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. • 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:

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14.8 MW small-scale grid connected wind power project in Jaisalmer state Rajasthan, India by RSMML
Version 04
Date: January 19th, 2006

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

>>
Description of the project activity

The proposed project activity envisages the installation of 28 numbers of 350 kW (in equal phases of 14 machines each - phase I & II) and 4 numbers of 1.25 MW (phase III) Wind Electric Generators (WEG) of Suzlon Energy Ltd by Rajasthan State Mines & Minerals Limited (RSMML) with a cumulative power generative capacity of 14.8 MW at Jaisalmer, Rajasthan.

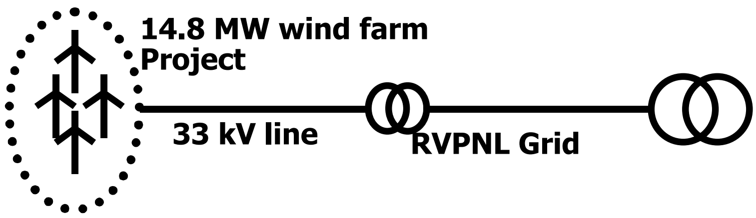
These WEGs have been installed in three phases (phase I & II with 0.35 MW machines and phase III with 1.25 MW machines) at two locations namely Badabagh and Pohra in Jaisalmer district of Rajasthan.

The commissioning of machines started from August 3, 2001 with first machine of 0.35 MW (phase I) and finished with commissioning of 1.25 MW machine (phase III) on March 2003.

The electricity generated from the candidate CDM project installations is supplied to the state electricity grid (33 / 11 kV) for transmission, which is then partially consumed by RSMML (25% from phase I & II and 5% from phase III) and the balance is passed on to the grid for sale to state electricity utility and third party (Hindustan Zinc Limited). The installations therefore has been essentially conceived for captive electricity utilization (replacing the electricity generated by 4 MW captive DG unit already installed by RSMML) and supplying the balance electricity to the grid.

The project activity on an average basis meets 25% of the electricity requirement of RSMML and the balance electricity replaces the equivalent amount of fossil fuel based grid electricity.

The line diagram of the project activity is:



Purpose of the project activity

The project activity was essentially conceived to meet the electricity requirements of RSMML (replacing captive installation owned by RSMML) by renewable source of electricity and supply balance electricity to the grid.

The activity was considered and investment was made against the standard business practice:

1. The installation of WEGs cannot be carried out in the premises of RSMML, and thus additional wheeling expenditures were to be borne by the company towards the wheeling of electricity from Wind Park to RSMML utility end. – The installations were carried out when already operation 4 MW captive installation was owned by RSMML (not a BAU case)

2. The capital investment required for installing WEGs as replacement of captive thermal unit (which is already operational) was more by 300% because of lower PLF of WEGs. – (not a BAU case)

3. There were no commercial installations of 0.35 MW WEGs in Rajasthan (at the time of making the investment), thus first of its kind large-scale investment was made in Rajasthan.(first of its kind project)

From the above, it is clear that "**promotion of clean source of energy**" and "**environmental considerations**" were at the first place while making the investment in WEGs.

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 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 access road and improvement of electricity quality, frequency and availability as the electricity is fed into a deficit local grid.

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

The project activity leads to an investment of about Rs 750 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 (the investor already owns a 4 MW captive installation and was also drawing electricity from the regional electricity grid) 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 installation of 0.35 MW WEGs during phase I & II, which practically paved the way for commercial installations of WEGs in Jaisalmer, thus infusion of new technology for generation of electricity in the state was done by the company.

During the phase III of installation, the company moved further and invested in Megawatt class of WEGs and installed 4 numbers of 1.25 MW Suzlon machines, further emerging as a leader in promoting renewable energy technologies.

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)	Rajasthan State Mines & Minerals Limited	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):

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Country – India

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

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District – Jaisalmer
State - Rajasthan

A.4.1.3. City/Town/Community etc:

>>
Pohra & Badabagh

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

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The project is located at:

1. Village: **Pohra**
   District: **Jaisalmer**
   State: **Rajasthan**
   Latitude: **27^0 02” N**
   Longitude: **70^0 57” E**
   Height above MSL: **150 – 325 m**

Pohra is approximately 24 km from the Jaisalmer Railway Station, and is blessed with wind energy generation potential. The measurement of wind potential was done both by the project developer (Suzlon Energy Limited) and by the Ministry of Non Conventional Energy Sources. The details of location of WEGs on the Pohra revenue land are as follows:

Revenue Village	Khasra Number	Area Alloted	
		Bigha	**Biswa**
Pohra	456	70	08
Pohra	457	92	03
Pohra	460	37	00
Pohra	462	66	07
Pohra	448	38	13
Pohra	450	153	05
Pohra	451	65	14
Pohra	458	37	11
Total Land		561	01

2. Village: **Badabagh**
   District: **Jaisalmer**

State: **Rajasthan**

Badabagh is approximately 15 km from the Jaisalmer railway station and is well accessible by road. The project is located on a revenue land, the details of the location is as under:

Phase I

Revenue Village	Khasra Number	Area Alloted	
		Bigha	**Biswa**
Badabagh	52	148	07
Badabagh	54	140	10
Badabagh	55	026	03
Badabagh	58	009	17
Total Land		324	17

Phase II

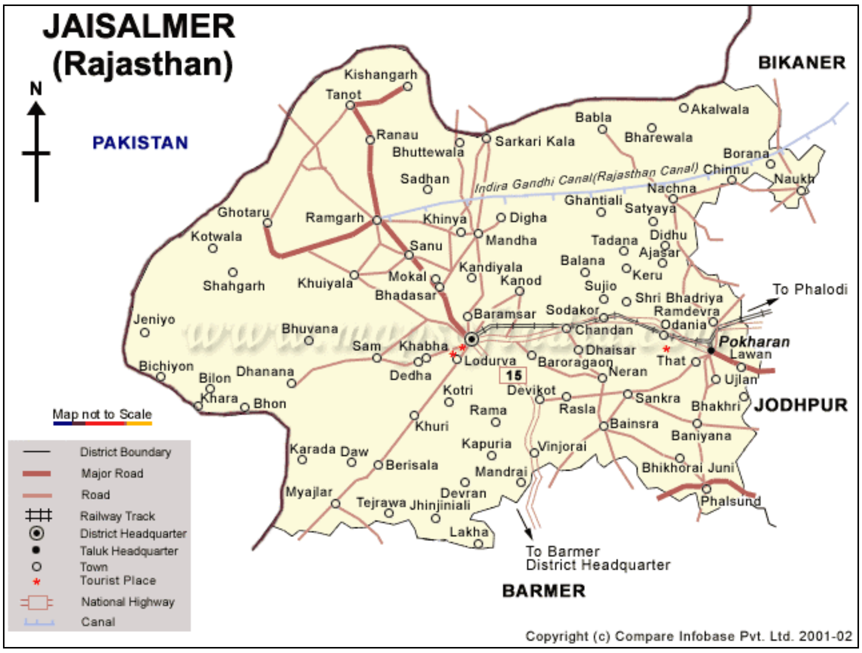
Revenue Village	Khasra Number	Area Alloted	
		Bigha	**Biswa**
Badabagh	436	50	17
Badabagh	437	62	12
Badabagh	438	49	02
Badabagh	440	74	06
Badabagh	446	58	11
Badabagh	447	85	09
Total Land		380	17

The detailed maps of the location are as under:

Country Map

State Map

District Map



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

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Type and Category

Since, the capacity of the proposed project is only 14.8 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:

Scope – 1	Energy Industries (renewable/non-renewable sources
Type – I	Renewable Energy Projects
Category I-D	Renewable Electricity Generation for a grid.

Technology – 0.35 MW WEG

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.

Technology – 1.25 MW WEG

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

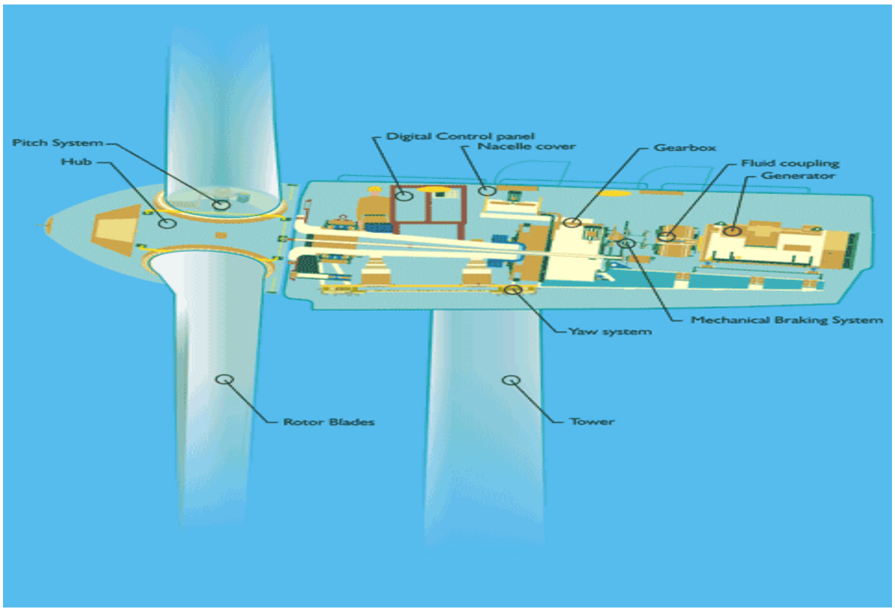
Braking System:

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

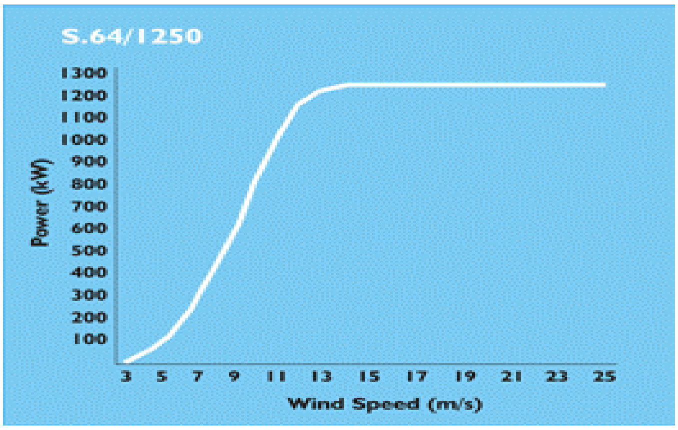
Control Unit:

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 (specifically in the state of Rajasthan).**

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:

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The candidate CDM project will generate electricity from WEGs in Jaisalmer, Rajasthan at two locations. The project activity has been essentially conceived for captive utilization by wheeling electricity through

state electricity utility (RVPNL – Rajasthan Vidyut Prasaran Nigam Limited) as well as strengthening of northern grid by supplying balance electricity to the state electricity board. Due to excessive failure of grid at the utilization end, the project activity is able to meet 25% of the demand of RSMML (which otherwise would have met through the 4 MW DG set) and the balance electricity, which is fed into the regional electricity grid (through local grid substation) replaces the fossil fuel based generation supplying the electricity to the grid.

Thus in both the cases of "captive use" and "consumption by other users drawing electricity from the regional grid" – the candidate CDM project is able to supply GHG free electricity, which would have otherwise be generated by other sources of energy.

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 project activity started in August 2001 will generate approximately 20 million kWh per year, contributing an estimated reduction of 133523 tCO_2e over the ten-year crediting period of the project from 2001-2010. This reduction is the result of displacement of fossil fuel fired power plants that would otherwise have delivered the electricity to Northern Region Grid in the absence of the project activity.

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

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Financial Year	Phase I Generation	Phase II Generation	Phase III Generation	Total Generation	Baseline Emission Factor	CERs
2001 – 02	3513734			3513734	0.7678	2698
2002 – 03	9350299	6820967		16171266	0.7678	12416
2003 – 04	7067517	6962875	29405	14059797	0.7678	10795
2004 – 05	6543433	6484588	7130198	20158219	0.7678	15478
2005 – 06	Estimated at 200,00,000 kWh per year			20000000	0.7678	15356
2006 – 07				20000000	0.7678	15356
2007 – 08				20000000	0.7678	15356
2008 – 09				20000000	0.7678	15356
2009 – 10				20000000	0.7678	15356
2010 – 11				20000000	0.7678	15356
Total estimated reduction from the proposed project activity (tonnes of CO2e)						133523
Total number of crediting years						10
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)						13352.30

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

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

The project activity was earlier proposed through the following structured financing route: (phase I)

RSMML Equity – 12.5%

Soft Loan – 33% (10 years of moratorium)

Debt from financial institutions – 54.5%

The soft loan was not provided to the company, and thus the actual execution was carried out through:
RSMML Equity – 27%
Debt from financial institutions – 73%

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 1 km of the project boundary of the proposed small scale activity

The owner (RSMML) hereby confirms that none of the above mentioned conditions are applicable to the investor, and no other WEG based CDM project has been submitted / planned to be submitted by the investor.

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: Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b)

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

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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 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.

Grid System of the proposed project activity:

There are three choices available for choosing the grid system for the project activity, viz. national grid, regional grid or state grid.

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

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

Table 1: States connected to different regional grids

Regional grid	**Northern**	**Western**	**Southern**	**Eastern**	**North Eastern**
States	Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, Delhi	Gujarat, Madhya Pradesh, Maharashtra, Goa, Chattisgarh	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu,	Bihar, Orissa, West Bengal, Jharkhand	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

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

The Northern Region grid managed by Northern Region Electricity Board (NREB) constitutes eight states (viz Himachal Pradesh, Jammu and Kashmir, Haryana, Punjab, Uttaranchal, Delhi, Uttar Pradesh and Rajasthan). These states under the regional grid have their own power generating stations as well as centrally shared power-generating stations. While the power generated by own generating stations is fully owned and consumed through the respective state's grid systems, the power generated by central generating stations is shared by more than one state depending on their allocated share. NRLDC facilitates the share of power generated by the central generating stations. Presently the share from central generating stations is a small portion of their own generation.

Since the CDM project would be supplying electricity to the Northern regional grid, it is preferable to take the regional grid as project boundary than the state boundary. It also minimizes the effect of inter state power transactions, which are dynamic and vary widely. Considering free flow of electricity among the member states and the union territory through the Northern Region Load Dispatch Centre (NRLDC), the entire Northern grid is considered as a single entity for estimation of baseline.

Emission factor for the grid

Out of the methodologies specified in Appendix B to the simplified Modalities and Procedures for Small-Scale CDM project activities, the first method i.e. the average of the “approximate operating margin” and the “built margin” is chosen for the proposed project activity.

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 14.8 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 / financial barriers:
Since RSMML was the first company to make a large-scale investment in Wind Electricity Generation through wind farm activity in the state of Rajasthan, their investment decisions was based on parameters, which were as yet uncertain, thus possible CDM revenue was considered to factor in the uncertainties. In hindsight many of these parameters turned worse than was proposed in the project document.

While proposing the project it was envisaged (as per policy of Government of Rajasthan)

- A soft loan of 33% @ 5% interest, of project cost was to be made available to the investor by REDA (Rajasthan Energy Development Agency – state level nodal agency for promotion of non-conventional energy) with a moratorium of 10 years but the same was not made available in spite of the registration of the project proponent’s application. Thus the project proponent has absorbed additional cost by raising the equity from 12.5% to 27%. This has resulted in additional burden over the resources of the company.

- It was considered that all the power generated will be utilized by the project proponent for captive use thereby replacing the HT tariff of INR 4.01 / kWh through the electricity generated by the

project activity. But after actual implementation only 25% of electricity generated by the WEGs could be consumed due to non-availability of grid, thus company had to necessarily sell the balance generation to the state electricity utility. Thus, the project proponents could not stop the usage of captive installation (already owned by them within their premises). Although the electricity generated through WEGs replaced fossil fuel based grid electricity, but the company has to continue the 4 MW DG set, resulting in continued financial burden of operating expenditures of both WEGs as well as DG sets.

- RSMML started selling part of the generated electricity directly to M/s Hindustan Zinc Limited from August 2001 to November 2002 and thereafter in the first week of December 2002 RERC has stopped the third party sale by issuing their order on account of which RSMML has incurred loss due to non adjustment of the generated electrical units for the month of December 2002.

- Additionally, RSMML has invested in establishing evacuation facility of 14.9 km for inducting the electricity at a stable grid interconnection point. This US$ 0.23 million investment was over and above the capital expenditure required for the implementation of WEGs.

- The Plant Load Factor (PLF) was considered as 25% before the WEGs started operating, it was later found out to be less than 18%. This impacted the project financials as the generation was overestimated during calculations of the revenue of the project.

- In peak wind season, due to non-availability of grid, the WEGs were to stop, which further resulted in generation loss and poor operating financials.

Due to all these reasons the IRR of the project activity reduced to less than 10% after the execution of the project.

Thus the initially considered CDM revenue can bring in viability to the project, which will enable the company to overcome the financial barriers.

Technological barriers

RSMML was a leader in commercial wind farm establishment in the state of Rajasthan by implementing 0.35 MW wind farm in village Badabagh (district Jaisalmer). This was major initiative taken by the company against the technology infusion barrier faced within the state. The company paved way for other investors to invest in renewable energy technologies. Additionally a step further the company again took the front stage in investing in megawatt class turbines thereby creating a whole market for WEG manufacturers to venture in the state of Rajasthan.

The company made the first large-scale investment for commercial wind farm in the state, when practically nothing has moved beyond the pilot installations in the state of Rajasthan. The company has invested in a new technology of generating electricity and paved way for commercial wind farming for other investors.

Prevailing practice

The prevailing practice by most of the HT customers in the state of Rajasthan is to use the grid-based electricity (where stable grid is present) and to use captive thermal installations (where frequent electricity cuts and unstable grid is observed). RSSML has gone out of the standard business practice by

making investment in WEGs even when they already had a captive thermal installation of 4 MW, which was operational and is still operating during the grid failure.

The company has made additional expenditures and created an additional facility for electricity generation through clean source of energy when they already owned a captive installation, which is not a "Business As Usual Scenario"

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:

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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 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:

>>

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 emission factor of the Northern Region Grid

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. In-fact 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).

Thus the baseline emission factor i.e. the Combined Margin emission factor will be calculated as the average of A and B2.

Baseline Emission factor: Average EF_{OM} & EF_{BM} **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.

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: 01/09/2005

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:

>>
01/08/2001

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

>>
20 years

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

>>
Fixed

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:

>>
10 years (with no renewal)

C.2.2.1. Starting date:

>>
01/08/2001

C.2.2.2. Length:

>>

10 years

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:

>>

The name of the methodology applied for the project activity is I.D **"Renewable electricity generation for a grid".** This is in accordance with the Appendix B of simplified modalities and procedures for small-scale CDM project activities. The reference to the proposed monitoring methodology is Appendix B of simplified modalities and procedures 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	

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.

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 undertaken an operation and maintenance agreement with the supplier of the wind turbines i.e. Suzlon for a period of 20 years. The performance of the mills, safety in operation and scheduled /breakdown maintenances are organized and monitored by the contractor. Suzlon has appointed a Senior Manager (Mr Rajiv) at the main office who is the incharge of both Operation and Maintenance team which are separate. The maintenance team is headed by the Deputy Manager and under him is the Assistant Manager. Two Senior Engineers have been appointed on the wind mill site to look after the WEGs and they report to the Assistant Manager about the various activities undertaken on a daily basis. The operations team consists of Senior Engineers, Engineers and Technicians who take the readings and prepare a daily generation report of all the WEGs.

The monitoring personnel i.e. the engineers when appointed undergo one week training at the Suzlon WEG manufacturing facility at Daman.

The project registration responsibility has been given to:
Mr. C. L. Jain
Group General Manager
Rajasthan State Mines & Minerals Limited

Various activities carried out by the Operations and Maintenance staff is 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, 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 ABC's Wind Farm and supplied to SEB Grid from the meter/s maintained by SEB for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

4 Technical Services

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

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

1. The proposed project activity requires evacuation facilities for sale to grid and the evacuation facility at Amarsagar is essentially maintained by the state electricity 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 electricity utility (RVPNL). Machines for sale to utility will be connected to the feeder.
5. There are two energy meters (Secure Meters Class 0.2 – the best available meters in the country for HT consumption / generation measurement) installed at the site. One acts as a back up meter if the other one fails. Due to any unforeseen events if both the meters fail, the generation can be monitored at the controller end as explained below in point no.7.
6. The joint measurement will be carried out once in a month in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading.
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:

>>

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Fax: +91 11 2465 5144

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:

>>

N/A

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 RSMML 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 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 ($EF_{BM,y}$):

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

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:

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

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

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

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:

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

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.

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:

>>
133523 tCO_2e for the 10 year crediting period.

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

>>

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)
2001-02	2698	0	0	2698
2002-03	12416	0	0	12416
2003-04	10795	0	0	10795
2004-05	15478	0	0	15478
2005-06	15356	0	0	15356
2006-07	15356	0	0	15356
2007-08	15356	0	0	15356
2008-09	15356	0	0	15356
2009-10	15356	0	0	15356
2010-11	15356	0	0	15356
Total (tonnes of CO_2e)	133523	0	0	133523

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 WEG installation and development of wind farm does not require any EIA (Environmental Impact Assessment). Additionally the installations carried out under the proposed project activity are away from human habitation, and the land used for installations of WEG is of no use (barren land).

The villages in the near vicinity were contacted before the implementation of the proposed project activity, and were apprised about the execution of wind farm project. The local stakeholders raised no issues, thus no action was required.

The land used for installations has been kept without any fencing and thus no right-of-way / current usage (what so ever) has been disturbed. The villagers are free to move around and make use of the land (if it can come to any use).

G.2. Summary of the comments received:

>>

The stakeholders were positive about the installation of the wind farm in the area and no negative comments were received.

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

>>

N/ A

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Developer

Organization:	Rajasthan State Mines and Minerals Limited
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Building:	
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URL:	http://www.rsmm.com
Represented by:	C.L. Jain / Gopal Gandhi
Title:	Group General Manager / Senior Manager
Salutation:	Mr.
Last Name:	Jain
Middle Name:	L
First Name:	C
Department:	Projects
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the project activity.
