**CLEAN DEVELOPMENT MECHANISM**
**SIMPLIFIED PROJECT DESIGN DOCUMENT**
**FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)**
**Version 02**

**CONTENTS**

**Revision history of this document**

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

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

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

>>
5 MW Wind Power Project at Baramsar and Soda Mada, district Jaisalmer, Rajasthan, India.
Version 03
Date: 02/01/2006

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

>>

*Description of the project activity*
The project activity is an initiative by the Transport Corporation of India Limited towards clean energy generation by means of installation of 4 state-of-art Wind Electricity Generators of individual capacities 1.25 MW each, at two locations, village Baramsar (2.5 MW) and Soda Mada (2.5 MW), District Jaisalmer in the State of Rajasthan aggregated to a total installed capacity of 5MW.

The generated electricity from the aforesaid wind farm is evacuated to the RVPN grid under a power purchase agreement and subsequently all the electricity generated is sold to the state electricity utility.

*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 sell the generated output to the Northern Region Grid 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 MW class wind turbines in the region
- To contribute to the sustainable development of the region, socially, environmentally and economically

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

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

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

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

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

The project activity leads to an investment of about INR 108 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 - *This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.*

The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. As wind power projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power. Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

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

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

**A.3. Project participants:**

>>

| **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) | Transport Corporation of India Ltd. | No |
| (*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the party (ies) involved is required. | | |
| **Note**: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party (ies) and any known project participant (e.g. those proposing a new methodology) shall be identified. | | |

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

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

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

>>

Host Country – India

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

>>

District – Jaisalmer
State - Rajasthan

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

>>

Village – Baramsar and Soda Mada

**A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):**

>>

The wind farm is located at village Baramsar (Turbine location: J 70 and J 71) and Mada (Turbine location: J 227 and J 228) at District Jaisalmer in the state of Rajasthan. The location has been chosen based on the available average wind power potential in the area established by the micrositing studies done by the Suzlon Energy Limited (Supplier of WEGs). The details of revenue land allotted for the project activity are:

| S. No. | Village | Khasra Number | Area Alloted (Bigha) | | |
|---|---|---|---|---|---|
| | | | Hector | Bigha | Biswa |
| 1. | Baramsar | 1139/P | 0.81 | 5 | 00 |
| 2. | Baramsar | 1140/P | 0.81 | 5 | 00 |
| 3. | Mada | 104/P1 | 0.81 | 5 | 00 |
| 4. | Mada | 104/P2 | 0.81 | 5 | 00 |

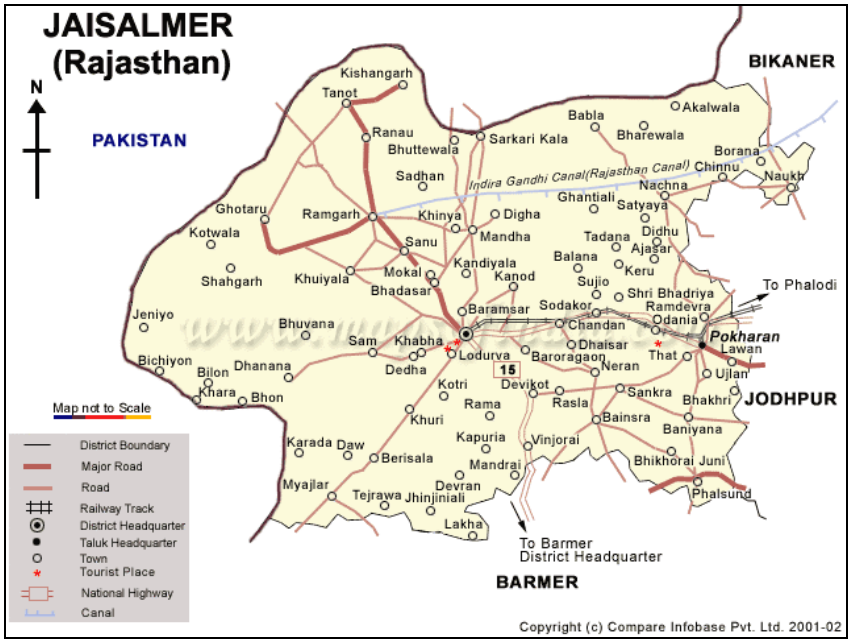
**Location of Rajasthan in India**


LOCATION OF RAJASTHAN IN INDIA
JAMMU & KASHMIR
CHINA
PAKISTAN
UTTARANCHAL
DELHI
NEPAL
BHUTAN
RAJASTHAN
Jaipur
Patna
JHARKHAND
CHHATTISGARH
Calcutta
Mumbai (Bombay)
ARABIAN SEA
BAY OF BENGAL
N
Map not to Scale
Copyright (c) Compare Infobase Pvt. Ltd. 2001-02

**State Map**


RAJASTHAN
District Map
N
PUNJAB
HARYANA
PAKISTAN
Ganganagar
Hanumangarh
Bikaner
Churu
Jhunjhunun
Sikar
Alwar
Bharatpur
UTTAR PRADESH
Nagaur
Jaipur
Dausa
Jaiselmer
Jodhpur
Ajmer
Tonk
Karauli
Dhaulpur
Sawai Madhopur
Barmer
Pali
Bhilwara
Bundi
Baran
Jalor
Rajsamand
Kota
Sirohi
Udaipur
Chittaurgarh
Jhalawar
Map not to Scale
State Capital
State Boundary
Dungarpur
Banswara
GUJARAT
MADHYA PRADESH
Copyright (c) Compare Infobase Pvt. Ltd. 2001-02

**District Map**




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

>>

Type and Category

Since, the capacity of the proposed project is only 5 MW, which is less than the maximum qualifying capacity of 15MW, 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:

| | |
|---|---|
| Type – I | Renewable Energy Projects |
| Category I-D | Renewable Electricity Generation for a grid. |

Technology

Individual state-of-art WEGs of capacity 1.25 MW has been installed. The salient features and technical details of the Suzlon 1.25 MW WEGs are as under:

The salient features of 1.25 MW WEGs is as follows:

1. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (Cp)
2. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
3. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
4. Intelligent Control - Next gen 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

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

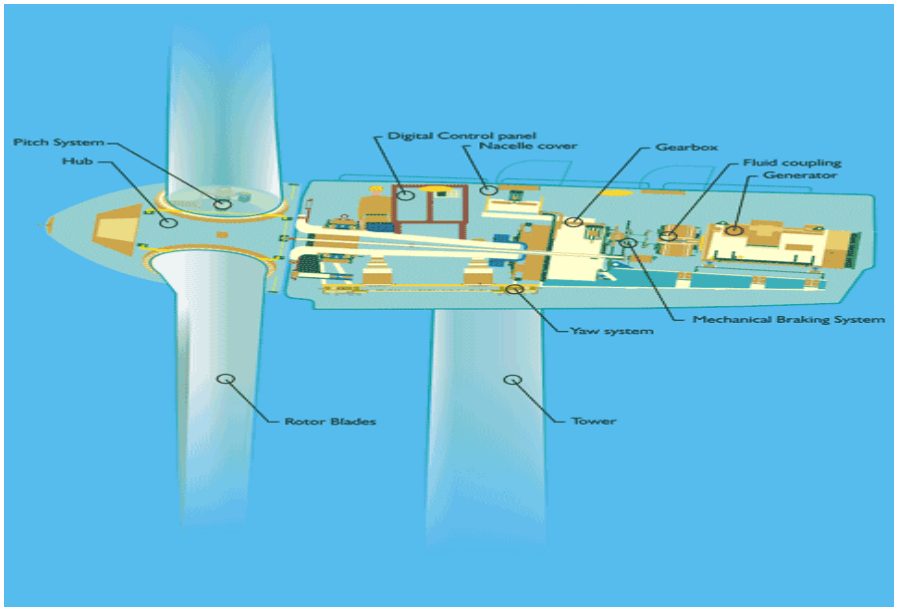
*Braking System:*

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

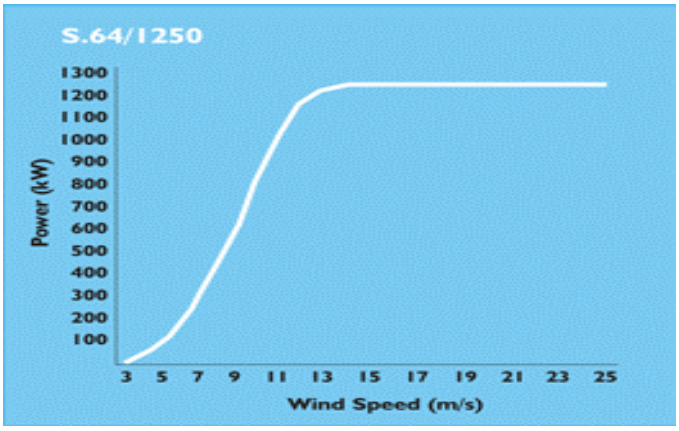
*Control Unit:*

1. Type: Programmable microprocessor based; high speed data communication, active multilevel security, sophisticated operating software, advance data collection remote monitoring & control option, UPS backup, Real time operating indication.

Technical description of technology used:




Power Curve:




Technology transfer:

No technology transfer from other countries is involved in this project activity, but the development of the technology has taken place in the R & D unit of Suzlon established in Europe. Thus, although the project activity has no direct involvement towards technology transfer, but the implementation of MW class machines have created a market for the new European technology in India.

**A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:**

>>

The candidate CDM project will generate electricity from WEGs in the Baramsar and Soda Mada Wind Park. The project activity has been essentially conceived for the sale of generated electricity to state

electricity utility. The wind power will be wheeled utilizing the regional grid (Northern Region Electricity Board), and will be supplied to the local consumers drawing electricity from the grid. Since wind power is GHG emissions free, the wind power generated will save the anthropogenic Green House Gas (GHG) emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas.

The installed capacity of Northern Region at the end of financial year 2003-04 as per CEA General Review 2005 was 31089.58 MW. The total installed capacity comprises of Hydro – 10588.39 MW, Gas – 3213.20 MW, Coal- 15914.5 MW, Nuclear- 1180 MW, Wind including RES – 178.5 MW and Diesel – 14.99 MW. Thus around 62% of the installed capacity in the Northern region is thermal. In 2003-04 approximately 167334 Million Units (kWh) were generated in the Northern Region out of which about 72% of the generation was thermal.

The candidate project activity generates approximately 8.4 GWh of clean electricity per year using WEGs which is evacuated to the regional electricity grid. Thus the project is displacing an equivalent quantity of energy which otherwise would have been generated by Fossil fuel fired generating units and leads to an emission reduction of 58046 $tCO_2e$ over the ten year crediting period.

**A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:**

>>

| S. No. | Year | Annual Emission Reduction $tCO_2e$ |
|---|---|---|
| 1 | 2003-04 | 2062 |
| 2 | 2004-05 | 4384 |
| 3 | 2005-06 | 6450 |
| 4 | 2006-07 | 6450 |
| 5 | 2007-08 | 6450 |
| 6 | 2008-09 | 6450 |
| 7 | 2009-10 | 6450 |
| 8 | 2010-11 | 6450 |
| 9 | 2011-12 | 6450 |
| 10 | 2012-13 | 6450 |
| Total estimated reductions (tonnes of $CO_2e$) | | 58046 |
| Total number of crediting years | | 10 |
| Annual average over the crediting period of estimated reductions (tones of CO2 e) | | 5804.6 |

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

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The project proponents confirm that there is no public funding involved in the proposed project activity.

**A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger 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 1km of the project boundary of the proposed small scale activity

The project promoter hereby confirms that there is no registered small scale project activity registered within the previous two years with them in the same project category and technology whose project boundary is within 1km of the project boundary of the proposed small scale activity. Thus the project is not a debundled component of any other large-scale project activity.

## SECTION B. Application of a baseline methodology:

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

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**Project Type: I** Renewable energy project
**Project Category: I D** Renewable electricity generation for a grid
**Reference:** Latest amended Version 07 (28th November 2005) of Appendix B to the simplified M&P for Small-scale CDM project activities

**B.2 Project category applicable to the small-scale project activity:**

>>

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 kgCO2/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 $kgCO_2$ equ/kWh) of the current generation mix.

The project proponent has chosen the option (a) i.e. the average of the "approximate operating margin" and the "built margin" for the purpose of calculation of baseline where:

(i) The "approximate operating margin" is the weighted average emissions (in kg CO2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.
(ii) The "build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants."

The project is supplying the generated electricity to the Northern Region Grid, thus the Northern grid has been chosen as the grid system for the baseline calculation.

**B.3. 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 5 MW, which is less than the limiting capacity of 15 MW and is thus eligible to use small-scale simplified methodologies. Further, the project activity is generation of electricity for a grid system using wind 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.

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

Investment Barriers

- The project proponent approached various Banks and financial institutions for debt financing of the project, Most of the funding agencies have not reverted to the proponent for funding of the project, whereas one of the banks carried out the financial appraisal of the project and rejected the application for project funding. The proof of submission to the agencies as well as rejection from the bank is available for validation. Even after receiving the rejection from the bank, the project proponent pursued Indian Renewable Energy Development Agency (IREDA – a funding organization under the Ministry of Non-conventional Energy Sources) for project financing through the help of EPC contractor "Suzlon Energy Limited" and carried out the project implementation.

- The following table depicts the annual average generation of 1.25 MW WEG (of the same EPC contractor – Suzlon Energy Limited) under operation in various states of India with Wind Electricity Generation Potential and the tariff offered by the state electricity utility for sale of power to the electricity board.

| State | GROSS POTENTIAL | Technical potential | Harnessed Potential upto 31-03-03 (MW) | Annual Generation per WEG of 1.25 MW | Tariff for sale to EB In INR | Annual revenue Realisation |
|---|---|---|---|---|---|---|
| Andhra Pradesh | 8275 | 1920 | 92.6 | 2.4 Million | 3.42 | 8.20 Million |
| Gujarat | 9675 | 1780 | 173.1 | 2.52 Million | 2.65 | 6.67 Million |
| Karnataka | 6620 | 1180 | 124.3 | 2.91 Million | 3.31 | 9.63 Million |
| Madhya Pradesh | 5500 | 845 | 22.6 | 2.5 Million | 3.97 | 9.92 Million |
| Maharashtra | 3650 | 3040 | 401.2 | 2.5 Million | 3.50 | 8.75 Million |
| Rajasthan | 5400 | 910 | 60.7 | 2.25 Million | 3.32 | 7.43 Million |
| Tamil Nadu | 3050 | 1880 | 990.3 | 2.95 Million | 2.70 | 7.96 Million |

* (All states except Gujarat are giving higher return on investment)

- The project proponent was apprised by the EPC contractor about the possibility of having higher annual revenue realization per WEG in other states on the basis of tariff policy and annual average generation from the operational turbines.
- It is clear that the proponent took a voluntary decision for investment in the state of Rajasthan and precisely at a location which is a part of western desert belt of the state, which is sharing borders with Pakistan against the standard business practice.
- Looking at the harnessed potential in various states at the time of decision making, the decision of investment in RE technologies (wind) was determined by the generation potential at a site.
- Additionally it is clear from the table, which can be verified by the operational facts (in other states) and regulatory policies (for tariff) prevailing at the time of making the investment decision, that investing in WEG installation in Rajasthan was not the most profitable option among the options available to the investor.

The table below depicts the generation details at the machine controller end for the installations carried out by TCI at Baramsar and Soda mada respectively:

**Baramsar: 2 x 1.25 MW**

| Financial Year | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003-04 | 0 | 0 | 313,415 | 474,682 | 513,662 | 455,462 | 91,527 | 125,476 | 146,429 | 180,840 | 237,257 | 147,191 | 2,685,941 |
| 2004-05 | 349,769 | 672,463 | 663,656 | 978,194 | 522,728 | 417,864 | 213,115 | 120,346 | 86,433 | 137,546 | 185,036 | 220,322 | 4,567,472 |
| 2005-06 | 242,526 | 343,752 | 477,059 | 545,668 | 600,223 | 259,060 | 185,108 | 0 | 0 | 0 | 0 | 0 | 2,653,396 |

**Mada: 2 x 1.25 MW**

| Financial Year | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2004-05 | 0 | 0 | 0 | 0 | 0 | 3 | 224,232 | 112,594 | 161,633 | 202,245 | 204,253 | 237,435 | 1,142,395 |
| 2005-06 | 136,250 | 329,090 | 416,165 | 462,379 | 511,526 | 205,710 | 153,989 | 0 | 0 | 0 | 0 | 0 | 2,215,109 |

- Both the installations are carried out in the state district (Jaisalmer) and the sites are separated by just few kilometres. The generation recorded at Baramser is significantly high than the generation recorded at Soda-mada during the same months of operation.

- The EPC contractor "Suzlon Energy Limited" apprised the project proponent that the wind site at Baramsar (with higher PLF) was not available for further installations and advised if the proponent would like to move to a different state with higher generation potential. However, the project proponent continued with its previous stand to invest in an economically less developed region of state of Rajasthan in view of fulfilling its sustainable development objectives.

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 status in Rajasthan is briefly indicated below:

*March 1999 – February 2000:*
Purchase of electricity at Rs 2.75 (US$ 0.061/kWh) with just 2% wheeling charges along with sales tax incentives. The developer was allowed to bank electricity for one year.

*February 2000 – April 2003:*
Purchase of electricity at Rs 3.03 (US$ 0.067/kWh) while the wheeling charges were kept same at 2%. The provision for banking for 12 months has been limited to end of financial year only (March 31). If the banking period is exhausted and the electricity was not sold out by then, the state power utility will buy balance amount of electricity at 60% of the agreed purchase price.

*April 2003 – October 2004:*
Purchase of electricity at Rs 3.32 (US$ 0.073 /kWh). The wheeling charges have been drastically increased from 2% to 10% for the volume of electricity supplied to the grid. The banking period has been reduced from 12 months to the end of calendar year (December 31).

*October 2004 – Onwards:*
The present policy regime in the state of Rajasthan is not conducive for business investment in WEG as the purchase price has been reduced from Rs 3.32 / kWh (US$ 0.073 /kWh) to Rs 2.91 / kWh (US$ 0.064 / kWh) which is 13% lower then the previous power policy.

Indian electricity sector is gearing up for the Availability Based Tariff (ABT) in which the generators with firm delivery of power against commitment will start getting more price for the generated power, whereas investor in WEG will have to bear this setback as the generator 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. The availability of additional revenue stream from CDM was therefore considered as a medium for mitigating the policy risks associated with the project activity.

Technological Barriers
At the time when project activity was devised in 2003, the 1.25 MW WEGs were new to 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.

**B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:**

>>

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 equipment for each generator and substation, and the grid (Northern grid) which is used to transmit the generated electricity.

**B.5. Details of the baseline and its development:**

>>

Approximate Operating Margin Calculations:

The approximate operating margin is the weighted average emissions (in kg $CO_2$ equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

The project activity is supplying electricity to the northern grid. The latest available data for baseline calculation (as endorsed by various state and central government sources) has been used for calculation purpose.

**Step 1: Calculation of Operating Margin (OM) emission factor of the Northern Region Grid**

The OM emission factor ($EF_{OM,y}$) is calculated as the generation weighted average emissions per electricity unit ($tCO_2$/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants(Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation).

The operating margin emission factor has been calculated using a 3 year data vintage:
The $EF_{OM,Y}$ is estimated to be:
For the year 2002-2003 the $EF_{OM,Y}$ is 0.96809 $tCO_2$/MWh
For the year 2003-2004 the $EF_{OM,Y}$ is 0.96131 $tCO_2$/MWh
For the year 2004-2005 the $EF_{OM,Y}$ is 0.95432 $tCO_2$/MWh

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be **0.9612407 $tCO_2$/MWh**

**Step 2: Calculation of Build Margin Emission factor**

The build margin has to be calculated by constituting a sample group m from either the 5 most recently built power plants or the power plant capacity additions in the electricity system that comprise 20% of the system generation (that have been built most recently). The sample group that comprises larger annual generation from either of these has to be chosen. It is observed that the generation from the sample group that comprises 20% of the system generation has larger generation than the 5 most recently built plants. Infact the Build margin emission factor for the last five capacity additions to the grid comes out to be zero as the last five capacity additions to the grid are hydro power plants. So the Build Margin is calculated from the sample group comprising the most recently additions to the grid that comprise 20% of the system generation.

The $EF_{BM,y}$ is estimated as **0.57437 $tCO_2$/MWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

**Step 3**. **Calculation of Baseline Emission Factor $EF_y$**

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

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

Where the weights $w_{OM}$ and $w_{BM}$, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in $tCO_2$/MWh.

Thus the Baseline Emission factor is estimated to be **0.7678 $tCO_2$/MWh**

The baseline emissions are calculated by multiplying the Baseline emission factor calculated as above with the number of units of electricity evacuated to the regional electricity grid.

**Justify conservatism of the baseline methodology in the case of the Project**

1. The data is current on the date of submission of the PDD, cross verified and exact as per official records, errors, uncertainties, extrapolation and forecasting of any kind has been avoided.
2. The emissions from various generation sources in the baseline calculations have been taken from the IPCC guidelines.
3. The methodology is applicable if the low cost/ must run plants constitute less than 50% of the grid, which is the case in this scenario.
4. Default weightage of 50:50 for the build ad operating margins to calculate the combined margin as been used.
5. It has been assumed that the Project size and output remains the same to avoid any inconsistencies in the calculation.
6. All calculations and methods have been adopted strictly according to UNFCCC modalities and procedures as well as with case studies from Projects that are past the validation stage.

Several criteria were used to determine the baseline for grid-connected wind power generation. These were relevance, reliability, accuracy and transparency. In determining the baseline for grid electricity generation, an important criterion is transparency. The methodology is clearly transparent in that it requires the use of official grid data sourced from the Regional Electricity Board and Central Electricity Authority, which is used to determine the emissions associated with the displacement of grid electricity. All data used is readily available to the public and can easily be double checked by the DOE.

Key information and data used to determine the baseline scenario:
*Operating margin emission factor calculations:*

The data for installed capacity and generation details of all the power plants in the Northern grid for the year 2003-04 has been compiled from NRLDC Annual Report 2003-2004, CEA reports including Performance Review of Thermal Power Plants 2003-2004 and General Review 1999-2000 to 2004-2005 and websites of state electricity boards, NTPC, NHPC, NPCIL and other organisations. Installed capacity though not used directly in calculations, gives idea about the size of individual power plant, which is useful in future projections about the size of individual power plants, which would be added.

Station wise operating heat rates of coal/lignite based major thermal power stations were available in CEA Performance Review of Thermal Power Plants 2003-2004, Section 13. For the remaining coal/lignite based thermal power stations, the Finalised Operation Norms published by CEA in its report Technical Standards on Operation Norms for Coal/Lignite Fired Thermal Power Stations were used. The operating heat rates of gas (combined cycle and open cycle units) and diesel based thermal power plants were obtained from the report entitled "Baseline for Renewable Energy Projects under CDM" which is available under public domain on the official website of the MNES (http://www.mnes.nic.in). Tariff orders issued by state regulatory commissions are also used to determine the operating heat rates of specific power plants

The Net Calorific values (NCV) and emission factors ($EF_{CO2, i}$) of various fuel types (grades of coal from D to F, Lignite, Gas, Diesel) utilised in power stations were also obtained from the report "Baseline for Renewable Energy Projects under CDM" who have used the values used by CEA in planning studies.

The fuel consumption data was obtained by back calculating fuel consumption from generation data, operating heat rates and net calorific values of the fuel used.

The oxidation factors of the fuel used have been taken from 1996 Revised IPCC Guidelines for Green House Gas Inventories: Reference Manual.

*Calculation of Build Margin emission factor:*

It requires the data for recent capacity additions to the grid. This data was obtained from CEA General Review 1999-2000, 2000-2001, 2001-2002, 2002-2003 and 2003-2004. The generation details of these capacity additions for the year 2003-2004 were obtained from Performance Review of Thermal Power Station 2003-04 and NRLDC Annual Report 2003-04.

Date of completion of the baseline study: 15/10/05
The baseline calculations have been done by:
Senergy Global Private Limited
D-33 Defence Colony
New Delhi – 110024
India
Tel: +91 11 2645 5141 / 42 / 43
Fax: +91 11 2645 5144

## SECTION C. Duration of the project activity / Crediting period:

### C.1. Duration of the small-scale project activity:

>>
10 years (With no renewal)

### C.1.1. Starting date of the small-scale project activity:

>>
23/05/2003

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

>>
20 years

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

>>
Fixed crediting period has been chosen for the project activity.

**C.2.1. Renewable crediting period:**

>>
N/A

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

>>
N/A

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

>>
N/A

**C.2.2. Fixed crediting period:**

>>

**C.2.2.1. Starting date:**

>>
16/06/2003

**C.2.2.2. Length:**

>>
10 Years (2003-2012)

**SECTION D. Application of a monitoring methodology and plan:**

>>

**D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:**

>>
**Title:** "Renewable electricity generation for a grid" AMS I D
**Reference:** Latest amended version 07 (28th November 2005) of Appendix B to the simplified M&P for Small-scale CDM project activities

**D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:**

>>
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.

**D.3 Data to be monitored:**

>>

| ID number | Data type | Data variable | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Electricity supplied to the regional electricity grid | electricity | kWh | M | Monthly | 100% | Electronic & Paper | Two years beyond Crediting period | The metering equipment at the delivery point shall be in accordance with relevant provisions of metering code as applicable for generating stations. |

**D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:**

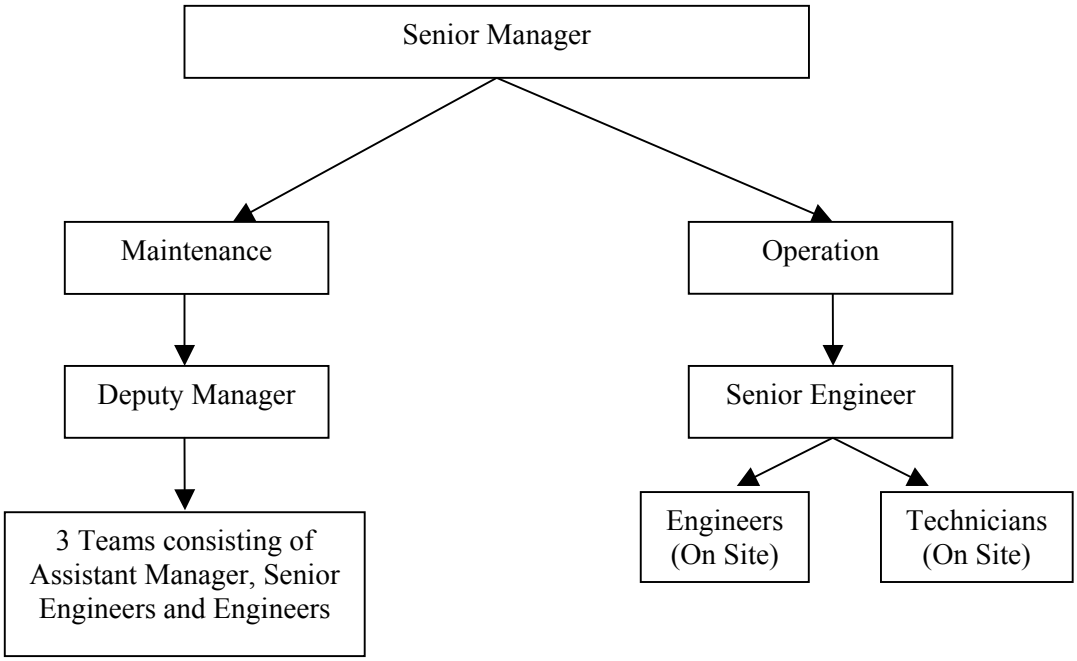
>>

| ID number | Uncertainty level of data (High/Medium/Low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
|---|---|---|
| 1 | L | 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 (RVPNL). SEB officials will take the readings in these meters and the same reading may be used to determine the net power wheeled to the user and determine the extent of mitigation of GHG over a period of time.<br><br>When the main metering system and/or backup metering system and/or any component thereof is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, recalibrated or replaced as soon as possible by the project proponent or the state electricity utility (RVPN). |

**D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:**

>>

The project proponent has undergone an operation and maintenance agreement with the Suzlon Wind Farm Services Limited. The organizational setup implemented by them for the monitoring of generation due to the project activity along with operation and maintenance is as follows:




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

1. The proposed project activity requires evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state power utility (RVPNL).
2. The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue and / or wheeling charges.
3. The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
4. The primary recording of the electricity fed to the state utility grid will be carried out jointly at the incoming feeder of the state power utility (RVPNL). Machines for sale to utility will be connected to the feeder.
5. 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 shall be used during the period main metering system is not in service.

6. The joint measurement will be 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.
7. The secondary monitoring, which will provide a backup (fail-safe measure) in case the primary monitoring is not carried out, would be done at the individual WEGs. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm through a wireless Radio Frequency (RF) network. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

**D.6. Name of person/entity determining the monitoring methodology:**

>>

Senergy Global private limited

**SECTION E.: Estimation of GHG emissions by sources:**

**E.1. Formulae used:**

>>

**E.1.1 Selected formulae as provided in appendix B:**

>>

The applicable project category from Appendix B i.e. Category I D does not indicate a specific formula to calculate the GHG emission reductions by sources

**E.1.2 Description of formulae when not provided in appendix B:**

>>

**E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:**

>>

No formula is used. 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.

**E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities**

>>

This 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.

**E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:**

>>

The net project activity emissions are zero.

**E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:**

>>

The wind power project uses the Combined Margin methodology as suggested in the Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

The total baseline emissions $BE_y$ ($tCO_2$/yr) = $EG_y$ * $EF_y$

Where
$BE_y$ = Baseline emissions in year *y* (tCO2).
$EG_y$ (MWh/yr) = Electricity generated by the project in year y;
$EF_y$ ($tCO_2$/MWh) = $CO_2$ emission factor of the Northern Region Grid

The emission factor $EF_y$ of the Northern Region Grid is a fixed value over the projects crediting period and is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

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

Where the weights $w_{OM}$ and $w_{BM}$, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are the Operating Margin and Build Margin emission factors respectively calculated in the following paragraph. The emission factor $EF_y$ is estimated to be **0.7678 kg $CO_2$/kWh**.

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:

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

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 CO2 emission coefficient of fuel *i* (tCO2 / 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 CO2 emission coefficient $COEF_i$ is obtained as

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

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 CO2 emission factor per unit of energy of the fuel *i*.

The $EF_{OM,Y}$ is estimated to be **0.9351 kg $CO_2$/kWh**. (based on three years average).

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:

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

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*

The $EF_{BM,y}$ is estimated as **0.5744 kg $CO_2$/kWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

The baseline emissions are estimated as the product of the electricity generated by the project activity and the Emission factor of the regional electricity grid as calculated above. It is estimated to be 58046t $CO_2$ over the ten year crediting period.

**E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:**

>>
**58046 t$CO_2$e** over ten year crediting period.

**E.2 Table providing values obtained when applying formulae above:**

>>

| Year | Estimation of baseline emissions (tonnes of $CO_2$e) | Estimation of project activity emission reductions (tonnes of $CO_2$e) | Estimation of Leakage (tonnes of $CO_2$e) | Estimation of emission reductions (tonnes of $CO_2$e) |
|---|---|---|---|---|
| 2003-04 | 2062 | 0 | 0 | 2062 |
| 2004-05 | 4384 | 0 | 0 | 4384 |
| 2005-06 | 6450 | 0 | 0 | 6450 |
| 2006-07 | 6450 | 0 | 0 | 6450 |
| 2007-08 | 6450 | 0 | 0 | 6450 |
| 2008-09 | 6450 | 0 | 0 | 6450 |
| 2009-10 | 6450 | 0 | 0 | 6450 |
| 2010-11 | 6450 | 0 | 0 | 6450 |

| | | | | |
|---|---|---|---|---|
| 2011-12 | 6450 | 0 | 0 | 6450 |
| 2012-13 | 6450 | 0 | 0 | 6450 |
| **Total** (tonnes of $CO_2e$) | 58046 | 0 | 0 | 58046 |

## SECTION F.: Environmental impacts:

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

>>

As per the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 27, 1994, - 30 activities are required to undertake environmental impact assessment studies. The details of these activities are available at:

http://envfor.nic.in/divisions/iass/notif/eia.htm

The proposed project doesn't fall under the list of activities requiring EIA as it will not involve any negative environmental impacts, as the WEGs installed for generation of power use wind (cleanest possible source of renewable energy), thus no EIA study was conducted.

## SECTION G. Stakeholders' comments:

### G.1. Brief description of how comments by local stakeholders have been invited and compiled:

>>

The installations of Baramsar and Soda Mada wind farm have been carried out on barren land owned by the revenue department of the state government. The state government has leased out the land to for a period of 19 years for erection and commissioning of WEGs.

All the necessary clearances from the revenue department have been obtained for commissioning and operation of wind farm

The Baramsar and Soda Mada villages are nothing but scattered hamlets of few habitants residing near the project site. The villagers have been apprised by the state government revenue department about the wind farm prior to leasing out the land.

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

>>

This land is practically under no use because neither any agricultural activity nor any other commercial / economic activity was happening at the site prior to the execution of wind farm.

Thus no comments were received except that the people residing in those hamlets asked for the right to use the land.

| G.3. Report on how due account was taken of any comments received: |
|---|

>>

The right to use the land has been given to the occupants, and they are continuing the use of land, as they had been in past.

## Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Proponent

| | |
|---|---|
| Organization: | Transport Corporation of India Limited |
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| Building: | TCI House |
| City: | Gurgoan |
| State/Region: | Haryana |
| Postfix/ZIP: | 122001 |
| Country: | India |
| Telephone: | 91-124-2381603 |
| Fax: | 91-124-2381611 |
| E-Mail: | op.jain@tcil.com |
| URL: | www.grouptci.com |
| Represented by: | A K Bansal |
| Title: | Sr. Vice President & Co. Secretary |
| Salutation: | |
| Last Name: | Bansal |
| Middle Name: | Kumar |
| First Name: | Akhil |
| Department: | Finance & Secretarial |
| Mobile: | 9350542036 |
| Direct Fax: | 91-124-2381611 |
| Direct Tel: | 91-124-2381604 |
| Personal E-Mail: | ak.bansal@tcil.com |

PDD Developer

| | |
|---|---|
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| Telephone: | +91 11 2465 5141 |
| FAX: | +91 11 2465 5144 |
| E-Mail: | am@senergyglobal.com |
| URL: | http://www.senergyglobal.com |
| Represented by: | Ajay Mathur |
| Title: | President |
| Salutation: | Dr. |
| Last Name: | Mathur |
| Middle Name: | |
| First Name: | Ajay |

| | |
|---|---|
| Department: | Carbon Credits |
| Mobile: | |
| Direct FAX: | |
| Direct tel: | |
| Personal E-Mail: | |

## Annex 2

**INFORMATION REGARDING PUBLIC FUNDING**

There is no public funding involved in the proposed project activity.

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