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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

42.5 MW Wind Power Project by VRL Logistics Ltd. In Karnataka State (India)

Version – 02
Date: 04/12/07

A.2 Description of the project activity:

42.5 MW Wind Power Project (hereafter referred as the 'project' or 'project activity') is a grid connected renewable energy project located at Mundargi Taluka, Gadag District of Karnataka state, India. The objective of the proposed project is to generate electricity using 1.25 MW state-of-the-art wind power generation technology (S66 WTGs- One of the latest available technologies in the country developed by M/s Suzlon Energy Limited) and to sell to Southern Region Power Grid. The proposed project will achieve CO_2 emission reductions by replacing electricity generated by fossil fuel fired power plant connected into Southern Region Power Grid.

The project activity consists of 34 Wind Turbine Generators (WTGs) installed at Mundargi Taluka. Project was implemented in six phases, based on the PPA signed date, date of commissioning & location. Location and other details of the installed WTGs are given below.

Phases	No. of Installed WTGs	Machine No.	Survey No.	Date of Commissioning	Village	Taluka, District, State
I	8	K201 to K204	442	23.9.2006	Hirevadatti	Mundargi, Gadag, Karnataka
		K205 to K207	325			
		K280	442			
II	2	K227 / K228	201	23.9.2006	Huregri	
III	4	K264 / K265	204	29.3.2007	Huregri	
		K266	201			
		K267	189	27.3.2007		
IV	12	K268 to K270	323	29.3.2007	Hirevadatti	
		K271	44	29.3.2007	Keluru	
		K273	44	29.3.2007	Keluru	
			27		Chikkavadatti	
		K272	44	27.3.2007	Keluru	
			27		Chikkavadatti	
		K274	44	29.3.2007	Keluru	
		K275 to K277	161	29.3.2007	Chikkavadatti	

Phases	No. of Installed WTGs	Machine No.	Survey No.	Date of Commissioning	Village	Taluka, District, State
		K278/K279	162	29.3.2007	Chikkavadatti	
V	3	K261	78	27.3.2007	Bagewadi	
		K262 / K263	78	29.3.2007		
VI	5	K301/ K302/ K305/K307	44	29.3.2007	Keluru	
		K306	44	27.3.2007		

The electricity generation from this project will contribute to annual GHG reductions estimated at 86,706 tCO_2e. Although the project life is envisaged as 20 years, 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 evacuate approximately 93.258 GWh of renewable power annually to the power deficit Southern Region Grid.

Purpose of the project activity:

The main 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 state electricity utility and to contribute to climate change mitigation efforts.

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

- To enhance the propagation of commercialisation of 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 project through revenues from the CDM.

Contribution of project activity to sustainable development:

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

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

[1] Designated National Authority (CDM India) web site: http://cdmindia.nic.in/host_approval_criteria.htm

1. Social well-being

The proposed project activity leads to alleviation of poverty by establishing direct and indirect employment benefits accruing out of ancillary units for manufacturing towers for erecting the WTGs and for maintenance during operation of the project activity. The infrastructure in and around the project area will also improve due to project activities. This includes development of road network and improvement of the quality of electricity in terms of its availability and frequency as the generated electricity is fed into a deficit grid.

2. Economic well-being

The project contributes to the economic sustainability around the plant site, which is promotion of decentralization of economic power, leading to diversification of the national energy supply, which is dominated by conventional fuel based generating units. 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 and 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.

3. Environmental well-being

The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely – fossil fuel) based power plants, thereby contributing to the 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. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

4. Technological well-being

The project activity leads to the promotion of 1.25 MW WTGs, demonstrating the success of wind turbine generators in the region, 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.

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

A.3 Project participants:

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

A.4 Technical description of the project activity:

A.4.1 Location of the project activity:

A.4.1.1 Host Party(ies):

India

A.4.1.2 Region/State/Province etc.:

Karnataka

A.4.1.3 City/Town/Community etc:

Taluka – Mundargi
District – Gadag
State – Karnataka

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

Unique identification		
Region	**Latitude**	**Longitude**
Mundargi Taluka	15˚ 13’ 0 N	75˚ 54’ 0 E

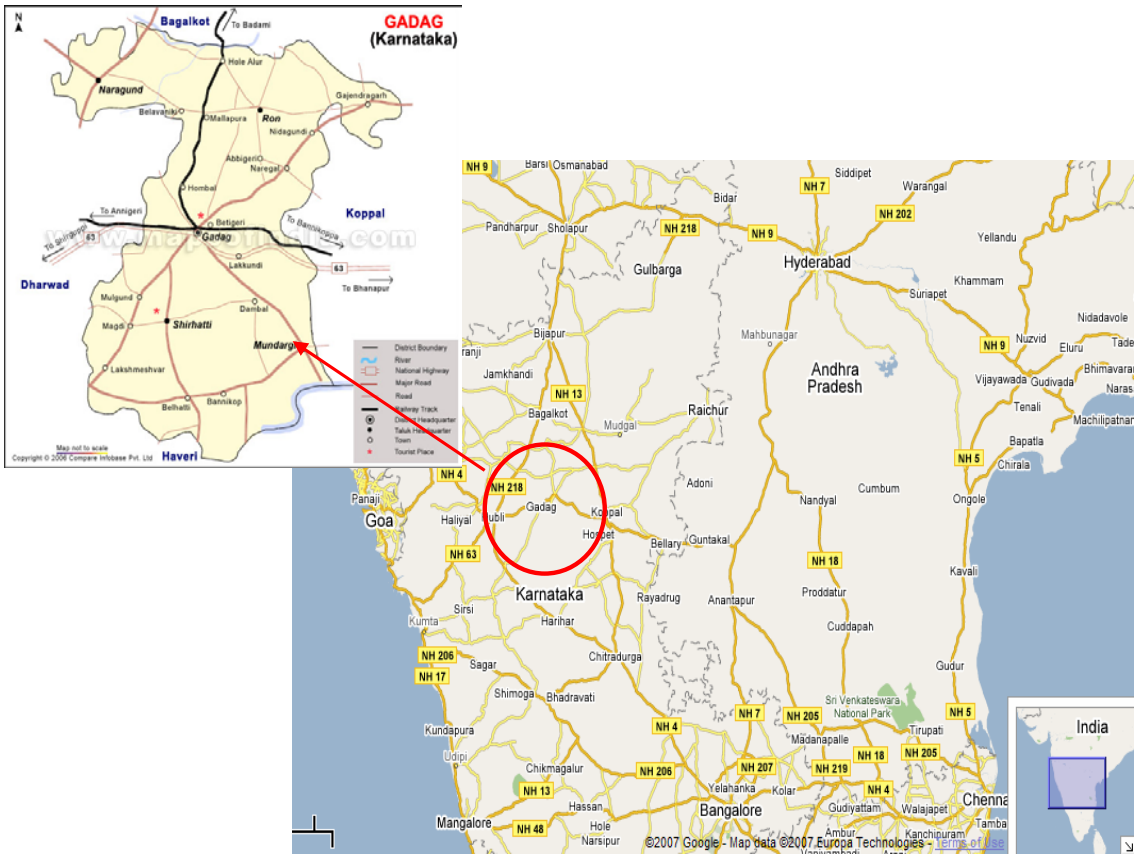

Figure 1: Project Location

A.4.2 Category(ies) of project activity:

The project activity is electricity generation from wind energy which is a renewable resource. The generated electricity is then wheeled through the grid. The project hence can be considered under "Grid-connected electricity generation from renewable sources". The project activity has a capacity more than 15 MW (limit for small scale project). Therefore as per the scope of the project activities enlisted in the list of sectoral scopes and related approved baseline and monitoring methodologies, the project activity is a large scale project and may principally be categorized in Scope Number 1, Sectoral Scope – Energy Industries (renewable/non-renewable sources).

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

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind has considerable amount of kinetic energy when blowing at high speeds. This kinetic energy when 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 envisages the utilization of a state-of-the-art wind power generation technology 1.25 MW Wind Turbine Generators (WTGs) to generate electricity – One of the latest available technologies in the country developed by M/s Suzlon Energy Limited.

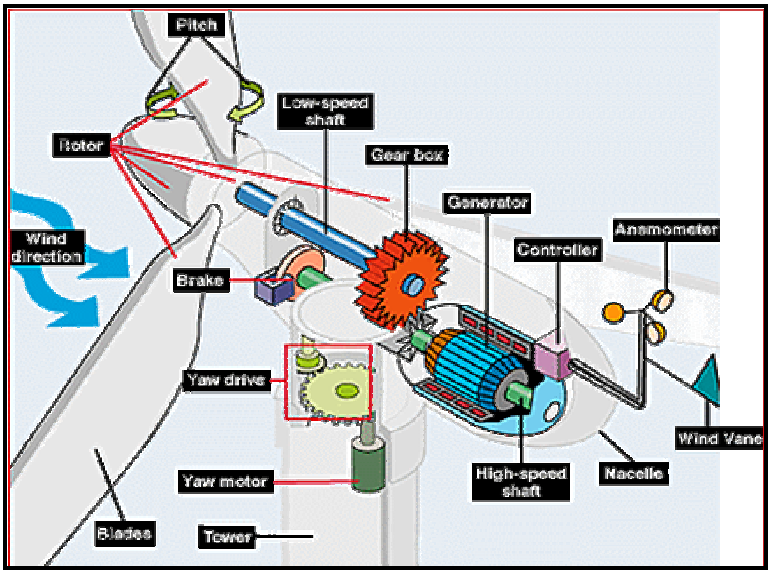

Figure 2: Major Mechanical Parts of a Wind Turbine

Salient Features of 1.25 MW (S 66) WTG

Sr. No.	Particulars	Specifications
	Rotor	
1.	Rotor diameter	66 m
2.	Hub height	56 m
3.	Installed electrical output	1250 kW
4.	Rotor swept area	3421 m^2
5.	Rotational speed	13.8/20.7
6.	Rotor material	GRP
7.	Regulation	Pitch
	Operational Data	
8.	Cut-in wind speed	3 m/s
9.	Rated wind speed	14 m/s
10.	Cut-out wind speed	22 m/s
	Generator	
11.	Type	Asynchronous Generator, 4/6 poles
12.	Rated output	250/1250 kW
13.	Rotational speed	1006/1506 rpm

Salient Features of 1.25 MW (S 66) WTG

Sr. No.	Particulars	Specifications
14.	Operating voltage	690 V
15.	Frequency	50 Hz
16.	Insulation class	H
17.	Cooling system	Air cooled
18.	Enclosure class	IP 56
	Gear Box	
19.	Type	Integrated 3-stage gearbox, 1 planetary & 2 helical.
20.	Gear box manufacturer	Winergy
21.	Gear ratio	1:74:917
22.	Nominal load	1390 kW
23.	Type of cooling	Oil cooling, forced lubrication
	Yaw Drive	
24.	Yaw drive system	4 active electrical yaw motors
25.	Yaw bearing	Polyamide slide bearing
	Operating Brakes	
26.	Aerodynamic brake	3 times independent pitch regulation
27.	Mechanical brake	Spring power disc brake, hydraulically released, fail safe. Microprocessor controlled.
	Tower	
28.	Tower	Tubular
29.	Design standards	GL/IEC

Technology transfer: This is an indigenous technology and not a technology transfer.

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

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2008-09	86706
2009-10	86706
2010-11	86706
2011-12	86706
2012-13	86706
2013-14	86706
2014-15	86706
2015-16	86706
2016-17	86706
2017-18	86706
Total estimated reductions	**867060**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (t of CO_2 eqiv.)	**86706**

A.4.5 Public funding of the project activity:

The project has not received any public funding from Annex I countries and Official Development Assistance (ODA).

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:

Title: Approved consolidated baseline and monitoring methodology ACM0002 **"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"** Version: 07
Scope no. : 1
Sectoral Scope Energy Industries: (Renewable/non-renewable)
Date: EB 36

This methodology also refers to:

Tool to calculate the emission factor for an electricity system (Version 01) EB 35**;**
Tool for the demonstration and assessment of additionality (Version 04) EB 36

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

This methodology is applicable to grid-connected renewable power generation project activities under the following conditions:

Criterion	Conditions	Applicability
Criterion 1	The methodology is applicable under the following conditions: The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	▪ Project activity involves generation of electricity from wind. ▪ Electricity generation capacity is of 42.5 MW. ▪ Project activity is located at Mundargi Taluka, Gadag District of Karnataka state, India. ▪ The project activity supplies electricity to the utility connected to the Southern Regional grid.
Criterion 2	In case of hydro power plants: ✓ 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	▪ Project activity involves generation of electricity from wind. Hence this is not applicable.

	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/m^2. ✓ 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/m^2.	
Criterion 3	The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available;	Project activity will be located in Karnataka state and as per the Indian Electricity System; Karnataka state falls in the Southern regional grid. The "Southern Grid" electricity system and boundary is well defined. All the details pertaining to the same can be assessed through the Central Electricity Authority website – http://www.cea.nic.in/
Criterion 4	Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities (ACM0001)"	There is no relevance between the project and Clause 4 of the applicability criteria.
Criterion 5	5 years of historical data (or 3 years in the case of non hydro project activities) have to be available for those project activities where modification/retrofit measures are implemented in an existing power plant.	This is not a modification / retrofit project. The project activity is completely a new venture. Hence not applicable.
Criterion 6	This methodology is not applicable to : ✓ Project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; ✓ Biomass fired power plants; ✓ Hydro power plants that result in	The project does not involve fuel switching from fossil fuel use to renewable energy at the site of the project activity. Neither is it a biomass or a hydro project. The project activity is totally new wind project and was established as an effort of project proponent to promote sustainable development.

	new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	

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

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

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

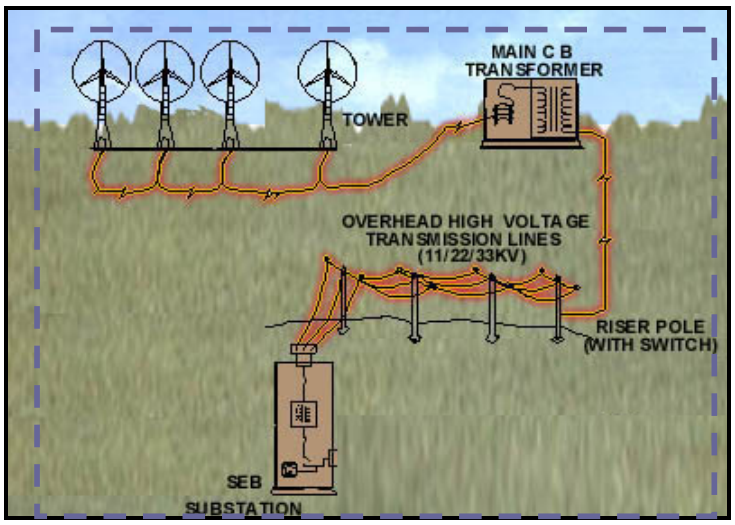

Figure 3: Project Boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the	CO_2	Yes	Main emission source

	Source	Gas	Included?	Justification/Explanation
	project activity.	CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project Activity	On site fossil fuel consumption due to the implementation of the project	CO_2	No	This source is not required to be estimated under ACM0002 for wind energy projects.
		CH_4	No	Estimates not required
		N_2O	No	Estimates not required

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

The project category is renewable electricity generation for a grid system, which is also fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind). According to ACM0002, for project activities that do not modify or retrofit an existing electricity generation facility, in the absence of the CDM project activity, the electricity that is being delivered to the grid by the CDM project would have been generated by the operation of grid-connected power plants and by the additions of new generation sources, as reflected in the combined margin calculations.

Baseline Scenario

The baseline scenario as explained above is that the electricity supplied by the CDM project activity would have been supplied by the operation of the power plants connected to the grid and by addition of new generation sources. These generation sources will be depicted in OM and BM calculations as part of the combined margin method for calculation of the baseline emission factor. The calculation of the baseline emission factor using the combined margin methodology has been detailed in Section B.6.

Grid System for the Project Activity

The Southern Region of India comprises of four states and one Union Territory (UT) namely Tamil Nadu, Kerala, Karnataka, Andhra Pradesh and Pondicherry (UT). Pondicherry has only one combined cycle gas power generating station (32.50 MW) and hence receives power from the states in the Southern Region, through allocations and also imports power from Western and Eastern Regions[2].

The installed capacity of Southern Region at the end of financial year 2006- 07 was 36823.32 MW (source: CEA). The total installed capacity comprises Hydro - 11011.71 MW (29.91 %), Thermal + Gas + Diesel - 20698.12 MW (56.20 %), Nuclear - 880 MW (2.39 %) and Wind + R.E.S - 4233.49 MW (11.50 %). The Hydro Thermal ratio was 35:65 as on 31.03.2007[3].

[2] Source: Southern Regional Power committee Annual Report / 2006-2007

[3] Source: Southern Regional Power committee Annual Report 2006-2007

As per the generation statistics of power stations in the Southern Region during the year 2006-07 (as on 31.03.2007), the quantum of hydro, thermal + gas + diesel, nuclear, state wind power & IPPs generation in the region during 2006-07 was 38,254.52 MUs (20.32 %), 1,20,423.03 MUs (63.95 %), 5,161.53 MUs (2.74 %), 35.45 MUs (0.02%) & 24,424.22 MUs (12.97%) respectively[4].

Type	Generation, MUs		% increase in generation
	2005-2006	2006-2007	
Hydro	32970.78	38254.52	16.03
Thermal + Gas + Diesel	108660.66	120423.03	10.82
Nuclear	4711.56	5161.53	9.55
Wind Power	34.68	35.45	2.22
IPPs	20675.86	24424.22	18.13
Total	167053.54	188298.75	12.72
Source: Southern Regional Power committee Annual Report / 2006-2007			

The power sector in India including the southern region is driven by thermal power stations (as shown by the figures above). As clear from the table above, during 2006-2007 there was an increase of only 2.22 % in generation by wind projects from the previous year. A list of future capacity additions based on the energy demand has been planned by Central Electricity Authority (CEA) and these plans are revised from time to time based on demand projections. Detailed projections are available for the eleventh plan period, i.e. 2007 till 2011. To bridge power shortages in the Southern region in the business as usual scenario, nearly 14,518.2 MW of fresh capacity addition would be required at the end of 11th year plan, more than 15% of which is likely to be fossil fuel based[5].

The proposed project activity can evacuate approximately 93.258 Million Units of clean electricity per year using wind turbines. Taking into account energy shortages and current trend of investment in fossil fuel based energy generation in the region, in absence of the project activity, an equivalent amount of electricity would have been generated using fossil fuel based power plants. Thus the generation from the project activity displaces the energy generated using fossil fuel fired power plant and leads to an emission reduction of 86,706.5 tCO_2e annually over the ten-year crediting period.

Following information is used for baseline determination:

Sr. No.	Key information/data used for baseline determination	Source of data/information
1	Grid emission factor (Southern Region)	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 2, Date: June, 2006) http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

[4] Southern Regional Power committee Annual Report 2006-2007

[5] http://www.cea.nic.in/(Power Scenario at a glance for the month of June 2007, Page no. 43)

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)

A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered project activity. According to the selected methodology ACM0002, the project developer is required to establish that the GHG emission reductions due to the project activity are additional to those that would have occurred in the absence of the current project activity as per the "tool for the demonstration and assessment of additionality" (Version 04, EB 36).

Step 1: **Identification of alternatives to the project activity consistent with current laws and regulations** *Realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario can be defined through the following sub-steps:*		
Sub-step 1a. *Define alternatives to the project activity*	The following alternatives were available to the project proponents: **Alternative 1:** The proposed project activity not undertaken as a CDM project activity. In the said alternative, project participant would have gone ahead with the implementation of project activity, generating renewable electricity and exporting the same to the state electricity grid under a power purchase agreement thereby displacing equivalent units of power generated by fossil fuel based plants in the grid but without considering CDM benefits. However there exist barriers to the implementation of the proposed project activity without CDM as explained in step 2 and step 3 below. **Alternative 2:** Continuation of current situation i.e. no project activity and equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity addition to the grid (thermal) i.e. Continuation of current situation.	The project activity has crossed step 1 (1a and 1b) of additionality demonstration, and can move to either step 2 or step 3 or both.
Sub-step 1 (b): *Consistency with mandatory laws and regulations*	1. Electricity generation from wind farm is not legal and regulatory requirements or a mandatory choice. 2. There are, State and Sectoral policies, primarily framed to encourage wind based power projects to attract more private investment as there are many anticipated risks under the project and requires good amount of equity. 3. The Indian Electricity Act of 2003 does not restrict or empower any authority to restrict the fuel choice for power generation. In addition, it may be noted that the draft National Electricity Policy (revised in August 2004) asserts 'coal would	

	necessarily continue to remain the major fuel'. 4. Similarly, at the time of investment there was no legal restriction according to Indian Electricity Act of 1948 on fuel choice for power generation. 5. The applicable Environmental Regulations do not restrict the use of wind energy for power generation. 6. There is no legal requirement on the choice of a particular technology for power generation. 7. Thus, it is clear that none of the alternatives that the project proponent had are restricted by the Environment Regulations, nor do they oppose any legal requirement enforced. Thus the project activity is not the only baseline scenario permitted by the regulations.	
Step 2: **Investment analysis** *To 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, following sub-step were used*		
Step 2a: *Appropriate Analysis Method*	As the electricity generated from project activity will be sold to Hubli Electricity Supply Company (HESCOM), it will generate financial benefits in terms of revenues from the sale of electricity units. Thus simple cost analysis (option I) cannot be applied to the proposed CDM project activity. Amongst the other two options – investment comparison analysis (option II) and benchmark analysis (option III), the benchmark analysis has been adopted wherein the Internal Rate of Return (IRR) of the project activity serves as a benchmark to assess the financial attractiveness of the project activity. Option III assesses if the project's returns are sufficient for investors to make the initial investment and further bear the associated costs of successfully operating the project activity over the crediting period of the project.	
Sub-step 2b Option III. *Benchmark Analysis*	An investment analysis of the project activity was conducted with the post tax project internal rate of return (Project IRR) as the financial indicator. 'Internal Rate of Return' is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. Project proponent took decision in year 2006 regarding project activity. The minimum lending rates of the commercial banks were in the range of 11 to 11.50 % during 2006-07. (Ref: Reserve	

[6] 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></td>
<td>Bank of India – Handbook of Statistics on Indian Economy, Table 74). Hence, the rate of interest at 11.50% is considered in financial analysis, which is on conservative side.

Karnataka Electricity Regulatory Commission (KERC) has decided a 16 % post tax return on equity as the benchmark return on equity for projects in private sector (Source: KERC order, dated 18th January 2005).

Also, The Central Electricity Regulatory Commission (CERC) has fixed the tariff for the power sold to electricity board by IPPs on the basis of 16% post-tax Return on Equity[6]. Hence, 16% post tax return on equity (or equity IRR) is used as a benchmark for projects in public or private sector.

We have considered the same rate (16%) as the rate required by the equity investors. The debt component was estimated at 70%. Thus, with cost of financing as 11.50% and required rate for investors as 16%, the project was expected to generate IRR at minimum of 11.11% (post tax) so as to satisfy lender as well as investor.

Hence, 11.11% post tax return (project IRR) is used as a benchmark for comparison with the equity IRR of the proposed project activity.</td>
<td></td>
</tr>
<tr>
<td>Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):</td>
<td>All the reasonable costs and benefits accruing to the project have been considered in the calculation of the project return. The projected costs are based on the actual data and the reasonable estimations by experts.

<table>
<tr><td>Capacity</td><td>MW</td><td>42.5</td></tr>
<tr><td>Tariff rate per unit</td><td>Rs. / unit</td><td>3.4</td></tr>
<tr><td>O & M exp. (free for 1st yr)</td><td>Rs. Mn / Yr.</td><td>1.025</td></tr>
<tr><td>Increase in O&M exp per year</td><td>% per year</td><td>5</td></tr>
<tr><td>Debt Component</td><td>%</td><td>70</td></tr>
<tr><td>Depreciation on WTG and other equipments (As per Section 80IA of Income Tax Act 1961)</td><td>% per year</td><td>80</td></tr>
<tr><td colspan="3">As per Section 80IA of Income Tax Act 1961, 100% exemption in profits for 10 years in first 15 years of operation is considered</td></tr>
<tr><td>Project life</td><td>Yrs.</td><td>20</td></tr>
</table>

The annual average CDM benefits considered for calculation are Rs. 370.66 lacs (86706 x 7.5 Euros per CER x Rs. 57 per Euro).

With CDM benefits the Project IRR moves up to 11.64%</td>
<td>The results of the investment analysis conducted confirm that the post-tax project IRR for the project activity without CDM revenues is lower than that which would make the project economically attractive for the investors/lenders.</td>
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</table>

<table>
<tr><td></td><td>whereas without CDM benefits it is only 10.11%.</td><td></td></tr>
<tr><td>Sub-step 2d. Sensitivity analysis (only applicable to options II and III)</td><td>A sensitivity analysis was carried out for the project IRR for an increase or decrease in electricity generation from the project and the following were the results of the analysis:

<table>
<tr><td>Salable units up (+) /down (-) by</td><td>- 4.0%</td><td>- 2.0%</td><td>Normal</td><td>2.0%</td><td>4.0%</td></tr>
<tr><td>Project IRR without CDM</td><td>4.85%</td><td>7.52%</td><td>10.11%</td><td>12.59%</td><td>15.02 %</td></tr>
<tr><td>Project IRR with CDM</td><td>6.74 %</td><td>7.54 %</td><td>11.64 %</td><td>14.01 %</td><td>16.33 %</td></tr>
</table>

Downward variations in the units sold to HESCOM for whatever reasons, is the most significant risk factor for the project.</td><td>The sensitivity analysis shows that the project is financially unattractive without CDM revenue and the CDM revenue could help mitigate some of the barriers to the project activity and help to sustain</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>As per Ministry of New and Renewable Energy (Annual Report 2006-2007) against the total potential of 45000 MW in India, the cumulative achievement till 31.12.2006 was only 6270.40 MW (MNRE Annual report 2006-2007) which is only 13.93 % of the total potential. But at the time of project conceptualization the total installed capacity of wind projects in India was only 4434.5 (as on 31/12/2005) which is only 9.85 % the total potential. (MNRE Annual Report 2005-2006). If we look at very recent statistics i.e. as on 30-9-2007 total installed capacity of wind power in India is 7660.2 MW (http://mnes.nic.in/ - About Us-Major Achievements), which is again meagre i.e. only 17% of the total potential.

India’s total installed capacity in year 2006-2007 was around 128,182 MW (As per Annual report 06-07, Ministry of Power). Thus, the wind power sector contributes to only 0.05 % of the total installed capacity in India.

As on 30-9-2007 total installed capacity of wind projects in the state of Karnataka was 910.635 MW as against the total potential of 7500 MW in the state. This is only 12 % of the total potential available in the state. Total Installed capacity of Southern region in year 2006-2007 (as on 31-01-07) was about 36809.32 MW (As per Annual report 06-07, Ministry of Power). Wind power projects contribution in it is only 2.5 %. Still thermal power forms the major portion of power generated in India.</td><td></td></tr>
</table>

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Sub-step 4b. Discuss any similar options that are occurring</td><td>By the End of March 2008, there will be 6 private wind farm project promoters with a total wind farm capacity of 20 MW or above in the state of Karnataka and exporting power to the grid as per the table given below:

All these project activities with an installed WTG are each of 600 KW or above have sought for CDM revenue.

<table>
<tr><th>Sr. No.</th><th>Name of the Project Developer</th><th>Total No. of WTGs</th><th>Capacity of Individual WTGs (kW)</th><th>Total Capacity (MW)</th><th>Has the Proponent Sought CDM Revenue/Reference</th></tr>
<tr><td>1</td><td>ENERCON Wind farms</td><td>86 and 35</td><td>800 & 600</td><td>68.8 & 21</td><td>Yes; http://cdm.unfccc.int/Projects/Validation/DB/4GSTDDCKD0IL1JLUKRI2ZNE1V7P55B/view.html and http://cdm.unfccc.int/Projects/Validation/DB/OXVWZAF5DIIKOJYLAKJC48EY8HWMFY/view.html</td></tr>
<tr><td>2</td><td>Nuziveedu Seeds Ltd.</td><td>16, 7 and 6</td><td>750, 950 and 1500</td><td>27.65</td><td>Yes; http://cdm.unfccc.int/UserManagement/FileStorage/7MKGRE0K2J0D6O1WKHV6XTW67UCAD6</td></tr>
<tr><td>3</td><td>MSPL Ltd.</td><td>7,17 and 46</td><td>750, 950 and 1250</td><td>78.9</td><td>Yes http://cdm.unfccc.int/Projects/Validation/DB/LDKZF875N9QAV14X33YCQV0NNGS0D0/view.html</td></tr>
<tr><td>4</td><td>Ramgad Minirals & Mining Pvt. Ltd.</td><td>31</td><td>1250</td><td>38.75</td><td>Yes http://cdm.unfccc.int/Projects/Validation/DB/LDKZF875N9QAV14X33YCQV0NNGS0D0/view.html</td></tr>
</table></td><td>Hence we can say that it is not a common practice in the region to install large scale wind farms in the region without consideration of CDM.</td></tr>
</table>

5	Hindustan Zinc Ltd.	43	800	34.4	Yes; http://cdm.unfccc.int/UserManagement/FileStorage/L5R9Y5U0YMIJ16D3YWJUK97I0XIMXJ
6	Accion Wind Energy Pvt. Ltd.	18	1650	29.70	Yes ; http://cdm.unfccc.int/Projects/Validation/DB/BUJTT9GN5BL5Q7ZPXBGW7DYMXTM2IV/view.html
7	VRL Logistics Ltd.	34	1250	42.5	Project Activity

From the above table, it is clear that there exists only 6 comparable wind farm projects in Karnataka and all have gone ahead only after considering benefits from CDM.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission Reductions

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 ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$\mathbf{ER_y = BE_y - PE_y - L_y}$$ ……..……Equation 11 (ACM0002, V 07)

Where:

ER_y = Emission reductions in year y (t CO_2e/yr).
BE_y = Baseline emissions in year y (t CO_2e/yr).
PE_y = Project emissions in year y (t CO_2/yr).
LE_y = Leakage emissions in year y (t CO_2/yr).

Baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$BE_y = (EG_y - EG_{Baseline}) . EF_{grid, CM, y}$ ……Equation 7 (ACM0002, V 07)

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).
EG_y = Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.
$EF_{grid, CM, y}$ = Combined margin CO_2 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".

The methodology assumes that all project electricity generation above baseline levels ($EG_{baseline}$) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in EF_y.

Calculation of $EG_{Baseline}$:

As the project activity involves installation of a new grid connected renewable (Wind) power plant

$EG_{Baseline} = 0$ ……Equation 8 (ACM0002, V 07)

Hence for a new wind project the baseline emissions (BE_y in tCO_2) are the product of the Combined margin CO_2 emission factor ($EF_{grid, CM, y}$ in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh or kWh).

$BE_y = EG_y . EF_{grid, CM, y}$

✓ **Calculation of CO_2 emission factor ($EF_{grid, CM, y}$) for the grid electricity:**

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 below:

CO_2 Emission factor for the grid electricity is calculated as Combined Margin (CM) which is the combination of Operation Margin (OM) and Build Margin (BM) factors according to the following six steps as per 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)':

Step 1: Identification of the relevant electric power system:

Central Electricity Authority (CEA), Ministry of Power, Government of India (Host Country) has given the delineations of the project electricity system and the connected electricity system in India, (as shown in table below). As per CEA the Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The

Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan).

Geographical Scope of five regional grids:

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
Utter Pradesh				
Uttaranchal				

For the purpose of calculating the emission reductions achieved by any CDM project, the 'Tool to calculate the emission factor for an electricity system' requires that the "project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints". This implies that the grid emission factors could be most appropriately calculated at the level of the five regional grids. As per the delineation given by CEA, Karnataka State falls into the Western Regional Grid.

Step 2: Selection of an Operating Margin (OM) method:

For calculation of operating margin four options are available:

(a) Simple operating margin;
(b) Simple adjusted operating margin;
(c) Dispatch data analysis operating margin;
(d) Average operating margin

CO_2 Baseline Database Version 2, Date-June 2007, published by Central Electricity Authority (hereafter CEA Database) has been referred for the values of OM. Simple OM has been used as the low-cost/must run resources constitute less than 50% (only 21.7 %-Average of five years, as shown in table below) of the total grid generation of Southern Grid in average of the five most recent years.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)					
	2001-02	**2002-03**	**2003-04**	**2004-05**	**2005-06**
North	25.7%	26.1%	28.1%	26.8%	28.1%
East	13.4%	7.5%	10.3%	10.5%	7.2%
South	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	41.7%	45.8%	41.9%	55.5%	52.7%
India	18.9%	16.3%	17.1%	18.0%	20.1%
Average of five years for SR					**21.7 %**

Table reference- CEA Baseline Database, Version 2

Step 3: Calculation of operating margin emission factor ($EF_{grid,OM, y}$) for the region based on simple OM:

OM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 2, June 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Government of India.

Simple Operating Margin Emission Factor (Southern Region) in tCO_2/GWh	
Year	**Simple OM**
2003-2004	1000
2004-2005	1000
2004-2005	1010
Average of 3 years	**1003**

Table reference- CEA Baseline Database, Version 2

Note: As per the 'Tool to calculate the emission factor for an electricity system', the calculation of OM has been done *ex ante* based on the most recent 3 years for which data is available at the time of PDD submission.

Step 4: Identification of the cohort of power units to be included in Build Margin (BM):

BM calculation is based on 20% most recent capacity additions in the grid based on net generation. 20% of the most recent capacity additions have been shown in Annex 3. Power plant registered as CDM project activities have been excluded from the sample group m. Capacity additions from retrofits of power plants have not been included in the calculation of the build margin emission factor.

20% of Net Generation (GWh)					
	2001-02	**2002-03**	**2003-04**	**2004-05**	**2005-06**
North	28,283	28,949	31,009	31,458	33,641
East	11,619	11,968	13,686	15,594	17,203
South	24,726	25,558	25,675	26,935	27,666
West	30,625	32,890	31,956	34,145	35,201
North-East	1,043	1,134	1,150	1,552	1,531
India	96,296	100,498	103,475	109,685	115,241

Net Generation in Build Margin (GWh)					
	2001-02	2002-03	2003-04	2004-05	2005-06
North					34,340
East					17,567
South					28,158
West					35,425
North-East					1,793
India					117,283

Table reference- CEA Baseline Database, Version 2

Vintage of data is based on option 1 of step 4. (Refer 'Tool to calculate the emission factor for an electricity system'). BM calculation has been done *ex-ante* and hence BM value will remain fixed and need not be monitored during the crediting period.

Step 5: Calculation of build margin ($EF_{grid,BM,y}$) emission factor for the region (ex ante):

BM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 2, June 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Government of India.

Build Margin Emission Factor (Southern Region) in tCO_2/GWh	
Year	$EF_{grid,BM,y}$
2004-2005	710

Table reference- CEA Baseline Database, Version 2

Step 6: Calculation of combined margin (CM) emissions factor - Emission factor for the grid electricity ($EF_{grid,CM,y}$):

The CO_2 emission factor for grid is calculated as the weighted average of the operating margin emission factor ($EF_{OM,\ simple,\ y}$) and the build margin emission factor ($EF_{BM,\ y}$), where the weights W_{OM} and W_{BM} for wind projects, by default, are $W_{OM} = 0.75$ & $w_{BM} = 0.25$.

Southern Region:

$$EF_{grid,CM,y} = 0.75\ EF_{OM,\ simple,\ y} + 0.25\ EF_{BM,}$$
$$= 0.75*1003 + 0.25*\ 710$$
$$= 752.25 + 177.5$$
$$= 929.75\ tCO_2/GWh$$

Project activity emissions

According to the chosen baseline methodology ACM0002, for wind energy based renewable energy project activities, $PE_y = 0$.

Leakage

According to ACM0002, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power

plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using ACM0002 shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. Thus the leakage emissions are nil.

As PEy and L_y are zero for the project activity, emission reduction caused by the project activity is equivalent to baseline emissions.

$$\mathbf{ER_y = BE_y}$$

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

(Copy this table for each data and parameter)

Data / Parameter:	**EF_y**
Data unit:	tCO_2/ GWh
Description:	CO_2 Combined Margin emission factor for the Southern Region Grid 2004-2005
Source of data used:	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 2, Date June, 2006) http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	929.75 tons of CO_2 / GWh Estimated as: $\mathbf{EF_y = 0.75\ EF_{OM,y} + 0.25\ EF_{BM,}}$ = 0.75*1003+0.25* 710) = 752.25 +177.5 = 929.75 tCO_2/GWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated as per 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)' based on 75% of OM and 25% of BM values approach.
Any comment:	Computed once during PDD finalization (*ex-ante*)

Data / Parameter:	**$EF_{OM, y}$**
Data unit:	tCO_2/ GWh
Description:	CO_2 Operating Margin emission factor for the Southern Region Grid 2004-2005 (Three years average has been taken)
Source of data used:	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 2, Date June, 2006) http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	**Simple Operating Margin emission factor (Southern Region) in tCO_2/GWh**

Year	**Simple OM**
2003-2004	1000
2004-2005	1000
2004-2005	1010

	Average of 3 years 1003
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Central Electricity Authority of India prepares the data. This database is an official publication of Government of India for the purpose of CDM baselines. It is based on most recent data available to the Central Electricity Authority , Ministry of Power, Govt. of India
Any comment:	**$EF_{OM, y}$** is determined as per 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)' taking average of 3 years vintage data and option of ex ante calculation based on Simple Operating Margin Method. Computed once during PDD finalization (*exante*)

Data / Parameter:	**$EF_{BM, y}$**
Data unit:	tCO_2/ GWh
Description:	CO_2 Build Margin emission factor for the Southern Region Grid 2004-2005
Source of data used:	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 2, Date June, 2006) http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	710 tons of CO_2 / GWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Central Electricity Authority of India prepares the data. This database is an official publication of Government of India for the purpose of CDM baselines. It is based on most recent data available to the Central Electricity Authority, Ministry of Power, Govt. of India.
Any comment:	Calculated as per 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)' with 3 years vintage data and option of ex ante calculation based on "20% of total generation approach". Computed once during PDD finalization. (*ex-ante*)

B.6.3 Ex-ante calculation of emission reductions:

Emission Reduction Calculation (ER_y):

For the project activity:

$ER_y = BE_y$ ……Refer Section B.6.1

- **Baseline emissions (BE_y) are given as:**

$BE_y = EG_y . EF_{grid, CM, y}$ ……Refer Section B.6.1

➢ **CO_2 emission factor for grid ($EF_{grid, CM, y}$):**

For calculation of CO_2 emission factor, please refer Section B.6.1

CO_2 emission factor for Southern Grid ($EF_{grid, CM, y}$): 929.75 tCO_2 /GWh

➢ **Net quality of electricity supplied to the grid by the project (EG_y):**

Installed capacity of each WTG = 1.25 MW
Total no. of WTGs = 34
Total installed capacity = 42.5 MW
Net export (EG_y) = 93258000 kWh or 93.258 GWh (Refer following table)

➢ **Baseline emissions caused by the project activity (BE_y) in tCO_2 =**

Baseline emissions (BE_y) = CO_2 emission factor (EF_y) x Power generated (EG_y)
(tCO_2) (tCO_2/GWh) (GWh)

BE_y = 929.75 (tCO_2/GWh) x 93.258 (GWh/year)
= 86706.5 tCO_2 / Year ……Refer excel sheet

Parameters	Units	Per WTG	Total Units
Capacity of Wind Power Project			
No. of WTGs	No.	--	34
Total	MW	1.25	42.5
Generation and sale of energy			
Possible annual generation from the project @ 100 % PLF	Mn. Units (Million kWh)	10.95	372.3
Plant load factor (PLF)	Percent	26.50	26.50
Transformation loss & auxilliery consumption	Percent	0.50	0.50
Anticipated average WTG non-availability	Percent	5	5
Net salable units (EG_y)	Mn. Units (Million kWh) or GWh	2.743	93.258
Basline emission factor	tCO_2/GWh		929.75
Total emission reduction caused by the project activity (ER_y)	tCO_2 per year		86706.5

- **Emission Reduction:**

ER_y = BEy (As project activity emission and leakage for the project activity are zero)

ER_y = BE_y = 86,706.5 tons of CO_2/year

≈ 86,706 tons of CO_2/year

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

Year	Estimation of Project Activity	Total Baseline Emissions	Estimation of Leakage	Estimation of Emission Reduction

	Emission Reduction (tonnes CO_2e /yr.)	(tonnes CO_2e /yr.)	(tonnes CO_2e / yr.)	(tonnes CO_2e /yr.)
2008-09	0	86706	0	86706
2009-10	0	86706	0	86706
2010-11	0	86706	0	86706
2011-12	0	86706	0	86706
2012-13	0	86706	0	86706
2013-14	0	86706	0	86706
2014-15	0	86706	0	86706
2015-16	0	86706	0	86706
2016-17	0	86706	0	86706
2017-18	0	86706	0	86706
Total	**0**	**867060**	**0**	**867060**

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	Energy, (EG_y)
Data unit:	kWh or GWh
Description:	Net electricity supplied to the Southern regional electricity grid.
Source of data to be used:	Invoice of electricity sell to the regional electricity utility company. For the purpose of emission reduction estimation in the PDD, EG_y has been computed based on certain assumptions as explained in section B.6.3 of the PDD (as the actual electricity generation figures for one complete year is not yet available)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	93258000 kWh or 93.258 GWh
Description of measurement methods and procedures to be applied:	The data can be very accurately measured. The meters (tri vector meter) installed measure mentioned variable on a continuous basis. Every month these meter readings will be recorded by plant personnel, these records will be archived for crosschecking yearly figures.
QA/QC procedures to be applied:	The data can be very accurately measured. The meters installed on sub stations (grid interconnection point) will be used to measure mentioned variables on a continuous basis. Every month these meter readings will be recorded by plant personnel, these records will be archived for crosschecking yearly figures. The meters at the sub station will be two-way meters and will be in custody of State Electricity Utility. Utility officials will take the readings (joint meter reading) on these meters and the same reading will be used to determine the net power wheeled and determine the extent of mitigation of GHG over a period of time
Any comment:	Data will be archived for two years after the end of crediting period.

B.7.2 Description of the monitoring plan:

The monitoring plan is being devised as per approved consolidated monitoring methodology ACM0002 (Version 06) - **"Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources".**

The methodology requires monitoring of the following parameters:

- Electricity generation from the proposed project activity;

- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)';

- Data needed to recalculate the build margin emission factor, if needed, consistent with 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)';

For the project activity to establish its creditable emission reduction, it has to record the actual electricity generation, which would displace equivalent units of electricity at the operating and build margin of the grid. Since the simple OM emission factor is calculated based on a 3 year average, based on the most recent statistics available at the time of PDD preparation, its updation based on ex post monitoring is not required. For BM calculation, option 1 ('Tool to calculate the emission factor for an electricity system (Version 01, EB 35)') has been chosen, which is calculated ex ante based on the most recent information, hence its monitoring is also not required. Hence, under the monitoring protocol for the project it is required to: Monitor and record the electricity generated and exported by the wind farm to the regional grid.

The project activity essentially involves generation of electricity from wind, the employed WTG 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 for sale to grid and the evacuation facility is essentially maintained by the state power utility.
- The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue.
- 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 jointly at the incoming feeder of the state power utility. Machines for sale to utility will be connected to the feeder.
- 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 WTGs. Each WTG 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 (SCADA). 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.

The project proponents have signed an "Operation and Maintenance" agreement with the supplier of the wind turbines for the operation of the wind turbines. The O & M management structure is as follows:

The responsibilities of CDM project team is presented below-

Designation	Responsibilities
Project Head	▪ Overall performance monitoring ▪ Project execution
Project Executer and Controller	▪ Operation ▪ Verification of data ▪ Site visit to check authenticity of data and take corrective action, wherever necessary ▪ Storage of data
Site Main Controller	▪ Operation, monitoring and verification of data ▪ Data recording ▪ Storage of data
Operation and Maintenance Contractor	▪ Operation and maintenance ▪ Data recording ▪ Storage of data

- **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

Security Services: This service includes watch and ward and security of the wind turbines and the equipment.

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 utility of power generated at promoter's wind turbines and supplied to grid from the meter/s maintained by utility for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

Technical Services:

a) Visual inspection of the WTGs 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.

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)

Completion Date: 4/12/2007.

Name of person/entity determining the baseline: M/s VRL Logistics Ltd. and their consultant. Consultant is not a project participant.

Organization:	VRL Logistics Limited
Street/P.O.Box:	Circuit House Road
Building:	Giriraj Annex
City:	Hubli
State/Region:	Karnataka
Postfix/ZIP:	580 029
Country:	India
Telephone:	0836 2237511
FAX:	0836 2256612
E-Mail:	headoffice@vrllogistics.com
URL:	http://www.vrlgroup.in/
Represented by:	
Title:	Vice-President (Finance)
Salutation:	Mr.
Last Name:	Ayyer
Middle Name:	Sheshagiri
First Name:	Gopalkrishna
Department:	Finance
Mobile:	93412 73611
Direct FAX:	0836 2256612
Direct tel:	--
Personal E-Mail:	ayyergs@vrllogistics.com

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:

27/05/2006 (Date of the board meeting when a resolution to consider CDM benefit for the project activity was passed)

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

20 years (As guaranteed by technology provider)

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

C.2.1. Renewable crediting period

Not opted for

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

Opted for.

C.2.2.1. Starting date:

The starting date of the crediting period shall be 01/03/2008 or a date not earlier than the date of registration.

C.2.2.2. Length:

10 years

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 farm does not require an environmental impact assessment. The Ministry of Environment and Forests (MoEF), Government of India notification dated September 14, 2006 regarding the requirement of Environment Impact Assessment (EIA) studies as per the Environment Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) Ministry of Environment and Forests) states that any project developer in India needs to file an application to MoEF (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Wind farms are not included in this list and thus an EIA is not required.

The project activity has no significant impact on the environment. However, certain foreseen impacts due to the project activity are discussed below:

During Construction Phase:

Impact on air

Movement of construction material during construction will have some impact on the air. As the transportation is quite less for the project activity, the impacts will be negligible.

Impact on water
Not much water discharge takes place during construction. However proper sanitary arrangements were provided by project proponents.

Impact on land use
The land on which the project activity took place is largely unproductive. Prior to the project activity, most of the land had no beneficial use. The project proponents had bought the land for a worthwhile application and obtained necessary approvals for installation of wind turbines. No dislocation of people is involved in the course of the project activity.

Impact due to noise
Personal protective equipments were provided to workers involved in the construction activity to mitigate the effects of noise pollution, but they have no impact on ambient noise level.

Taking into consideration the project life cycle, the magnitude of the impacts during the construction phase is negligible and exists for a temporary period of time till the end of construction phase. Therefore, it would not effect the environment considerably. The impacts on the environment due to construction activities of wind turbines are negligible.

Operation and Maintenance Phase:

SUZLON Energy Limited maintains highest level of safety standards. Systematic and scientific maintenance of all equipments has been undertaken to ensure the best safety standards.

Impact on air
Wind energy plants are known to contribute to zero atmospheric pollution as no fuel combustion is involved during any stage of the operation.

Impact on water
There is absolutely no effluent discharge during operation of wind turbine generators.

Impact on ecology
There are no known migratory birds/endangered species in the region of project activity. Therefore, no harm on the ecological environment is envisaged.

Impact due to noise
Noise is generated due to the movement of rotor blades. Noise is very much below the regulatory norms. It has no direct effect on the population, as the area is less populated and noise generated will be attenuated by ambient conditions. Considering the overall impact of the project in reducing GHG's, creation of employment etc., makes this effect negligible.

Socio-Economic Impacts:

There is no inconvenience to the local community due to the transmission lines. The locals have benefited economically through land sales. The project activity helps upliftment of skilled and unskilled manpower in the region. The project provided employment opportunities not only during the construction phase, but also will provide during its operational lifetime. The project activity improves employment rate and livelihood of local populace in the vicinity of the project. Moreover, the project generates eco-friendly, GHG free power which contributes to sustainable development of the region.

Conclusion:
The net impact under environmental pollution category would be positive as all necessary abatement measures would be adopted and periodically monitored. The project activity does not have any major adverse impacts on environment during its construction or operational phase. The human interest parameters would show positive impacts due to increased job opportunities at the facility as well as other ancillary units coming up.

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:

As discussed above, the project activity would not have any adverse environmental impacts. The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. Hence EIA is not required to be undertaken by the host party.

SECTION E. Stakeholders' comments

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

42.5 MW Wind Power Project by Project Participants is located at district Gadag in the state of Karnataka. The stakeholders are defined as the public, including individuals, groups or communities, affected, or likely to be affected, by the proposed CDM project activity. The local stakeholders identified for the proposed project activity are as follows:

1. Local villagers and representatives of village governing body
2. Ministry of New and Renewable Energy Sources (MNRE)
3. Supplier of WEG (SUZLON Energy Limited)
4. Karnataka Renewable Energy Development Agency Limited (KREDAL)
5. Karnataka Power Transmission Corporation Limited (KPTCL)
6. Operation and Maintenance staff of SUZLON Energy Limited
7. Representatives of Non Governmental Organisation
8. Ministry of Environment and Forests

Local villagers and representatives of village governing body
The varied sections of the local population, village panchayat / NGO & local elected body of representatives administering the local area are a true representative of the local population in a democracy like India. Hence, their consents / permissions to set the project are necessary. Project Participant had organised a stakeholder consultation meeting with them on 01 August 2007 at SUZLON office at Kappatgudda site in order to inform them

on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity.

Ministry of New and Renewable Energy (MNRE)
The Government of India, through Ministry of New And Renewable Energy, has been promoting energy conservation, demand side management and renewable energy projects including wind, small hydro and hydro / bio-mass power. Project Participant's efforts in implementing the wind power project is in line with the goals and targets of the said Ministry and hence supported by them.

Karnataka Renewable Energy Development Agency Limited
KREDL is the principal agency in Karnataka responsible for development of renewable energy sources in the State. Project Participants has obtained permission from KREDL for setting up the wind power project.

Supplier of WTGs
SUZLON India Ltd. is the supplier of WTGs and is also responsible for the operation and maintenance of the wind turbines..

Karnataka Power Transmission Corporation Limited
KPTCL has issued an interconnection approval and has also provided the commissioning certificate.

Electricity Supply Company (HESCOM)
Project participants signed power purchase agreement with HESCOM for selling the units generated from the project activity at a price fixed by the HESCOM according to the power purchase agreement.

Designated National Authority - Ministry of Environment & Forest (MoEF), Government of India
The Ministry of Environment & Forests is the Designated National Authority in India. The Government of India, through MoEF is encouraging project participants to take up such Climate Change initiatives. Project Participants will be submitting the Project Concept Note and Project Design Document to the MoEF for Host Country Approval shortly.

E.2	Summary of the comments received:

Stakeholders had no objections from installations of WTGs instead they have openly said that wind power projects helped to them by

- Generating additional revenue through land / lease to outsiders like contractors & their employees.
- Job opportunities for day -to - day maintenance and security of WTGs
- Development of roads.
- No any adverse impact on rains, agriculture, flora and fauna.

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

The stakeholders have given positive feedback and thus no measures were required to be taken.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	VRL Logistics Limited
Street/P.O.Box:	Circuit House Road
Building:	Giriraj Annex
City:	Hubli
State/Region:	Karnataka
Postfix/ZIP:	580 029
Country:	India
Telephone:	0836 2237511
FAX:	0836 2256612
E-Mail:	headoffice@vrllogistics.com
URL:	http://www.vrlgroup.in/
Represented by:	
Title:	Vice-President (Finance)
Salutation:	Mr.
Last Name:	Ayyer
Middle Name:	Sheshagiri
First Name:	Gopalkrishna
Department:	Finance
Mobile:	93412 73611
Direct FAX:	0836 2256612
Direct tel:	--
Personal E-Mail:	ayyergs@vrllogistics.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received any public funding and official development assistance (ODA)

Annex 3

BASELINE INFORMATION

Emission Reductions

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 ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$\mathbf{ER_y = BE_y - PE_y - L_y}$$ ……Equation 11 (ACM0002, V 07)

Where:

ER_y = Emission reductions in year y (t CO_2e/yr).
BE_y = Baseline emissions in year y (t CO_2e/yr).
PE_y = Project emissions in year y (t CO_2/yr).
LE_y = Leakage emissions in year y (t CO_2/yr).

Baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = (EG_y - EG_{Baseline}) \cdot EF_{grid, CM, y}$$ ……Equation 7 (ACM0002, V 07)

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).
EG_y = Electricity supplied by the project activity to the grid (MWh).
$EG_{baseline}$ = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.
$EF_{grid, CM, y}$ = Combined margin CO_2 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".

The methodology assumes that all project electricity generation above baseline levels ($EG_{baseline}$) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in EF_y.

Calculation of $EG_{Baseline}$:

As the project activity involves installation of a new grid connected renewable (Wind) power plant

$$EG_{Baseline} = 0$$ ……..Equation 8 (ACM0002, V 07)

Hence for a new wind project the baseline emissions (BE_y in tCO_2) are the product of the Combined margin CO_2 emission factor ($EF_{grid, CM, y}$ in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh or kWh).

$BE_y = EG_y \cdot EF_{grid, CM, y}$

✓ **Calculation of CO_2 emission factor ($EF_{grid, CM, y}$) for the grid electricity:**

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 below:

CO_2 Emission factor for the grid electricity is calculated as Combined Margin (CM) which is the combination of Operation Margin (OM) and Build Margin (BM) factors according to the following six steps as per 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)':

Step 1: Identification of the relevant electric power system:

Central Electricity Authority (CEA), Ministry of Power, Government of India (Host Country) has given the delineations of the project electricity system and the connected electricity system in India, (as shown in table below). As per CEA the Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan).

Geographical Scope of five regional grids:

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

Utter Pradesh				
Uttaranchal				

For the purpose of calculating the emission reductions achieved by any CDM project, the 'Tool to calculate the emission factor for an electricity system' requires that the "project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints". This implies that the grid emission factors could be most appropriately calculated at the level of the five regional grids. As per the delineation given by CEA, Karnataka State falls into the Western Regional Grid.

Step 2: Selection of an Operating Margin (OM) method:

For calculation of operating margin four options are available:

(a) Simple operating margin;
(b) Simple adjusted operating margin;
(c) Dispatch data analysis operating margin;
(d) Average operating margin

CO_2 Baseline Database Version 2, Date-June 2007, published by Central Electricity Authority (hereafter CEA Database) has been referred for the values of OM. Simple OM has been used as the low-cost/must run resources constitute less than 50% (only 21.7 %- Average of five years, as shown in table below) of the total grid generation of Southern Grid in average of the five most recent years.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)					
	2001-02	**2002-03**	**2003-04**	**2004-05**	**2005-06**
North	25.7%	26.1%	28.1%	26.8%	28.1%
East	13.4%	7.5%	10.3%	10.5%	7.2%
South	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	41.7%	45.8%	41.9%	55.5%	52.7%
India	18.9%	16.3%	17.1%	18.0%	20.1%
Average of five years for SR					**21.7 %**

Table reference- CEA Baseline Database, Version 2

Step 3: Calculation of operating margin emission factor ($EF_{grid,OM,y}$) for the region based on simple OM:

OM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 2, June 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Government of India.

Simple Operating Margin Emission Factor (Southern Region) in tCO_2/GWh	
Year	**Simple OM**
2003-2004	1000
2004-2005	1000
2004-2005	1010

Average of 3 years	1003

Table reference- CEA Baseline Database, Version 2

Note: As per the 'Tool to calculate the emission factor for an electricity system', the calculation of OM has been done *ex ante* based on the most recent 3 years for which data is available at the time of PDD submission.

Step 4: Identification of the cohort of power units to be included in Build Margin (BM):

BM calculation is based on 20% most recent capacity additions in the grid based on net generation. 20% of the most recent capacity additions have been shown in Annex 3. Power plant registered as CDM project activities have been excluded from the sample group m. Capacity additions from retrofits of power plants have not been included in the calculation of the build margin emission factor.

20% of Net Generation (GWh)					
	2001-02	**2002-03**	**2003-04**	**2004-05**	**2005-06**
North	28,283	28,949	31,009	31,458	33,641
East	11,619	11,968	13,686	15,594	17,203
South	24,726	25,558	25,675	26,935	27,666
West	30,625	32,890	31,956	34,145	35,201
North-East	1,043	1,134	1,150	1,552	1,531
India	96,296	100,498	103,475	109,685	115,241

Net Generation in Build Margin (GWh)					
	2001-02	**2002-03**	**2003-04**	**2004-05**	**2005-06**
North					34,340
East					17,567
South					28,158
West					35,425
North-East					1,793
India					117,283

Table reference- CEA Baseline Database, Version 2

Vintage of data is based on option 1 of step 4. (Refer 'Tool to calculate the emission factor for an electricity system'). BM calculation has been done *ex-ante* and hence BM value will remain fixed and need not be monitored during the crediting period.

Step 5: Calculation of build margin ($EF_{grid,BM,y}$) emission factor for the region (ex ante):

BM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 2, June 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Government of India.

Build Margin Emission Factor (Southern Region) in tCO_2/GWh	
Year	**$EF_{grid,BM,y}$**
2004-2005	710

Table reference- CEA Baseline Database, Version 2

Step 6: Calculation of combined margin (CM) emissions factor - Emission factor for the grid electricity ($EF_{grid,CM,y}$):

The CO_2 emission factor for grid is calculated as the weighted average of the operating margin emission factor ($EF_{OM,\ simple,\ y}$) and the build margin emission factor ($EF_{BM,\ y}$), where the weights W_{OM} and W_{BM} for wind projects, by default, are $W_{OM} = 0.75$ & $w_{BM} = 0.25$.

Southern Region:

$$\mathbf{EF_{grid,CM,y}} = \mathbf{0.75\ EF_{OM,\ simple,y} + 0.25\ EF_{BM,}}$$
$$= 0.75*1003 + 0.25*\ 710$$
$$= 752.25 + 177.5$$
$$= 929.75\ tCO_2/GWh$$

Project activity emissions

According to the chosen baseline methodology ACM0002, for wind energy based renewable energy project activities, $PE_y = 0$.

Leakage

According to ACM0002, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using ACM0002 shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. Thus the leakage emissions are nil.

As PE_y and L_y are zero for the project activity, emission reduction caused by the project activity is equivalent to baseline emissions.

$\mathbf{ER_y = BE_y}$

Emission Reduction Calculation (ER_y):

For the project activity:

$\mathbf{ER_y = BE_y}$

- **Baseline emissions (BE_y) are given as:**

$BE_y = EG_y \,.\, EF_{grid,\ CM,\ y}$

➢ **CO_2 emission factor for grid ($EF_{grid,\ CM,\ y}$):**

CO_2 emission factor for Southern Grid ($EF_{grid,\ CM,\ y}$): 929.75 tCO_2 /GWh

➢ **Net quality of electricity supplied to the grid by the project (EG_y):**

Installed capacity of each WTG = 1.25 MW
Total no. of WTGs = 34
Total installed capacity = 42.5 MW
Net export (EG_y) = 93258000 kWh or 93.258 GWh (Refer following table)

➢ **Baseline emissions caused by the project activity (BE_y) in tCO_2 =**

Baseline emissions (BE_y) = CO_2 emission factor (EF_y) x Power generated (EG_y)
(tCO_2) (tCO_2/GWh) (GWh)

BE_y = 929.75 (tCO_2/GWh) x 93.258 (GWh/year)
= 86706.5 tCO_2 / Year ……Refer excel sheet

Parameters	Units	Per WTG	Total Units
Capacity of Wind Power Project			
No. of WTGs	No.	--	34
Total	MW	1.25	42.5
Generation and sale of energy			
Possible annual generation from the project @ 100 % PLF	Mn. Units (Million kWh)	10.95	372.3
Plant load factor (PLF)	Percent	26.50	26.50
Transformation loss & auxilliery consumption	Percent	0.50	0.50
Anticipated average WTG non-availability	Percent	5	5
Net salable units (EG_y)	Mn. Units (Million kWh) or GWh	2.743	93.258
Basline emission factor	tCO_2/GWh		929.75
Total emission reduction caused by the project activity (ER_y)	tCO_2 per year		86706.5

- **Emission Reduction:**

ER_y = BE_y (As project activity emission and leakage for the project activity are zero)

ER_y = BE_y = 86,706.5 tons of CO_2/year

≈ 86,706 tons of CO_2/year

Power Plants included in BM Calculation:

NAME	UNIT_ NO	DT_ COMM	CAPACITY MW AS ON 31/03/2006	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2005-06 Net Generation GWh
KONDAPALLI GT	1	22-Jun-00	112	SR	ANDHRA PRADESH	PVT	KONDAPALI	THERMAL	GAS	NAPT	676
KONDAPALLI GT	2	22-Jun-00	112	SR	ANDHRA PRADESH	PVT	KONDAPALI	THERMAL	GAS	NAPT	676
KONDAPALLI GT	3	22-Jun-00	126	SR	ANDHRA PRADESH	PVT	KONDAPALI	THERMAL	GAS	NAPT	760
BELLARY DG	1	20-Sep-00	25.2	SR	KARNATAKA	PVT	BELLARY	THERMAL	DISL	n/a	17
KAIGA	1	26-Sep-00	220	SR	KARNATAKA	CENTER	NPC	NUCLEAR	NUCLEAR		1,129
SAMALPATTI DG	1	23-Jan-01	105.7	SR	TAMIL NADU	PVT	SAMALPATI	THERMAL	DISL	n/a	333
KUTTIADI EXTN.	4	27-Jan-01	50	SR	KERALA	STATE	KSEB	HYDRO			205
KOVILKALAPPAL	1	5-Feb-01	107	SR	TAMIL NADU	STATE	TNEB	THERMAL	GAS	n/a	534
SHARAVATHY TAIL RACE	1	20-Feb-01	60	SR	KARNATAKA	STATE	KPCL	HYDRO			139
P.NALLUR CCGT	1	22-Feb-01	330.5	SR	TAMIL NADU	PVT	PPNPG	THERMAL	GAS	NAPT	424
SRISAILAM LBPH	1	30-Mar-01	150	SR	ANDHRA PRADESH	STATE	APGENCO	HYDRO			370
BELGAUM DG	1	31-Mar-01	27.1	SR	KARNATAKA	PVT	TATA PCL	THERMAL	DISL	n/a	44
BELGAUM DG	2	31-Mar-01	27.1	SR	KARNATAKA	PVT	TATA PCL	THERMAL	DISL	n/a	44
BELGAUM DG	3	31-Mar-01	27.1	SR	KARNATAKA	PVT	TATA PCL	THERMAL	DISL	n/a	44
SHARAVATHY TAIL RACE	2	15-May-01	60	SR	KARNATAKA	STATE	KPCL	HYDRO			139
JOG	1	15-May-01	13.2	SR	KARNATAKA	STATE	KEB	HYDRO			22
KUTHUNGAL	1	1-Jun-01	7	SR	KERALA	PVT	INDSIL	HYDRO			16
KUTHUNGAL	2	1-Jun-01	7	SR	KERALA	PVT	INDSIL	HYDRO			16
KUTHUNGAL	3	1-Jun-01	7	SR	KERALA	PVT	INDSIL	HYDRO			16

NAME	UNIT_ NO	DT_ COMM	CAPACITY MW AS ON 31/03/2006	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2005-06 Net Generation GWh
TANIR BAVI	1	8-Jun-01	42.5	SR	KARNATAKA	PVT	GMR ENERG	THERMAL	GAS	NAPT	47
TANIR BAVI	2	8-Jun-01	42.5	SR	KARNATAKA	PVT	GMR ENERG	THERMAL	GAS	NAPT	47
TANIR BAVI	3	8-Jun-01	42.5	SR	KARNATAKA	PVT	GMR ENERG	THERMAL	GAS	NAPT	47
TANIR BAVI	4	8-Jun-01	42.5	SR	KARNATAKA	PVT	GMR ENERG	THERMAL	GAS	NAPT	47
TANIR BAVI	5	8-Jun-01	50	SR	KARNATAKA	PVT	GMR ENERG	THERMAL	GAS	NAPT	55
SAMAYANALLUR DG	1	22-Sep-01	106	SR	TAMIL NADU	PVT	MADURAI P	THERMAL	DISL	OIL	328
LVS POWER DG	1	18-Oct-01	18.4	SR	ANDHRA PRADESH	PVT	LVS POWER	THERMAL	DISL	n/a	0
LVS POWER DG	2	18-Oct-01	18.4	SR	ANDHRA PRADESH	PVT	LVS POWER	THERMAL	DISL	n/a	0
SHARAVATHY TAIL RACE	3	1-Nov-01	60	SR	KARNATAKA	STATE	KPCL	HYDRO			139
SRISAILAM LBPH	2	12-Nov-01	150	SR	ANDHRA PRADESH	STATE	APGENCO	HYDRO			370
PALLIVASAL	2	16-Nov-01	5	SR	KERALA	STATE	KSEB	HYDRO			32
PALLIVASAL	1	19-Nov-01	5	SR	KERALA	STATE	KSEB	HYDRO			32
PALLIVASAL	3	20-Nov-01	5	SR	KERALA	STATE	KSEB	HYDRO			32
PANNIAR	2	20-Nov-01	15	SR	KERALA	STATE	KSEB	HYDRO			80
SENGULAM	4	30-Nov-01	12	SR	KERALA	STATE	KSEB	HYDRO			47
SENGULAM	3	5-Dec-01	12	SR	KERALA	STATE	KSEB	HYDRO			47
PEDDAPURAM CCGT	1	26-Jan-02	220	SR	ANDHRA PRADESH	PVT	REL	THERMAL	GAS	n/a	842
SIMHADRI	1	22-Feb-02	500	SR	ANDHRA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	3,588
SRISAILAM LBPH	5	28-Mar-02	150	SR	ANDHRA PRADESH	STATE	APGENCO	HYDRO			370

NAME	UNIT_ NO	DT_ COMM	CAPACITY MW AS ON 31/03/2006	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2005-06 Net Generation GWh
SRISAILAM LBPH	3	29-Mar-02	150	SR	ANDHRA PRADESH	STATE	APGENCO	HYDRO			370
SHARAVATHY TAIL RACE	4	30-Mar-02	60	SR	KARNATAKA	STATE	KPCL	HYDRO			139
SIMHADRI	2	24-Aug-02	500	SR	ANDHRA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	3,716
NEYVELI TPS(Z)	1	11-Oct-02	250	SR	TAMIL NADU	PVT	TNEB	THERMAL	LIGN	OIL	1,347
NEYVELI FST EXT	1	21-Oct-02	210	SR	TAMIL NADU	CENTER	NLC	THERMAL	LIGN	OIL	1,398
JOG	8	30-Oct-02	21.6	SR	KARNATAKA	STATE	KEB	HYDRO			37
SRISAILAM LBPH	4	29-Nov-02	150	SR	ANDHRA PRADESH	STATE	APGENCO	HYDRO			370
RAICHUR	7	11-Dec-02	210	SR	KARNATAKA	STATE	KPCL	THERMAL	COAL	OIL	944
VALUTHUR GT	1	24-Dec-02	95	SR	TAMIL NADU	STATE	TNEB	THERMAL	GAS	n/a	658
MADHAVAMANTRI	1	31-Mar-03	1.5	SR	KARNATAKA	PVT	BHORUKA	HYDRO			8
MADHAVAMANTRI	2	31-Mar-03	1.5	SR	KARNATAKA	PVT	BHORUKA	HYDRO			8
MADHAVAMANTRI	3	31-Mar-03	1.5	SR	KARNATAKA	PVT	BHORUKA	HYDRO			8
NEYVELI FST EXT	2	22-Jul-03	210	SR	TAMIL NADU	CENTER	NLC	THERMAL	LIGN	OIL	1,405
SRISAILAM LBPH	6	4-Sep-03	150	SR	ANDHRA PRADESH	STATE	APGENCO	HYDRO			370
KUTTALAM GT	1	27-Nov-03	64	SR	TAMIL NADU	STATE	TNEB	THERMAL	GAS	n/a	393
CHEMBUKADAVU-II	1	25-Jan-04	1.25	SR	KERALA	STATE	KSEB	HYDRO			4
CHEMBUKADAVU-II	2	25-Jan-04	1.25	SR	KERALA	STATE	KSEB	HYDRO			4
CHEMBUKADAVU-II	3	25-Jan-04	1.25	SR	KERALA	STATE	KSEB	HYDRO			4
URUMI	1	25-Jan-04	1.25	SR	KERALA	STATE	KSEB	HYDRO			4
URUMI	2	25-Jan-04	1.25	SR	KERALA	STATE	KSEB	HYDRO			4

URUMI	3	25-Jan-04	1.25	SR	KERALA	STATE	KSEB	HYDRO			4

NAME	UNIT_ NO	DT_ COMM	CAPACITY MW AS ON 31/03/2006	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2005-06 Net Generation GWh
KUTTALAM GT	2	24-Mar-04	36	SR	TAMIL NADU	STATE	TNEB	THERMAL	GAS	n/a	221
ALMATTI DAM	1	26-Mar-04	15	SR	KARNATAKA	STATE	KPCL	HYDRO			35
R_GUNDEM STPS	7	26-Sep-04	500	SR	ANDHRA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	3,518
ALMATTI DAM	2	4-Nov-04	55	SR	KARNATAKA	STATE	KPCL	HYDRO			128
ALMATTI DAM	3	13-Jan-05	55	SR	KARNATAKA	STATE	KPCL	HYDRO			128
KARUPPUR GT	1	19-Feb-05	70	SR	TAMIL NADU	PVT	ABAN	THERMAL	GAS	n/a	391
ALMATTI DAM	4	26-Mar-05	55	SR	KARNATAKA	STATE	KPCL	HYDRO			128
ALMATTI DAM	5	6-Jul-05	55	SR	KARNATAKA	STATE	KPCL	HYDRO			94
KARUPPUR GT	2	15-Jul-05	49.8	SR	TAMIL NADU	PVT	ABAN	THERMAL	GAS	n/a	197
ALMATTI DAM	6	10-Aug-05	55	SR	KARNATAKA	STATE	KPCL	HYDRO			82
PYKARA ALIMATE	1	11-Aug-05	50	SR	TAMIL NADU	STATE	TNEB	HYDRO			65
PYKARA ALIMATE	2	11-Aug-05	50	SR	TAMIL NADU	STATE	TNEB	HYDRO			65
PYKARA ALIMATE	3	5-Sep-05	50	SR	TAMIL NADU	STATE	TNEB	HYDRO			58
JEGURUPADU GT	5	9-Oct-05	140	SR	ANDHRA PRADESH	PVT	GVK IND	THERMAL	GAS	n/a	0
VALANTHARVI GT	1	29-Oct-05	38	SR	TAMIL NADU	STATE	ARKAY ENERGY	THERMAL	GAS	n/a	95
JEGURUPADU GT	6	11-Nov-05	80	SR	ANDHRA PRADESH	PVT	GVK IND	THERMAL	GAS	n/a	0
VEMAGIRI CCCP	1	13-Jan-06	233	SR	ANDHRA PRADESH	PVT	VEMAGIRI	THERMAL	GAS	n/a	5
Total											**28,158**

Annex 4

MONITORING INFORMATION

The monitoring plan is being devised as per approved consolidated monitoring methodology ACM0002 (Version 06) - **"Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources".**

The methodology requires monitoring of the following parameters:

- Electricity generation from the proposed project activity;

- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);

- Data needed to recalculate the build margin emission factor, if needed, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);

For the project activity to establish its creditable emission reduction, it has to record the actual electricity generation, which would displace equivalent units of electricity at the operating and build margin of the grid. Since the simple OM emission factor is calculated based on a 3 year average, based on the most recent statistics available at the time of PDD preparation, its updation based on ex post monitoring is not required. For BM calculation, option 1 (refer ACM 0002) has been chosen, which is calculated ex ante based on the most recent information, hence its monitoring is also not required. Hence, under the monitoring protocol for the project it is required to: Monitor and record the electricity generated and exported by the wind farm to the regional grid.

The O & M personnel are qualified engineers and are trained at the WTG manufacturing facility of SUZLON Energy Limited for operating and ensuring best performance of the WTGs.

To ensure trouble free operations and efficient generations through all the wind turbines, project participants has entered into a comprehensive Operation and Maintenance agreement with the manufactures of the turbines for a period of 20 years.

The general conditions set out for metering, recording, meter readings, meter inspections, test & checking and communication shall be as per the Power Purchase Agreement (PPA) with Hubli Electricity Supply Company Limited. (HESCOM).

1. **Metering:** The delivered energy shall be metered by the representatives of HESCOM & Project Participants (hereafter referred as 'parties') at the high voltage side of the step up transformer installed at the receiving station. The electricity generated by the project shall be metered by the parties at the high voltage side of the step up transformer installed at the project site.

2. **Metering Equipment:** Metering equipment shall be electronic trivector meters of accuracy class 0.2% required for the project (both main and check meters). The main meter shall be installed and owned by Project Participant, whereas check meters shall be installed by the HESCOM.

Dedicated core of both CT's and PT's of required accuracy are made available by project participant to HASCOM. The metering equipment shall be maintained in accordance with electricity standards. Such equipment shall have the capability of recording half-hourly and monthly readings. Project participant shall provide such metering results toHESCOM. The meters installed shall be capable of recording and storing half hourly readings of all the electrical parameters for a minimum period of 35 days with digital output.

3. **Meter Readings:** The monthly meter readings (both main and check meters) at the project site and the receiving station shall be taken simultaneously and jointly by the parties on pre-decided day & time day of the following month. The recorded metering data shall be downloaded through meter recording instrument. At the conclusion of each meter reading, an appointed representative of HESCOM and the Project Participant shall sign a document indicating the number of kilowatt-hours indicated by the meter. The Project Participant shall pay to HESCOM, charges, as notified by HESCOM from time to time, to read, record and calibrate each additional energy meter installed by Project Participant other than the bulk energy meter, for the purpose of determination of the losses in the transmission lines constructed and maintained by Project Participant for the purpose of interconnection with the grid system and for the facilitation of settlement of the tariff invoices.

4. **Inspection of Energy Meters:** The entire main and check energy meters (export and import) and all associated instruments, transformers installed at the project shall be of 0.2% accuracy class. Each meter shall be jointly inspected and sealed on behalf of the parties and shall not be interfered with by either party except in the presence of the other party or its accredited representatives.

5. **Meter Test Checking:** All the main and check meters shall be tested for accuracy every calendar quarter with reference to a portable standard meter which shall be of an accuracy class of 0.1%. The portable standard meter shall be owned by HESCOM at its own cost and expense and tested and certified at least once every year against an accepted laboratory standard meter in accordance with electricity standards. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2% accuracy class. The consumption registered by the main meters alone will hold good for the purpose of billing as long as the error in the main meter is within the permissible limits.

   a. If during the quarterly tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then billing will be as per the main meter as usual. The check meter shall however, be calibrated immediately.
   b. If during the quarterly tests, the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible limits of error, then the billing for the month upto the date and time of such test shall be as per the check meter. There will be a revision in the bills for the period from the previous calibration test upto the current test based on the readings of the check meter. The main meter shall be calibrated immediately and billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
   c. If during the quarterly tests, both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the meters shall be immediately calibrated and the correction applied to the reading registered by the main meter to arrive

at the correct reading of energy supplied for billing purposes for the period from the last month's meter reading upto the current test. Billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.

d. If during any of the monthly meter readings, the variation between the main meter and the check meter is more than that permissible for meters of 0.2 % accuracy class, all the meters shall be re-tested and calibrated immediately.

6. **Records:** SUZLON Energy Ltd. will maintain an accurate and up-to-date operating log with records of:

a. Hourly logs of real and reactive power generation, frequency, transformer tap position, bus voltage(s), main meter and back up meter readings and any other data mutually agreed.
b. Any unusual conditions found during operation/inspections
c. Chart and printout of event loggers, if any, for system disturbances/outages
d. All the records will be preserved for 2 years beyond the crediting period.

7. The billing will be on monthly basis. The HESCOM will be billed by Project Participants based on statement given by State load dispatch centre at the end of each month for the energy supplied.

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