighted sum of the OM and BM emission factors.

b) $EF_{OM,y}$

Data / Parameter:	$EF_{grid, OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Operating margin emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 3, 15th December 2007 (Refer Annex 5)
Value applied	1.0039 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is used in calculation of emission factor Ey - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as indicated in the simple OM baseline method

c) $EF_{BM,y}$

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Build margin emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 3, 15th December 2007 (ReferAnnex 5)
Value applied	0.7055 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is used in the calculation of emission factor Ey. - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as indicated in the simple OM baseline method

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline emissions

Baseline emissions calculated for each year of the crediting period as explained in section B.6.1 above. The equation used to reach the result is:

BE_y = 56240 MWh * 0.9293 tCO_2/MWh = 52265 tCO_2

S. No	Year	Estimation of baseline emissions ($tCO_2eq.$)
1.	2008-2009	52265
2.	2009-2010	52265
3.	2010-2011	52265
4.	2011-2012	52265
5.	2012-2013	52265
6.	2013-2014	52265
7.	2014-2015	52265
8.	2015-2016	52265
9.	2016-2017	52265
10.	2017-2018	52265
Total		**522650**

In the above table, the year 2008-2009 corresponds to the one year period starting from the date of registration in 2008. Similar interpretation shall apply for remaining years.

Project emissions

(PE_y) for the project = 0

The project emissions calculated for the proposed project activity for each year of the crediting period are mentioned below.

S. No	Year	Estimation of project emissions ($tCO_2eq.$)
1.	2008-2009	0
2.	2009-2010	0
3.	2010-2011	0
4.	2011-2012	0
5.	2012-2013	0
6.	2013-2014	0
7.	2014-2015	0
8.	2015-2016	0
9.	2016-2017	0
10.	2017-2018	0
Total		**0**

In the above table, the year 2008-2009 corresponds to the one year period starting from the date of registration in 2008. Similar interpretation shall apply for remaining years

Leakage

$L_y = 0$
The leakage emissions calculated for the proposed project activity for each year of the crediting period are mentioned below.

S. No	Year	Estimation of leakage emissions (tCO_2eq.)
1.	2008-2009	0
2.	2009-2010	0
3.	2010-2011	0
4.	2011-2012	0
5.	2012-2013	0
6.	2013-2014	0
7.	2014-2015	0
8.	2015-2016	0
9.	2016-2017	0
10.	2017-2018	0
Total		**0**

In the above table, the year 2008-2009 corresponds to the one year period starting from the date of registration in 2008. Similar interpretation shall apply for remaining years

Emission Reduction

ER_y = BEy = 52265 tCO2e

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

>>
Summary of the ex ante estimation of emission reductions are furnished below.

S. No	Year	Estimation of Project activity Emissions (tCO_2eq.)	Estimation of baseline Emissions (tCO_2eq.)	Estimation of Leakage (tCO_2eq.)	Estimation of overall emission reductions (tCO_2eq.)
1.	2008-2009	0	52265	0	52265
2.	2009-2010	0	52265	0	52265
3.	2010-2011	0	52265	0	52265
4.	2011-2012	0	52265	0	52265

5.	2012-2013	0	52265	0	52265
6.	2013-2014	0	52265	0	52265
7.	2014-2015	0	52265	0	52265
8.	2015-2016	0	52265	0	52265
9.	2016-2017	0	52265	0	52265
10.	2017-2018	0	52265	0	52265
Total ($tCO_2eq.$)		**0**	**522650**	**0**	**522650**

In the above table, the year 2008-2009 corresponds to the one year period starting from the date of registration in 2008. Similar interpretation shall apply for remaining years

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

B.7.1 Data and parameters monitored:

>>

a) EGy

Data / Parameter:	EG_y
Data unit:	MWh/KWh
Description:	Electricity supplied to the grid by the project
Source of data:	JMR Sheets/measurement records of the EPC contractor.
Measurement procedures (if any):	The electricity generated and delivered will be metered both at the project and at the receiving station.
Monitoring frequency:	The monthly meter readings (both main and check meters) at the substation shall be taken simultaneously and jointly by the parties every month.
QA/QC procedures to be applied:	Sales record to the grid and other records are used to cross check this data and hence ensure consistency. The meters would be calculated annually for accurate readings.
Any comment:	Electricity is supplied by the project activity to the grid. This is double checked by receipt of sales.

B.7.2 Description of the monitoring plan:

>>

1. Routine Maintenance Services

Routine Maintenance Labour Work involves making available suitable manpower for operation and maintenance of the Equipment and covers periodic preventive maintenance, cleaning and upkeep of the Equipment including -

a) Tower Torquing
b) Blade Cleaning
c) Nacelle Torquing and Cleaning
d) Transformer Oil Filtration
e) Control Panel & LT Panel Maintenance

f) Site and Transformer Yard Maintenance

2. **Security Services**
   This service includes watch and ward and Security of the Wind Farm and the Equipment.

3. **Management Services**
   a) Data logging in for power generation, grid availability, machine availability.
   b) Preparation and submission of monthly performance report in agreed format.
   c) Taking monthly meter reading jointly with SEB, of power generated at the Wind Farm and supplied to SEB Grid from the meter/s maintained by SEB for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

4. **Technical Services**
   a) Visual inspection of the WTG and all parts thereof.
   b) Technical Assistance including checking of various technical, safety and operational parameters of the Equipment, trouble shooting and relevant technical services.

M/s Suzlon Energy Limited maintains a dedicated team of O&M staff inclusive of Section –in –charge, Shift- in – charge, junior engineers etc. Thus, majority of the staff recruited have sound technical knowledge and prior experience in the same field. For others, the training is mainly on-the job.

The project activity essentially involves generation of electricity from wind, the employed WEGs convert wind energy into electrical energy and do not use any other input fuel for electricity generation. Thus no special ways and means are required to monitor leakage from the project activity.

The responsibility of registration of the project has been assigned to

Senergy Global Limited,
Ground Floor, Eroa Plaza, Eros Corporate Tower, Nehru Place
New Delhi - 110 019, India.

Senergy Global, has been assigned overall supervision of the project performance including the following:

- Performance review of the WEG installations.
- Arranging for annual verification of the installations for issuance of CERs

Since the project activity does not involve any leakage and only measurement of generated electricity from wind farm installations will form the basis of annual GHG reduction by the project. The project management does not require any extensive training of personnel. The respective EPC contractors do the operation and maintenance of the installations and measurement of generated electricity is done by state electricity utility. The EPC contractors are ISO certified organizations and follow designated procedures for the assigned tasks. The operation and maintenance structure for the project activity has been given in a flow chart in Annexure 4.

1. The proposed project activity requires evacuation facilities for supply to the grid and the evacuation facility is essentially maintained by the state power utility (TNEB).

2. The electricity generation measurements are required by the utility and the investors to assess electricity supplied to the grid.
3. The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
4. The primary recording of the electricity fed to the state utility grid will be carried out at the HT side of the step up transformer of the Transformer yard at each individual location.
5. The joint measurement will be carried out once in a month in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading.
6. The secondary monitoring, which will provide a backup (fail-safe measure) in case the primary monitoring is not carried out, would be done at the individual WEGs. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

Data Archiving

The data of the electricity generated by the project activity would be archived in electronic form for 2 years after the end of the last crediting period.

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

>>

Date of Completion: 26.04.2008

Senergy Global Limited,
Ground Floor, Eroa Plaza, Eros Corporate Tower, Nehru Place
New Delhi - 110 019, India.
Tel. : +91- 11- 4180 5501 / 02
Fax : +91- 11- 46505555
E.mail : mail@senergyglobal.com
URL : www.senergyglobal.com

As the project is a bundled project, thus Senergy global ltd is the project representative.

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:

>>

08.01.2003

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

>>
20 years

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

>>
Fixed crediting period

C.2.1. Renewable crediting period

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:

>>
01.12.2008

C.2.2.2. Length:

>>
10 years 0 months with no renewal.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
>> According to Indian regulation, the implementation of the wind park does not require an Environmental Impact Assessment (EIA) study. As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India and also the line ministry for environmental issues in India, Environmental Impact Assessment (EIA) studies need not to be conducted for the projects which comes under the list whose investment is less than Rs. 1000 millions[9, 10] Since the Wind parks are not included in this list and also the total cost of the project is only Rs 439.6 million, the project activity doesn't call for EIA study.

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[9] S.O. 60 (E), Environment Impact Assessment Notification, Ministry of Environment and Forests, Govt. of India dated 27th January 1994.
[10] Amendments made on 13th June 2002 vide S.O. 632 (E), Ministry of Environment and Forests, Govt. of India.

Also, in the redefined EIA notification i.e. S.O. 1533[11], dated 14th September 2006, Ministry of Environment & Forests (MoEF), Govt. of India, the wind projects are not included in the list of projects that has to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities and hence no EIA study was conducted.

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 analysis concluded that there are no reasons and areas for concern. The wind park is located in a sparsely populated area with no vulnerable flora or fauna. The wind park results only in positive environmental impacts and no negative impacts

SECTION E. Stakeholders' comments

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

>>

The project implementation involved the following stakeholders

TNEB – Tamilnadu Electricity Board – Responsible for registration of points for implementation of wind electric generators and evacuation of generated electricity.

Local villagers (owners of land) - The land used for implementation of project was not used for agriculture or any other economic activities, the real estate agencies involved in the land acquisition carried out meetings with the land owners (landowners and prominent people of villages) and apprised them about the proposed project activity.

E.2. Summary of the comments received:

>>

The villagers had no reservations towards selling of their land for implementation of wind turbines except the following:

- Job opportunities, if available with proposed activity of electricity generation, should be open to villagers / local habitants.

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

>>

Jobs were provided to the villagers and road were improved in the village due to the project activity. As expected the project activity has increased the economic activity of the neighbourhood.

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[11] Page No: 10, S. O. 1533, Ministry of Environment & Forests (MoEF), Govt. of India, http://envfor.nic.in/legis/eia/so1533.pdf

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Senergy Global Limited
Street/P.O.Box:	Nehru Place
Building:	Ground Floor, Eros Plaza, Eros Corporate Towers, Nehru Place
City:	New Delhi
State/Region:	New Delhi
Postfix/ZIP:	110019
Country:	India
Telephone:	+91-11- 41805501/02
FAX:	+91-11-46505555
E-Mail:	cns@senergyglobal.com
URL:	www.senergyglobal.com
Represented by:	Mr Chintan Shah
Title:	Mr
Salutation:	
Last Name:	Shah
Middle Name:	
First Name:	Chintan
Department:	Carbon Credits
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	cns@senergyglobal.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from any Annex I party involved in the project activity.

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

The project proponents have undertaken an operation and maintenance agreement with the supplier of the wind turbines i.e. Suzlon for a period of 20 years. The performance of the mills, safety in operation and scheduled /breakdown maintenances are organized and monitored by the contractor. So the authority and responsibility of project management lies with the contractor.

The monitoring personnel receive intensive training at the Suzlon Manufacturing facility in Daman before being appointed at the site to look after the operations.

As the operation of WEGs is emission free and no emissions are produced during the lifetime of the WEG, no specific procedures have been laid down for emergency preparedness for cases where emergencies can cause unintended emissions.

Various activities carried out by the Operations and Maintenance teams are as follows:

2 Routine Maintenance Services

Routine Maintenance Labour Work involves making available suitable manpower for operation and maintenance of the Equipment and covers periodic preventive maintenance, cleaning and upkeep of the Equipment including -

a) Tower Torquing
b) Blade Cleaning
c) Nacelle Torquing and Cleaning
d) Transformer Oil Filtration
e) Control Panel & LT Panel Maintenance
f) Site and Transformer Yard Maintenance

2 Security Services

This service includes watch and ward and Security of the Wind Farm and the Equipment.

3 Management Services

d) Data logging in for power generation, grid availability, machine availability.
e) Preparation and submission of monthly performance report in agreed format.
f) Taking monthly meter reading jointly with SEB, of power generated at ABC's Wind Farm and supplied to SEB Grid from the meter/s maintained by SEB for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

4 Technical Services

c) Visual inspection of the WTG and all parts thereof.
d) Technical Assistance including checking of various technical, safety and operational parameters of the Equipment, trouble shooting and relevant technical services.

The project activity essentially involves generation of electricity from wind, the employed WEG can only convert wind energy into electrical energy and cannot use any other input fuel for electricity generation. Thus no special ways and means are required to monitor leakage from the project activity.

- The proposed project activity requires evacuation facilities both for supply to the investors (for captive usage) and the evacuation facility is essentially maintained by the state power utility (TNEB).
- The electricity generation measurements are required by the utility and the investors to assess electricity wheeling charges.
- The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
- The primary recording of the electricity fed to the state utility grid will be carried out at the HT side of the step up transformer of the Transformer yard at each individual location.
- The joint measurement will be carried out once in a month in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading.
- The secondary monitoring, which will provide a backup (fail-safe measure) in case the primary monitoring is not carried out, would be done at the individual WEGs. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm through a wireless Radio Frequency (RF) network. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

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Annex 5

DETAILS OF INVESTORS

S. No.	Name of Investor	Turbine No.	Capacity (MW)	Usage	Date of Commissioning	Location
1	Muthoot Fincorp Ltd.	K-81	1.25	Sale to EB	11/10/2004	Melilanthikulam Sankaran Kovil taluk
2	Revathi Equipment Ltd.	K-86	1.25	Sale to EB	26/09/2004	Melilanthikulam Sankaran Kovil taluk
3	Revathi Equipment Ltd.	K-110	1.25	Sale to EB	25/03/2005	Vadakkukaval Kurichi Veerakeralamputhur taluk
4	Revathi Equipment Ltd.	K-111	1.25	Sale to EB	26/03/2005	Vadakkukaval Kurichi Veerakeralamputhur taluk
5	Revathi Equipment Ltd.	K-126	1.25	Sale to EB	18/04/2005	Vadakkukaval Kurichi Veerakeralamputhur taluk
6	Revathi Equipment Ltd.	K-62	1.25	Sale to EB	12/10/2004	Balabathiraramapuram Veerakeralamputhur taluk
7	Revathi Equipment Ltd.	K-89	1.25	Sale to EB	26/09/2004	Melilanthikulam Sankaran Kovil taluk
8	Revathi Equipment Ltd.	K-91	1.25	Sale to EB	26/09/2004	Melilanthikulam Sankaran Kovil taluk
9	Utkal Investments	K-125	1.25	Sale to EB	27/04/2005	Vadakkukaval Kurichi Veerakeralamputhur taluk
10	Thiagarajar Mills	K-63	1.25	Captive	14/10/2004	Balabathiraramapuram Veerakeralamputhur taluk
11	Kamal Engineering Corporation	K-118	1.25	Sale to EB	21/03/2005	Vadakkukaval Kurichi Veerakeralamputhur taluk
12	Subhash B Muttha	K-50	1.25	Sale to EB	22/09/2004	Balabathiraramapuram Veerakeralamputhur taluk
13	Global Calcium	S-502	1.25	Captive	30/03/2005	Sankaneri
14	Suzlon Infrastructure Limited	K-172	1.25	Sale to EB	10/11/2005	Devarkulam
15	Suzlon	K-161	1.25	Sale to EB	10/11/2005	Devarkulam

	Infrastructure Limited					
16	Suzlon Infrastructure Limited	K-164	1.25	Sale to EB	10/11/2005	Devarkulam
17	Markdata Power and Engineering Limited	K-82	1.25	Sale to EB	Sep - 2005	Devarkulam
18	Sastha Paper Mills Pvt. Ltd.	S-16	1.25	Captive	31/03/2003	Irrukandurai Radhapuram Taluk
19	Sastha Paper Mills Pvt. Ltd.	S-9	1.25	Sale to EB	May-2004	Irrukandurai Radhapuram Taluk

Annex 6

TECHNICAL DESCRIPTION OF THE PROJECT ACTIVITY

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind blowing at high speeds, has considerable amount of kinetic energy. When this kinetic energy passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity. The technology is a clean technology since there are no GHG emissions associated with the electricity generation. The project installs 3 WEGs of Suzlon make and 4 WEGs of Enercon, having individual capacities of 1.25 MW and 0.8 MW respectively.

The salient features of 1.25 MW WEGs is as follows:

1. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (Cp)
2. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
3. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
4. Intelligent Control - Next generation technologies applied by extensive operational experience maximizes yield
5. Maximum Power Factor - High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99
6. Climatic Shield - Hermetically sheltered, advanced over-voltage and lightning protection system
7. Unique Micro-Pitching Control - Unmatched fine pitching with 0.1° resolution to extract every possible unit of power
8. Grid-friendly - Grid friendly design generates harmonics-free pure sinusoidal power
9. ISO-certified vendors confirm high quality components
10. ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
11. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
12. Type certification by Germanischer Lloyd, Germany
13. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

The technical specifications of the 1.25 MW WEG are as follows:

Operating Data:

1. Rotor Diameter: 64 m
2. Hub Height: 65 m
3. Cut in Speed: 3 m/s
4. Rated Speed: 12 m/s
5. Cut out speed: 25 m/s
6. Survival Speed: 67 m/s

Rotor:

1. Blade: 3 Blade Horizontal Axis
2. Swept Area: 3217 m^2

3. Rotational Speed: 13.9 to 20.8 rpm
4. Regulation: Pitch Regulated

Generator:

1. Type: Asynchronous 4 / 6 Poles
2. Rated Output: 250 / 1250 kW
3. Rotational Speed: 1006 / 1506 rpm
4. Frequency: 50 Hz

Gear Box:

1. Type: Integrated (1 Planetary & 2 Helical)
2. Ratio: 74.971:1

Yaw System:

1. Drive: 4 electrically driven planetary gearbox
2. Bearings: Polyamide slide bearings

Braking System:

1. Aerodynamic Brake: 3 independent systems with blade pitching
2. Mechanical Brake: Hydraulic fail safe disc braking system

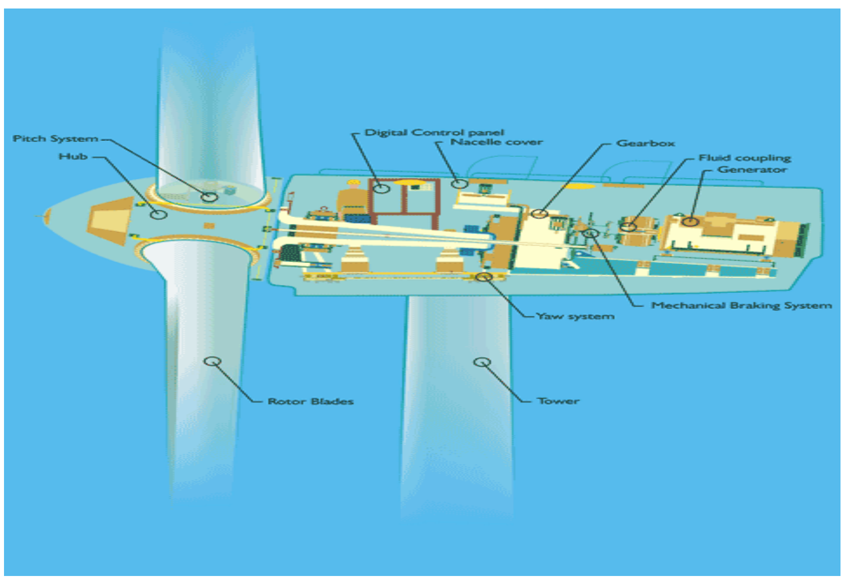

Figure 4: Technical description of technology used

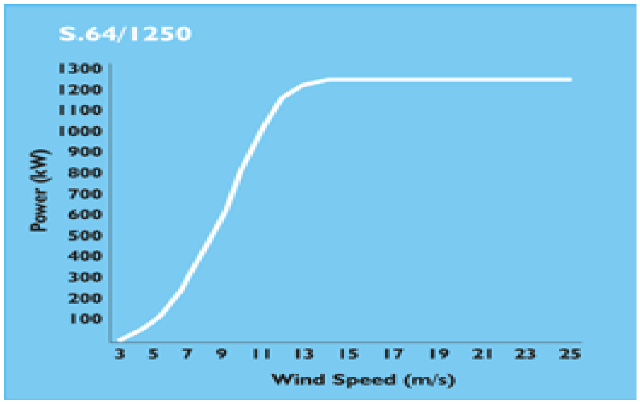

Figure 5: Power Curve