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

CONTENTS

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

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10.5 MW bundled grid connected renewable energy project in Rajasthan, India

Version: 1

Date: 16/08/2007

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

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Purpose of the project activity

The proposed CDM project is a wind farm located in the Jaisalmer district of the state of Rajasthan, India. The project is essentially renewable electricity generation facility making use of wind power through 10.5 MW of installed capacity at Sodamada, Hansuwa and Baramsar villages. The project activity will establish a cluster of 12 Nos. of sophisticated, state-of-art Suzlon make Wind Energy Generators (WEG) of different capacities of 1.25 MW and 0.35 MW, aggregating to a total installed capacity of 10.5 MW. The generated electricity is wheeled to the nearest grid sub-station through a 33 kV supply line and fed into the grid after stepping up to 132 kV. The generated electricity is sold to the grid. Apart from generating electricity the project activity also contributes to global green house gas mitigation.

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

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

A. Social well being

The proposed project activity leads to alleviation of poverty by establishing direct and indirect benefits through employment generation and improved economic activities by strengthening of local grid of the state electricity utility. The infrastructure in and around the project area has also improved due to project activity. This includes development of road network and improvement of electricity quality, frequency and availability as the electricity is fed into a deficit grid.

B. Economic well-being

The project activity leads to an investment of about INR 630 million to a developing region which otherwise would not have happened in the absence of project activity. The generated electricity is fed into the Northern regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development. The project activity also leads to diversification of the national energy supply, which is dominated by conventional fuel based generating units.

C. Environmental well being

The project utilizes wind energy for generating electricity, which otherwise would have been generated through conventional thermal based power plants, contributing to reduction in specific emissions (emissions of pollutant per 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.

D. Technological well being

The project demonstrates the superior technological edge offered by the Suzlon WEG. The project activity leads to the promotion of state-of-art Suzlon 1.25 MW and 0.35 MW Wind Electric Generators (WEGs) into the region, demonstrating the success of wind based renewable energy generation, which is fed into the nearest sub-station (part of the Northern regional grid), thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Country)	Senergy Global Private Limited	No

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

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

A.4.1.1. Host Party (ies):

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India

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

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State: Rajasthan

District: Jaisalmer

A.4.1.3. City/Town/Community etc:

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Villages: Sodamada, Hansuwa, Baramsar

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

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On the present map, district Jaisalmer is bounded on the north by Bikaner, on the west & south-west by Indian boarder, on the south by Barmer and Jodhpur, and on the east by Jodhpur and Bikaner Districts. Jaisalmer is located 897 kms from New Delhi; 638 kms from Jaipur, the state headquarters. The nearest airport is at Jodhpur at a distance of 285 kms. It is well connected by roadways, railways and airways.

Geographical positioning (Jaisalmer) –

Latitude: 26°25′ N to 26°32′ N

Longitude: 69°21′ E to 70°32′ E

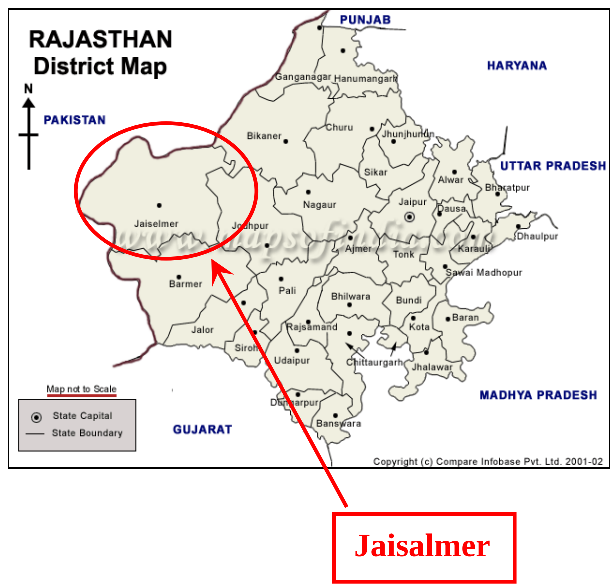
Identification of WEGs:

S. No.	Turbine Number	Capacity (MW)	Survey no.
1.	J - 604	1.25	192 / P
2.	J - 263	1.25	119/P
3.	J - 261	1.25	548 / P1
4.	J - 601	1.25	404/P & 1/P
5.	J - 602	1.25	402 / P
6.	J - 394	0.35	1159 / P
7.	J - 397	0.35	728 / P
8.	J - 40	0.35	1116 / P
9.	J - 41	0.35	1116 / P
10.	J - 42	0.35	1116/P &1152/P
11.	J - 271	1.25	97/P
12.	J - 281	1.25	185/P
	Total	**10.5**	

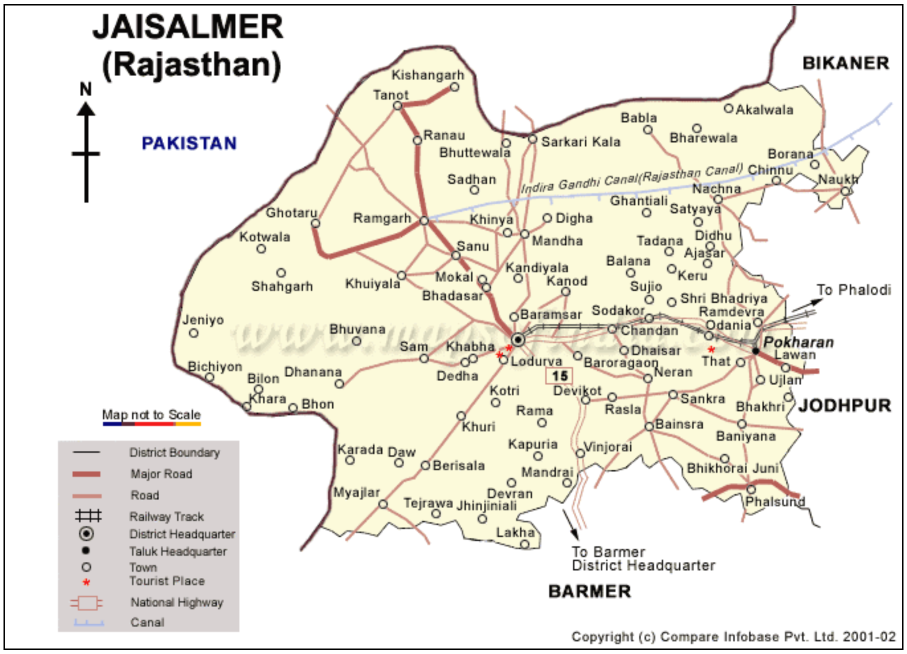
The details of the investors and the turbines have been furnished in Annexure 5 to the PDD.

Location of Rajasthan in India

Rajasthan State Map



District map of Jaisalmer



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

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Type and Category

Since, the capacity of the proposed project is 10.5 MW, which is less than the maximum qualifying capacity of 15 MW for small scale projects, the project activity has been considered as a small scale CDM project activity and UNFCCC indicative simplified modalities and procedures are applied. The project activity utilizes the wind potential for power generation and exports the generated electricity to the grid. According to small-scale CDM modalities the project activity falls under:

Project Type	: I - Renewable energy project
Project Category	: D - Grid connected Renewable electricity generation
Version	: 12
Date	: 33rd CDM EB Meeting. (25, 26, 27th July 2007)

The technology is a clean technology since there are no GHG emissions associated with the electricity generation. The project installs Suzlon-make WEGs of individual capacity 1.25 MW and 0.35 MW.

The salient features of the 1.25 MW WEGs are as follows:

1. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (C_p)
2. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
3. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
4. Intelligent Control – Sophisticated and advanced technologies applied by extensive operational experience maximizes yield

5. Maximum Power Factor - High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99
6. Climatic Shield - Hermetically sheltered, advanced over-voltage and lightning protection system
7. Unique Micro-Pitching Control - Unmatched fine pitching with 0.1° resolution to extract every possible unit of power
8. Grid-friendly - Grid friendly design generates harmonics-free pure sinusoidal power
9. ISO-certified vendors confirm high quality components
10. ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
11. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
12. Type certification by Germanischer Lloyd, Germany
13. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

The salient features of the 0.35 MW WEG are as follows:

1. Specially designed for tropical climates and remote operations
2. A High Coefficient of Power for ensuring optimum harnessing capacities
3. Integrated power transmission mechanism to ensure high efficiency
4. Carefully devised electrical system to withstand weak grid conditions
5. Microprocessor-based fully automatic control system deploying user-friendly operation and remote monitoring
6. Highest levels of safety systems (4 levels)
7. Active yaw gear drive
8. Polyamide slide bearings for yawing
9. Unique soft braking logic
10. ISO-certified vendors confirm high quality components
11. ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
12. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
13. Type certification by Germanischer Lloyd, Germany
14. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

The technical description of the various capacity turbines used in the project activity is furnished in Annex 6.

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

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

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S. No.	Year(*)	Annual Emission Reduction (tCO_2e)
1	2007 – 2008	15,250
2	2008 - 2009	15,250
3	2009 - 2010	15,250
4	2010 - 2011	15,250
5	2011 - 2012	15,250
6	2012 - 2013	15,250
7	2013 - 2014	15,250

8	2014 - 2015	15,250
9	2015 - 2016	15,250
10	2016 – 2017	15,250
Total estimated reductions (tonnes of CO_2e)		**152,500**
Total number of crediting years		**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e.)		**15,250**

* In the above table, the year 2007 - 2008 corresponds to a period of 01/12/2007 to 30/11/2008. Similar interpretation will apply for remaining years.

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

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The project has no recourse to any public funds.

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

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According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered a debundled component of a large project activity, if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small scale activity

The project promoters hereby confirm that none of the above mentioned conditions are applicable to the investors, and no other WEG based CDM project has been submitted / planned to be submitted by the investor.

SECTION B. Application of a baseline and monitoring methodology

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

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Project Type : I - Renewable energy project
Project Category : D - Grid connected Renewable electricity generation
Version : 12
Date : 33rd CDM EB Meeting. (25, 26, 27th July 2007)

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

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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). Hence, the applicable baseline, as per Clause 29 of Appendix B, indicative simplified baseline and monitoring methodologies is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner.

The project activity meets the eligibility criteria to use simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (c) of decision 17/CP.7.

The installed capacity would remain within the limits of a small scale CDM project, over the entire crediting period.

B.3. Description of the project boundary:

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As per the Appendix B of simplified modalities & procedures for small-scale CDM-project activities, the project boundary is "The project boundary encompasses the physical, geographical site of the renewable generation source."

The project boundary is composed of the Wind Energy Generators and the metering equipments for each generator and substation, and the grid which is used to transmit the generated electricity.

B.4. Description of baseline and its development:

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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). Hence, the applicable baseline, as per AMS ID, is the kWh produced by the renewable generating unit multiplied by an emission factor (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner.

The baseline emission factor is calculated using the weighted average method as it comes out to be the most conservative value as shown below.

Emission Factor (tCO_2/GWh) – Including Imports	**2003-04**	**2004-05**	**2005-06**	**Average Values**
Simple Operating Margin	987.08	975.81	994.58	985.82
Build Margin			600.52	600.52
Combined Margin				**889.49**
Weighted Average (Including Imports)				**724.04**
Weighted Average (Excluding Imports)				**713.74**

Approach

The baseline methodology approach called "existing actual or historical emissions, as applicable" has been applied in the context of the project activity. The approach selected in the baseline methodology checks the additionality of the project activity and determines the baseline emission factor for selected baseline scenario. In the absence of the CDM project activity, the electricity that is being sold to the grid by this 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 total installed capacity[1] of the power sector in India is 1,32,110 MW. Out of this 64.7% is contributed from thermal sources, 26.2% by hydro, 3.1% by nuclear and only 5.9% by all the other renewable sources. These figures prove that energy supply in India is highly dependent on thermal sources.

In the northern region[1], thermal and hydro are the major players in electricity generation with 58.76% and 35.75% of effective generation capacity respectively. Non-conventional including biomass and wind and excluding nuclear constitutes only 2.23% of the total.

In the state of Rajasthan[1], thermal again is the leader in electricity generation with approx. 59.6% of the contribution with non-conventional sources excluding nuclear and hydro contributing 32.6% of the total. Thus, clearly the baseline scenario is dominated by thermal sources at both national and regional level, with almost negligible amount being contributed by non-conventional sources.

Rajasthan, which is a part of Northern grid, is largely dependent on thermal generation. Like most other States in the country, the power system in Rajasthan is characterized by problems of frequent service interruptions, high system losses, unexpected voltage and frequency swings, restrictions on demand, poor cost recovery and heavy commercial losses. The state is also facing chronic power shortage, both in terms of peaking availability as well as energy availability, where the energy shortage (%) has gone up to 4.56 in 2006-07 from 3.86 in 2005-06[2]. The State's power scenario is unlikely to improve in the next few years and shortages, both in terms of MW and energy, would continue.

The occurrence of the project would help in not only strengthening the northern grid but also will help in solving the above mentioned problems to a certain extent. Additional energy supplied from the project activity will help in meeting the energy demand of the region and later increasing the reliability of the central grid. Moreover, since industries in Rajasthan face considerable amount of power related problems, a project like this would aid in the smooth running of the industry and encouraging power generation from non-conventional sources in the state. The project employs a non-GHG emitting technology (wind power).

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

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Justification for application of simplified methodologies to the project activity
The installed capacity of the project is 10.5 MW, which is less then the limiting capacity of 15MW and is thus eligible to use small-scale simplified methodologies. Further, the project activity is generation of electricity for a grid system using wind energy potential. Hence, the type and category of the project activity matches with I.D as specified in Appendix B of the indicative simplified baseline and monitoring methodologies for small-scale CDM project activities.

The project has been envisaged to generate electricity from WEGs in Rajasthan and the generated electricity is being sold to the state electricity utility through an Energy Purchase Agreement. The generated electricity will be wheeled utilising the available evacuation facility of Rajasthan Rajya Vidyut

[1] Central Electricity Authority, Govt. of India.
http://cea.nic.in/power_sec_reports/Executive_Summary/2007_04/22-28.pdf

[2] Northern Regional Electricity Board http://www.nreb.nic.in/Reports/ar05-06/Chapter2/Annex2.1.pdf

Prasaran Nigam Ltd. (RRVPNL), the state electricity utility and will be further supplied to distribution companies.

Hence, the wind power generated from the project site will be replacing the electricity generated from thermal power stations feeding into regional grid (during power surplus times) and will be replacing the usage of diesel generators for meeting the power demand during shortage periods.

Since wind power is GHG emissions free, the wind power generated will save the anthropogenic GHG emissions generated by fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to CO_2 (carbon dioxide) only. The project will displace fossil fuel based grid electricity with wind based electricity, contributing to GHG reductions estimated to the tune of 15,250 tCO_2e (tonnes of carbon dioxide equivalent) per annum. With a 10 year crediting period, the project is expected to reduce approximately 1,52,500 tCO_2e, thereby generating equivalent amount of CERs.

The project participants identified the following barriers for the proposed project activity:

1. Regulatory barriers:
The policy of the state of Rajasthan has not been investment friendly (inconsistent) for sale of power from wind installations, leading to additional risks for the investors. The policy regime in the state of Rajasthan during the commissioning of most of the WEGs was not conducive for business investment in WEG because of severe price fluctuations, as the purchase price was of Rs 3.32 / kWh (US$ 0.073 /kWh) during 2003-04 & Rs 2.91 / kWh (US$ 0.064 / kWh) during 2004-05.

Additionally, there has been a major change in the **National Tariff Policy** of India. Indian electricity sector has adopted Availability Based Tariff (ABT), in which the generators with firm delivery of power against commitment will start getting more price for the generated power[3]. The ABT policy has been applied in Rajasthan in the year 2006[4] but the Rajasthan Electricity Regulatory Commission has kept WEGs out of the ABT policy. However, the policy might not extend to the entire crediting period of the project and in future, with technology advancements; there is high chance of WEGs getting included in the ABT policy. Thus, the investor is taking a risk by investing in the project, as a WEG cannot play in the market for committed supply of electricity and will be left out for lower rates.

Such a non-conducive environment is prohibiting investment in RE sector for power generation. Thus, the initially considered CDM revenue can bring in viability to the project, which will enable the company to overcome the financial barriers.

2. Investment barrier:
The expected PLF in the state of Rajasthan is the lowest as compared to any other state where wind installations have been carried out. The PLF ranges between 18 to 22%[5] as compared to the states like Karnataka and Tamil Nadu which consider their PLF at 26.5% and 26.7%, respectively[6]. However, the

[3] Ministry of Power, Govt. of India http://powermin.nic.in/distribution/availability_based_tariff.htm
[4] Rajasthan Electricity Regulatory Commission (RERC) Order dated 30th June 2006 http://www.rerc.gov.in/Order/Intra_state_ABT_order.pdf
[5] Rajasthan Electricity Regulatory Commission (RERC) Tariff Order for wind and biomass projects dated 9th March 2007 http://www.rerc.gov.in/Order/JS_(PO)_Order_RE_Tariff_15.03.07.pdf
[6] Tamilnadu Electricity Regulatory Commission (TNERC) Order No. 3 dated 15/5/2006 http://tnerc.tn.nic.in/orders/nces%20order%20-approved%20order%20host%20copy.pdf

investors took a risk by investing in the project, despite knowing the fact that WEGs already operational during the time of investment were showing very low PLFs against the generation guarantee. Also the investors could have invested in states giving higher PLFs. The risk has been proven by the fact that the actual PLF for the project, calculated based on the available data[7] till date is very low i.e. 16.8 % as compared to the expected which is 22% for Jaisalmer district.

Name of the Investor	Optimal Gen. (kWh)	Expected PLF (%)	Actual Generation (kWh)			Actual PLF (%)
			2005-06	2006-07	Average	
Evershine Marbles & Exporters Pvt. Ltd.	10,950,000	25.6	1,476,964	1,934,898	1,705,931	15.6
B R Goyal Infrastructure Pvt Ltd.	10,950,000	25.6	1,304,594	2,119,939	1,712,267	15.6
Agarwal Roadlines	10,950,000	26.5	1,893,981	2,200,273	2,047,127	18.7
Rishabh Constructions Pvt. Ltd.	10,950,000	25.6	1,887,708	2,199,884	2,043,796	18.7
Delhi Trading Corporation	10,950,000	25.6	1,405,307	2,105,724	1,755,516	16.0
Shree Agencies Pvt. Ltd.	3,066,000	22.0	475,823	491,569	483,696	15.8
Khetan Tiles (P) Ltd.	3,066,000	22.0	494,019	519,072	506,546	16.5
Anamika Conductors Ltd. (2 WEGs)	6,132,000	22.0	1,035,712	1,045,318	1,040,515	16.9
Kavita Marbles	3,066,000	22.0	494,593	455,483	475,038	15.5
M/s J.B & Brothers	10,950,000	27.4	1,627,013	1,950,224	1,788,619	16.3
Zaveri & Co Exports	10,950,000	25.1	1,885,058	2,188,632	2,036,845	18.6
Average		**23.5**				**16.8**

Moreover, the PLF of thermal power plants, which is an alternative to the proposed project activity, is almost 70% and also the investment required for conventional electricity generation technologies, in terms of capital expenditure, is also much lesser as compared to the investment in WEG technologies. This further reduces incentive to invest in similar project activities. Also, the project being in the district of Jaisalmer, which is very far from the load centre, requires long transmission lines and suffers from high transmission & distribution losses. Power evacuation facility during peak season is also poor because of remote location of power project. Thus, the cost per unit of electricity is higher than other places.

The project proponents took the risk of investing in such conditions on the basis of availability of CDM revenue as a possible additional revenue stream.

3. Technological Barrier:

[7] Suzlon CMS Database

At the time when project activity was devised in 2003, the 1.25 MW WEGs were just introduced (2002-03)[8] in Indian conditions with a lack of track records for better generation efficiency and adaptability to the Indian conditions. The success of a technology depends on the adaptability to the site conditions, which was not established for this class of turbines. The investor thus, took a risk in investing in this new technology with no proper track record in the past. If the project proponent had invested the similar financial resources for installation of a thermal power plant with established technology performance and years of experience in the Indian subcontinent, the profits would have been more but would have lead to high GHG emissions.

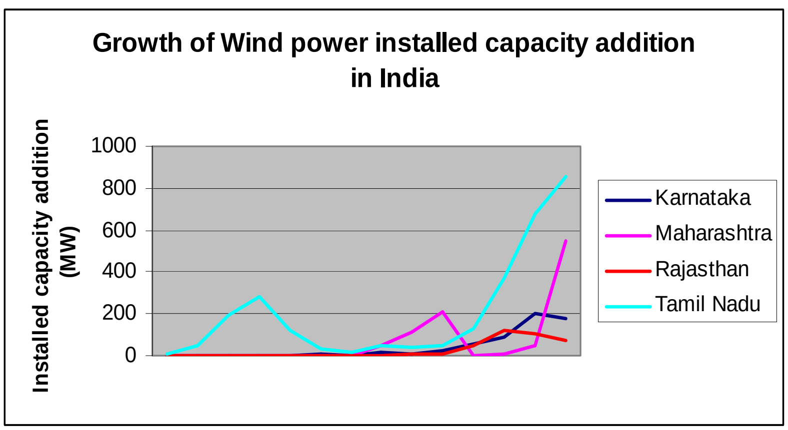
The decision taken by investors both on financial grounds as well as on technological grounds has proved to be farsighted and risky as the actual generation from individual WEGs was much lower than the perceived generation at the time of investment. Thus, investment was done taking into account CDM revenue as a possible revenue stream.

4. Inadequate Resource and Financial constraints

The state of Rajasthan has no Coal resources to generate power using conventional measures. It has to therefore, rely upon imports from states to meet its power supply. Non-conventional projects are therefore a blessing to the state as they not only provide generation capacity but also support sustainable development in the state. However, given the seasonal nature of power generation and the cost analysis these projects are not commercially viable. Thus, the establishment of such projects requires external cash flows, which would make them commercially viable. However, external funding for such projects is not available and most of the projects have been viable due to the CDM benefits.

5. Prevailing Practice Barrier

The trend of annual addition in the installed capacity of wind power has been shown in the figure below (1992-93 to 2004-05[9]). Rajasthan having the fifth highest gross potential of estimated wind power has one of the lowest growths in addition of installed capacity of wind power.



[8] Indian Windpower Directory 2005
[9] Wind Power Directory 2005

The table below shows that, in Rajasthan the renewable energy installed capacity is quite low as compared to the installed capacity for thermal power generation (60%). As on 30th April 2007, wind energy still amounts for only **7.9%** of the total installed capacity of power generation in Rajasthan. This figure was much lower (**3.2%**) till March 2002-03[10], when the project proponents decided to invest in the project.

Sector wise Installed Capacity in Rajasthan[11]

Owner -ship Sector	Mode wise Breakup (MW)							Grand Total
	Hydro	Thermal				RES	Nuclear	
		Coal	Gas	Diesel	Total			
State	1008.84	2545	223.8	0	2768	10.45	0	3788.09
Private	0	0	0	0	0	457	0	457
Central	468.56	567.49	217.74	0	785.23	0	469	1722.79
Total	**1477.4**	**3112.5**	**441.54**	**0**	**3554.03**	**467.45**	**469**	**5967.88**

The table also shows that there is no private sector investment in power generation except for the renewable energy projects. Most of the projects[12] which fall in this category have been viable because of the CDM benefits available and that the investor has taken a risk by investing in such an activity only on the backing of CDM revenue.

All the above information shows that private investment in wind electricity generation is therefore not the common practice in the state.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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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). Hence, the applicable baseline, as per Clause 29 of Appendix B, indicative simplified baseline and monitoring methodologies is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner.

Appendix B to the simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/ADD.3) gives two options for calculating the baseline for a Type I D project:

(a) The average of the “approximate operating margin” and the “built margin”

OR

(b) The weighted average emissions (in $kgCO_2e$/ kWh) of the current generation mix.

The project proponents have chosen the option (b) i.e. the simple weighted average for the purpose of calculation of baseline as the method proves to be most conservative.

[10] Wind Power Directory 2005

[11] Ministry of Power, Govt. of India, http://powermin.nic.in/JSP_SERVLETS/internal.jsp

[12] Designated National Authority of India for CDM, http://cdmindia.nic.in/cdmindia/projectList.jsp

Details of Baseline data:

Operating margin emission factor and Build Margin emission factor calculations:

Data of Operating and Build Margin for the three financial years from 2003 to 2006 has been obtained from **-**

'The CO_2 Baseline Database for the Indian Power Sector'

Central Electricity Authority (CEA), Ministry of Power, Govt. of India

Version 2, Dated: 21st June 2007

This database is prepared as per ACM0002 version 6.

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

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a) EFy

Data / Parameter:	EF_y
Data unit:	tCO_2/GWh
Description:	CO_2 emission factor of the grid
Source of data to be used:	Calculated using simple weighted average. The formulae for this are as per ACM0002
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- Emission factor is used in the calculation of emission reductions. - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as simple weighted average.

b) $EF_{OM,y}$

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/GWh
Description:	CO_2 Operating margin emission factor of the grid
Source of data to be used:	CEA : 'The CO_2 Baseline Database for the Indian Power Sector' Version 2, 21st June 2007
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is used in calculation of emissions factor E_y - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as indicated in the simple OM baseline method

c) $EF_{BM,y}$

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/GWh
Description:	CO_2 Build margin emission factor of the grid

Source of data to be used:	CEA : 'The CO_2 Baseline Database for the Indian Power Sector' Version 2, 21^{st} June 2007
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is used in the calculation of emission factor E_y. - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as indicated in the simple BM baseline method.

B.6.3 Ex-ante calculation of emission reductions:

>>

Appendix B to the simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/ADD.3) gives two options for calculating the baseline for a Type I D project:

(c) The average of the "approximate operating margin" and the "built margin"

OR

(d) The weighted average emissions (in $kgCO_2e$/ kWh) of the current generation mix.

The emission reductions from a project activity can be calculated by the following 2 methods:

Method 1:

According to ACM0002, Baseline emission factor can be calculated as Combined Margin, consisting of a combination of operating margin (OM) and build margin (BM) factors.

The Operating Margin is the weighted average emissions of all generating sources serving the Northern Grid excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. It is derived from the following equation:

$$EF_{OM,\ simple,\ y} = \frac{\Sigma F_{i,\ j,\ y}\ COEF_{i,\ j}}{\Sigma GEN_{j,\ y}}$$

where,

$F_{i,\ j,\ y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.

$COEF_{i,j\ y}$ is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and

$GEN_{\ j,\ y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as:

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

where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:

$$EF_{BM,y} = \frac{\Sigma F_{i,m,y} . COEF_{i,m}}{\Sigma GEN_{m,y}}$$

Where
$F_{i,m,y}$ = quantity of fuel i used in plant m (kt/yr) in year y,
$COEF_{i,m}$ = carbon emissions factor for fuel i in plant m (tCO_2/kt), taking into account the carbon content of the fuels by power sources and the percent oxidation of the fuel,
$GEN_{m,y}$ = annual generation from plant j (MWh/yr) in year y.

Step 1: Calculating the Operating Margin emission factor ($EF_{OM,y}$)
The operating margin emission factor has been calculated using 3 year data calculated by Central Electricity Authority (CEA) in their CO_2 baseline database.

The $EF_{OM,Y}$ is estimated to be:
For the year 2003-2004 the $EF_{OM,Y}$ is 987.08 tCO_2/GWh
For the year 2004-2005 the $EF_{OM,Y}$ is 987.08 tCO_2/GWh
For the year 2005-2006 the $EF_{OM,Y}$ is 994.58 tCO_2/GWh

Thus, the final $EF_{OM,Y}$ based on three years average is estimated to be **985.82 tCO_2/GWh**.

Step 2: Calculation of the Build Margin Emission Factor ($EF_{BM,Y}$)

The $EF_{BM,y}$ is estimated as **600.52 tCO_2/GWh** (with sample group *m* constituting most recent capacity additions to the grid comprising 20% of the system generation) for the year 2005-06, as given by CEA.

Step 3:.Calculation of Baseline Emission Factor (EF_y)

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

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

Where the weights w_{OM} and w_{BM} are 75% and 25% respectively, and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/GWh.

For wind and solar projects, the default weights are as follows: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature).

The Baseline Emission factor EF_y is estimated as **889.49 tCO_2/GWh.**

Method 2:
The baseline emission factor can also be calculated using Simple Weighted Average approach.

Step 1:.Calculation of Baseline Emission Factor EF_y
The baseline is calculated using the Simple weighted average approach.

However, the value of baseline emission factor for 2005-06 comes out to be **713.74 tCO_2/ GWh** by using Weighted average (excluding imports) and **724.04 tCO_2/ GWh** by using Weighted average (including imports). Since the project is small scale project, either of the two, Weighted average (excluding import) and Weighted average (including imports), could be used. For conservativeness, the one having lower value is chosen.

Based on above calculations, the value of baseline emission factor calculated using Weighted average (excluding imports) comes out to be most conservative as compared to calculating it using Weighted average (including imports) or Combined margin approach.

Thus, the Baseline emission factor is estimated to be **713.74 tCO_2/ GWh**.

Calculation of Baseline Emissions (BE_y)
Baseline emissions due to displacement of grid electricity are the product of the baseline emission factor (EF_y) calculated in step 1, times the electricity supplied by the project activity to the grid (EG_y), over the crediting period.

$BE_y = EG_y . EF_y$

Baseline Emissions = **15,250 tCO_2e / annum.**

Calculation of Emission Reductions (ER_y)
The emission reductions 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).

$ERy = BE_y – PE_y – L_y$

- Project Emissions by sources of GHGs due to the project activity within the project boundary are zero since wind power is a GHG emission free source of energy.
- Leakage is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the simplified procedures for SSC project activities, no leakage calculation is required.

Total project activity emissions, including leakage are zero for the project activity. Therefore, net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis. The project activity will evacuate approximately 21.4 GWh of renewable power annually to the power deficit Northern Region Grid and the annual emissions reductions are equal to 15,250 tCO_2e.

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

Year(*)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of Leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2007 – 2008	15,250	0	0	15,250
2008 - 2009	15,250	0	0	15,250
2009 - 2010	15,250	0	0	15,250
2010 - 2011	15,250	0	0	15,250
2011 - 2012	15,250	0	0	15,250
2012 - 2013	15,250	0	0	15,250
2013 - 2014	15,250	0	0	15,250
2014 - 2015	15,250	0	0	15,250
2015 - 2016	15,250	0	0	15,250
2016 - 2017	15,250	0	0	15,250
Total estimated reductions (tonnes of CO_2e)	**152,500**	**0**	**0**	**152,500**

* In the above table, the year 2007-2008 corresponds to a period of 01/12/2007 to 30/11/2008. Similar interpretation will apply for remaining years.

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

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	EG_y
Data unit:	GWh
Description:	Electricity exported to the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value of data	21.4 GWh
Description of measurement methods and procedures to be applied:	- The electricity is measured with the help of electronic meters at the wind farm substation. - The data is measured hourly and recorded monthly - 100% of the data is monitored - The data will be archived electronically
QA/QC procedures to be applied:	This data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to cross check this data and hence ensure consistency.
Any comment:	Electricity is sold to the grid through the project activity.

B.7.2 Description of the monitoring plan:

>>

The project activity essentially involves generation of electricity from wind, the employed WEGs are designed to convert wind energy into electrical energy and thus leakage due to emissions from use of any other form of fuel is not a possibility. Hence, no special ways and means are required to monitor leakage from the project activity.

Monitoring Plan

The project proponent (s) has undergone a comprehensive operation and maintenance agreement with Suzlon Energy Limited. The organizational setup implemented by them for the monitoring of generation due to the project activity is provided as Annex 4. The regular operation and maintenance activities undertaken by the contractor are as follows:

1 **Routine Maintenance Services**

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

a) Tower torquing
b) Blade cleaning
c) Nacelle torquing and cleaning
d) Transformer oil filtration
e) Control panel & LT panel maintenance
f) Site and transformer yard maintenance

2 **Security Services**

This service includes watch and ward and security of the wind farm and the equipment.

3 **Management Services**

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

4 **Technical Services**

a) Visual inspection of the WEG 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.

The proposed project activity requires evacuation facilities for sale to grid which is maintained by the state power utility, RRVPNL. However, in order to assess the electricity sales revenue and other associated charges, the investor needs to be aware of the power generation from the project on a regular basis. Therefore, two independent measurement systems have been established for this purpose.

Metering of the generated electricity:

The generated electricity from the windmills is evacuated at the state electricity utility for the complete project lifespan. The individual proponents have entered into power purchase agreements (PPA) with the state electricity utility. Thus, throughout the project cycle (crediting period) the electricity generated from the project will be monitored by both the project proponent and the SEB.

1. At the state utility, RRVPNL, recording of the electricity fed to the grid will be carried out jointly at the incoming feeder. Machines for sale to utility will be connected to the feeder.

2. The primary monitoring system is at the project site where the generated electricity before entering into the grid, at the grid interconnection point, is measured by digital, sealed meters, on a monthly basis. For all practical purposes, the readings from the main meter are referred to for generation records by the electricity board. The meter is calibrated for accuracy and dependability on regular intervals by the RRVPNL (as per the PPA).
3. The joint measurement is carried out on the first day of every month in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading, which forms the basis of payment by the SEB to the proponent.
4. In the event that the main metering system is not in service as a result of maintenance, repairs or testing, then the backup metering system, or the controller meter, shall be used for generation recordings. The secondary monitoring system will provide a backup (fail-safe measure) in case the primary monitoring is not carried out/ not functioning adequately, and would be done at the individual WEG level.
5. Each WEG is equipped with an integrated electronic meter called the controller meter. These meters are connected to the Central Monitoring Station (CMS) of the wind farm through a fibre optic cable network. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

In addition to the above, the proponent has also appointed positions for the overall management and monitoring of the CDM activity. The O & M structure is provided as Annex 4.

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

>>

Date of completion of baseline and monitoring methodology: 16/08/2007

Name of the Entity:

Senergy Global Private Limited,
9th Floor, Eros Corporate Tower, Nehru Place,
New Delhi - 110 019, India.
Phone : +91- 11- 4180 5501
Fax : +91- 11- 4180 5504
E.mail : mail@senergyglobal.com
Url : www.senergyglobal.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:

>>

31/03/2004

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

>>

20 Years 0 months

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

C.2.1. Renewable crediting period

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

>>
Not Applicable

C.2.1.2. Length of the first crediting period:

>>
Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/12/2007 (or date of project registration)

C.2.2.2. Length:

>>
10 Years 0 months

SECTION D. Environmental impacts

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

>>
According to Indian regulation, the implementation of the wind park does not require an Environmental Impact Assessment (EIA) study. As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India and also the line ministry for environmental issues in India, Environmental Impact Assessment (EIA) studies need not to be conducted for the projects which comes under the list whose investment is less than Rs. 1000 millions[13, 14] Since the Wind projects are not included in this list and also the total cost of the project is only Rs. 630 millions, the project activity doesn't call for EIA study.

Also, in the redefined EIA notification i.e. S.O. 1533[15], dated 14th September 2006, Ministry of Environment & Forests (MoEF), Govt. of India, the wind projects are not included in the list of projects that has to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities and hence no EIA study was conducted.

[13] S.O. 60 (E), Environment Impact Assessment Notification, Ministry of Environment and Forests, Govt. of India dated 27th January 1994.

[14] Amendments made on 13th June 2002 vide S.O. 632 (E), Ministry of Environment and Forests, Govt. of India.

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

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:

>>

There are no reasons and areas for concern. The wind park is located in a sparsely populated area with no vulnerable flora or fauna. The wind park doesn't results in negative environmental impacts.

SECTION E. Stakeholders' comments

>>

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

>>

The site selected for implementation of the project activity has no human occupancy within 2 kms of the occupied land. Being barren and devoid of any inhabitation, no stakeholder survey could be carried out in the immediate surroundings of the wind farm.

The revenue department of the state government of Rajasthan is responsible for providing land on lease for implementation of project.

The revenue department of the state government was approached and all necessary clearance / permissions have been obtained by individual proponents. The lease agreement has been executed between the project proponents and the state government for implementation of the project.

E.2. Summary of the comments received:

>>

The state revenue department has raised no concerns for the implementation of the project and thus no comments were received.

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

>>

No remediary action was deemed necessary for the project as no villagers reside in the immediate surroundings of the project activity.

Annex 1

CONTACT INFORMATION OF PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Senergy Global Private Limited
Street/P.O.Box:	
Building:	9th Floor, Eros Corporate Tower, Nehru Place
City:	New Delhi
State/Region:	Delhi
Postfix/ZIP:	110 019
Country:	India
Telephone:	+91- 11- 4180 5501/02
FAX:	+91- 11- 4180 5504
E-Mail:	mail@senergyglobal.com
URL:	www.senergyglobal.com
Represented by:	
Title:	
Salutation:	Mr
Last Name:	Shah
Middle Name:	
First Name:	Chintan
Department:	Carbon Credits
Mobile:	+91- 9818623817
Direct FAX:	+91- 11- 4180 5504
Direct tel:	+91- 11- 4650 6023
Personal E-Mail:	cns@senergyglobal.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no recourse to any public funding in the project activity

Annex 3

BASELINE INFORMATION

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**2.0**
DATE	**21 June 2007**
BASELINE METHODOLOGY	**ACM0002 / Ver 06**

EMISSION FACTORS

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7237	0.7265	0.7379	0.7095	0.7134	0.7137
East	1.0876	1.0573	1.1128	1.1035	1.0768	1.0756
South	0.7347	0.7451	0.8231	0.8417	0.7837	0.7353
West	0.8988	0.9247	0.9034	0.9020	0.9242	0.8746
North-East	0.4239	0.4140	0.4020	0.4281	0.3180	0.3309
India	0.8216	0.8309	0.8546	0.8507	0.8423	0.8170

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7237	0.7265	0.7401	0.7098	0.7203	0.7240
East	1.0876	1.0320	1.0852	1.0758	1.0534	1.0473
South	0.7446	0.7478	0.8235	0.8417	0.7843	0.7355
West	0.8984	0.9242	0.9026	0.9009	0.9234	0.8829
North-East	0.4239	0.4140	0.4020	0.4281	0.4799	0.3309
India	0.8191	0.8284	0.8520	0.8479	0.8397	0.8145

Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.9768	0.9778	0.9988	0.9870	0.9745	0.9933
East	1.2198	1.2210	1.2025	1.2303	1.2037	1.1585
South	1.0219	1.0001	1.0071	1.0041	0.9997	1.0073
West	0.9791	1.0102	0.9845	0.9922	1.0132	0.9936
North-East	0.7335	0.7101	0.7418	0.7366	0.7143	0.6994
India	1.0169	1.0239	1.0207	1.0259	1.0274	1.0228

Simple Operating Margin (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.9768	0.9778	0.9996	0.9871	0.9758	0.9946
East	1.2198	1.1874	1.1703	1.1959	1.1745	1.1255
South	1.0292	1.0001	1.0065	1.0041	0.9999	1.0073
West	0.9784	1.0094	0.9830	0.9903	1.0120	0.9934
North-East	0.7335	0.7101	0.7418	0.7366	0.8402	0.6994
India	1.0132	1.0202	1.0170	1.0217	1.0234	1.0189

Build Margin (tCO2/MWh) (excl. Imports)

Build Margin (tCO2/MWh) (not adjusted for imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.5336	0.6005
East					0.9043	0.9672
South					0.7089	0.7113
West					0.7700	0.6300
North-East					0.1456	0.1489
India					0.6953	0.6841

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.5336	0.6005
East					0.9043	0.9672
South					0.7089	0.7113
West					0.7700	0.6300
North-East					0.1456	0.1489
India					0.6953	0.6841

Combined Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7552	0.7557	0.7662	0.7603	0.7540	0.7969
East	1.0620	1.0626	1.0534	1.0673	1.0540	1.0628
South	0.8654	0.8545	0.8580	0.8565	0.8543	0.8593
West	0.8746	0.8901	0.8773	0.8811	0.8916	0.8118
North-East	0.4395	0.4278	0.4437	0.4411	0.4299	0.4242
India	0.8561	0.8596	0.8580	0.8606	0.8614	0.8534

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.7552	0.7557	0.7666	0.7603	0.7547	0.7976
East	1.0620	1.0458	1.0373	1.0501	1.0394	1.0463
South	0.8690	0.8545	0.8577	0.8565	0.8544	0.8593
West	0.8742	0.8897	0.8765	0.8802	0.8910	0.8117
North-East	0.4395	0.4278	0.4437	0.4411	0.4929	0.4242
India	0.8543	0.8578	0.8562	0.8585	0.8594	0.8515

GENERATION DATA

Gross Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	144,292	151,185	155,385	165,735	168,438	179,751
East	58,936	64,048	66,257	75,374	85,776	93,902
South	129,035	131,902	136,916	138,517	144,086	147,355
West	162,329	165,805	177,399	172,682	183,955	188,606
North-East	5,319	5,332	5,808	5,867	7,883	7,778
India	499,911	518,272	541,764	558,175	590,138	617,392

Net Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	135,230	141,415	144,743	155,043	157,291	168,206
East	53,350	58,097	59,841	68,428	77,968	86,014
South	121,158	123,630	127,789	128,373	134,676	138,329

EMISSION DATA

Absolute Emissions Total (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	97,866,565	102,743,113	106,808,582	109,996,544	112,212,597	120,056,079
East	58,026,488	61,427,499	66,593,200	75,512,010	83,956,860	92,517,515
South	89,019,263	92,112,060	105,187,726	108,049,156	105,539,862	101,712,149
West	135,192,153	141,597,621	148,557,341	144,127,175	157,781,065	153,933,199
North-East	2,202,108	2,158,348	2,280,049	2,462,796	2,468,463	2,532,819
India	382,306,576	400,038,640	429,426,898	440,147,681	461,958,846	470,751,761

Absolute Emissions OM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	97,866,565	102,743,113	106,808,582	109,996,544	112,212,597	120,056,079
East	58,026,488	61,427,499	66,593,200	75,512,010	83,956,860	92,517,515
South	89,019,263	92,112,060	105,187,726	108,049,156	105,539,862	101,712,149

West	150,412	153,125	164,448	159,780	170,726	176,003
North-East	5,195	5,213	5,671	5,752	7,762	7,655
India	465,345	481,479	502,492	517,376	548,423	576,206

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

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

Net Generation in Operating Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	100,189	105,076	106,942	111,450	115,151	120,869
East	47,570	50,308	55,377	61,378	69,746	79,863
South	87,114	92,103	104,449	107,603	105,568	100,978
West	138,071	140,173	150,889	145,264	155,731	154,918
North-East	3,002	3,039	3,074	3,343	3,456	3,621
India	375,947	390,700	420,730	429,040	449,653	460,249

20% of Net Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	27,046	28,283	28,949	31,009	31,458	33,641
East	10,670	11,619	11,968	13,686	15,594	17,203
South	24,232	24,726	25,558	25,675	26,935	27,666
West	30,082	30,625	32,890	31,956	34,145	35,201
North-East	1,039	1,043	1,134	1,150	1,552	1,531
India	93,069	96,296	100,498	103,475	109,685	115,241

Net Generation in Build Margin (GWh)

West	135,192,153	141,597,621	148,557,341	144,127,175	157,781,065	153,933,199
North-East	2,202,108	2,158,348	2,280,049	2,462,796	2,468,463	2,532,819
India	382,306,576	400,038,640	429,426,898	440,147,681	461,958,846	470,751,761

Absolute Emissions BM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					17,108,583	20,622,114
East					14,303,611	16,990,438
South					19,839,024	20,029,713
West					27,148,870	22,318,133
North-East					299,121	266,981
India					78,699,210	80,227,378

IMPORT DATA

Net Imports (GWh) - Net exporting grids are set to zero

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0	0	0	0	3,616	5,748
East	489	555	357	1,689	0	0
South	1,162	1,357	518	0	0	0
West	321	0	797	962	285	11,982
North-East	0	0	0	0	2,099	0

Share of Net Imports (% of Net Generation)

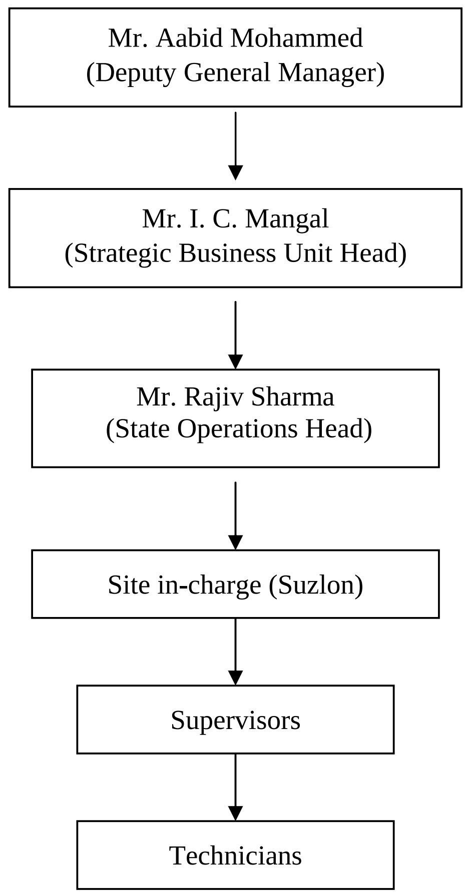
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					32,064	34,340
East					15,818	17,567
South					27,987	28,158
West					35,257	35,425
North-East					2,055	1,793
India					113,181	117,283

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.0%	0.0%	0.0%	0.0%	2.3%	3.4%
East	0.9%	1.0%	0.6%	2.5%	0.0%	0.0%
South	1.0%	1.1%	0.4%	0.0%	0.0%	0.0%
West	0.2%	0.0%	0.5%	0.6%	0.2%	6.8%
North-East	0.0%	0.0%	0.0%	0.0%	27.0%	0%

Annex 4

MONITORING INFORMATION

Operation and Maintenance Structure for the bundled wind energy project



Annex 5

LOCATION & INVESTOR SPECIFIC DETAILS OF WEGs

S. No	Name of Investor	No. of WEGs	Turbine No.	Capacity of each WTG (MW)	District	Taluka / Tehsil	Village	Survey No.	Commissioning date
1	Evershine Marbles & Exporters Pvt. Ltd.	1	J – 604	1.25	Jaisalmer	Jaisalmer	Sodamada	192 / P	02/04/2005
2	B R Goyal Infrastructure Pvt Ltd.	1	J-263	1.25	Jaisalmer	Jaisalmer	Hansuwa	119/P	30/03/2005
3	Agarwal Roadlines	1	J – 261	1.25	Jaisalmer	Jaisalmer	Sodamada	548 / P1	30/03/2005
4	Rishabh Constructions Pvt. Ltd.	1	J – 601	1.25	Jaisalmer	Jaisalmer	Sodamada	404/P & 1/P	30/03/2005
5	Delhi Trading Corporation	1	J – 602	1.25	Jaisalmer	Jaisalmer	Sodamada	402 / P	30/03/2005
6	Shree Agencies Pvt. Ltd.	1	J – 394	0.35	Jaisalmer	Jaisalmer	Baramsar	1159 / P	30/09/2004
7	Khetan Tiles (P) Ltd.	1	J – 397	0.35	Jaisalmer	Jaisalmer	Baramsar	728 / P	29/12/2004
8	Anamika Conductors Ltd.	1	J – 40	0.35	Jaisalmer	Jaisalmer	Baramsar	1116 / P	31/03/2004
9	Anamika Conductors Ltd.	1	J – 41	0.35	Jaisalmer	Jaisalmer	Baramsar	1116 / P	31/03/2004
10	Kavita Marbles	1	J – 42	0.35	Jaisalmer	Jaisalmer	Baramsar	1116/P &1152/P	31/03/2004
11	J.B & Brothers	1	J – 271	1.25	Jaisalmer	Jaisalmer	Sodamada	97/P	29/12/2004
12	Zaveri & Co Exports	1	J – 281	1.25	Jaisalmer	Jaisalmer	Sodamada	185/P	30/03/2005
	Total			**10.5**					

Annex 6

Technical description of the technology utilised in the project

1.25 MW WEG: Technical Description

A direct grid-connected high-speed generator, in combination with the multiple-stage combined spur/planetary gearbox of the Suzlon Megawatt Series, offers greater robustness and reliability than a low-speed generator connected to the electrical grid via AC-DC-AC-inverter systems. High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99. The generated power is free from harmonics and is grid friendly.

Operating Data:

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

Rotor:

1. Blade : 3 Blade Horizontal Axis
2. Swept Area : 3217 m^2
3. Rotational Speed : 13.9 to 20.8 rpm
4. Regulation : Pitch Regulated

Generator:

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

Gear Box:

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

Yaw System:

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

Braking System:

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

Control Unit:

Type: Programmable microprocessor based; high speed data communication, active multilevel security, sophisticated

0.35 MW WEG: Technical Description

Suzlon S.33 - 350 kW Wind Turbine is a stall-regulated turbine with a three-bladed high efficiency rotor. The rotor is coupled to the generator through flange. This unique integrated power-train design incorporates torsionally flexible coupling to avoid problems of misalignment and vibration. The salient features of this technology are as follows:

ROTOR

Suzlon S.33 - 350 kW has 15.4 m long FRP blades aerodynamically optimized to take varying wind velocities while delivering the maximum power. Their fail-safe tip brakes operate hydraulically and can bring a Wind Turbine to a soft stop within a few seconds without putting any undue stress on the machine. The total swept area covered by the rotor is 876.13 sq. m.

GEARBOX

Keeping the conversion & transmission efficiency to the maximum is probably the most important task, which was taken on with German perfection. Our association with some of the most renowned German manufacturers resulted in a highly efficient gearbox. The gearbox with its integrated design ensures precise assembly with a high level of efficiency, which requires an extremely low level of maintenance. This leads to an extensively trouble-free operational life, devoid of any alignment problems. It has the most advanced splash-type lubricating system.

GENERATOR

The heart of the system had to be designed with extreme ambient temperatures and humid conditions in consideration. From maintenance and reliability point of view, use of a totally closed generator to keep the moisture and dust out was paramount to Suzlon. The generator used in Suzlon S.33 - 350 kW is an asynchronous type with two speeds of operation. The generator has pole changing at 100 kW level of operation to go into the next range of generation capacity. The rated rotational speed is 756 RPM with 8 poles to generate up to 100 kW in low wind conditions and 1006 RPM with 6 poles from 100kW to 350 kW in the high wind conditions. IP 55 enclosure prevents any ingestion of air and moisture into the generator thus ensuring a long life of the generator.

CONTROL SYSTEM

The Control unit is microprocessor-based with an 8 x 40 digital display indicating all operating and error conditions. It also has a built-in graphical display showing average wind speeds and power output with daily, monthly and annual outputs amongst other parameters. The control unit keeps the Wind Turbine fully automated in the optimal operation state. Its digital interface unit helps it to be interfaced with other digital devices to be monitored and controlled remotely. The control unit can also transfer information about the Wind Turbine to remote places via modem. Its robust design gives a highly reliable operation even in the most severe conditions encountered.

YAW SYSTEM

To get the maximum from the available wind resources means that the Wind Turbine is in line with the wind direction. This important task is handled by the yaw system equipped with two motors with reduction gearbox. The system employs a hydraulic braking system to keep the Wind Turbine fixed in the direction facing the wind. The system ensures exact alignment of the rotor to the wind direction. This is achieved through an intelligent network of sensors for wind direction and wind speed, talking to the control unit in real time resulting in higher efficiency and reduced loads caused by oblique incident flows. The Yaw System is incorporated with twist sensors, which direct the control unit to untwist the cables if they are twisted beyond the set levels. This ensures the safety of cables even under frequent wind direction changes in the same direction.

SAFETY SYSTEM

- Safety System consists of four levels of independent systems:
- Electronic sensing of faults by the computer for immediate action.
- Independent electrical circuitry to act when over-speed is detected.
- Hydraulic sensing and active device to prevent over-speeding.
- Mechanical flexible couplings with shearing studs.

SOFT BRAKING

It consists of a specially designed unique mechanism for protecting the Wind Turbine against heavy loads due to sudden loss in grid power. The aerodynamic brakes are applied first and the rotor disc brakes are applied subsequently, which protect Wind Turbine components against wear & tear and fatigue.

LIGHTNING PROTECTION

Lightning arrestors are provided along with earthing cables connected to earthing pits. This has been done at various levels of the Wind Turbine, thereby protecting the entire Wind Turbine against lightning.

Annex 7

Abbreviations

ABT	Availability Based Tariff
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CERs	Certified Emission Reductions
CMS	Central Monitoring System
DGM	Deputy General Manager
EIA	Environment Impact Assessment
GHG	Greenhouse Gases
GWh	Giga Watt Hour
HT	High Tension
INR	Indian National Rupees
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent Power Producers
JMR	Joint Meter Reading
kW	Kilo Watt
kWh	Kilo Watt Hour
MNES	Ministry of Non-conventional Energy Sources
MoEF	Ministry of Environment & Forests
MoP	Ministry of Power
MW	Mega Watt
MWh	Mega Watt Hour
NHPC	National Hydro Power Corporation
NOC	No Objections Certificate
NREB	Northern Regional Electricity Board
NTPC	National Thermal Power Corporation
O&M	Operations & Maintenance
PDD	Project Design Document
PLF	Plant Load Factor
PPA	Power Purchase Agreement
RRVPNL	Rajasthan Rajya Vidyut Prasaran Nigam Limited
RES	Renewable Energy Sources
SEB	State Electricity Board
SERC	State Electricity Regulatory Commission
SLDC	State Load Dispatch Centre
SSC	Small Scale
UNFCCC	United Nations Framework Convention on Climate Change
WEG	Wind Electricity Generator

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