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

CONTENTS

Annexes

Revision history of this document

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

Abbreviations

CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CMS	Central Monitoring System
DGM	Deputy General Manager
DOE	Department of Environment
EIA	Environment Impact Assessment
GHG	Greenhouse Gases
HT	High Tension
INR	Indian National Rupees
IPCC	Intergovernmental Pnel on Climate Change
MoEF	Ministry of Environment & Forests
MoP	Ministry of Power
NHPC	National Hydro Power Corporation
NOC	No Objections Certificate
NREB	Northern Regional Electricity Board
NTPC	National Thermal Power Corporation
O&M	Operations & Maintenance
PLF	Plant Load Factor
RRVPNL	Rajasthan Rajya Vidyut Prasaran Nigam Limited
RES	Renewable Energy Sources
SSC	Small Scale
SERC	State Electricity Regulatory Commission
SLDC	State Load Dispatch Centre
UNFCCC	United Nations Framework Convention on Climate Change
WEG	Wind Electricity Generator

SECTION A. General description of small-scale project activity

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

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2.76 MW Grid Connected Renewable Energy Project in Rajasthan by Kalani Industries

Version: 3

Date: 02/04/2007

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

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The CDM project is a wind farm located in the Jaisalmer district of the state of Rajasthan, India. The project is essentially renewable electricity generation facility making use of wind power through 2.76 MW of installed capacity. The project has the distinction of being the first Private Sector investment in the area of Wind Power generation in the state.

Power generation from renewable sources of energy has emerged as one of the prime focus areas in the energy sector. Apart form harnessing available potential to provide electricity, wind energy provides a permanent shield against the ever-increasing power prices. The cost per kW reduces over a period of time as against rising costs for conventional power projects thus helps optimization of financial resources, which is of immense value addition in a country like India. Over the last decade significant progress has been made in harnessing wind for power generation in India.

The wind speed in this area has been found adequate to install WEG to generate electricity. The wind potential studies have been carried out and it has been found that the installation of WEGs in this can bring in about 22% to 25%PLF in this area.

Purpose of the project activity

Wind is commercially and operationally the most viable renewable energy resource and accordingly, emerging as one of the largest source in terms of the renewable energy sector.

The project activity has been therefore undertaken to harness the available wind potential at Barabagh village vis-à-vis development of local economy. The project activity will establish a cluster of 12 Nos. of sophisticated, state-of-art Enercon-30 make Wind Energy Generators (WEG) of) 0.23MW capacity each aggregating to a total installed capacity of 2.76 MW. The generated electricity is wheeled to the nearest grid sub-station through a 33 kV supply line and fed into the grid after stepping up to 132 kV. The generated electricity is sold to the grid.

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 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 147.6 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 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 was a pioneer in the State and demonstrated the superior technological edge offered by the Enercon- E-30 WEG. The project activity leads to the promotion of 12 state-of-art Enercon 0.23MW Wind Electric Generators (WEGs) into the region, demonstrating the success of wind based renewable energy generation, which is fed into the nearest sub-station (part of the Northern regional grid), thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

A.3. Project participants:

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

Government of India (Host Country)	Kalani Industries 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:

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

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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State: Rajasthan
District: Jaisalmer

A.4.1.3. City/Town/Community etc:

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Village: Barabagh

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

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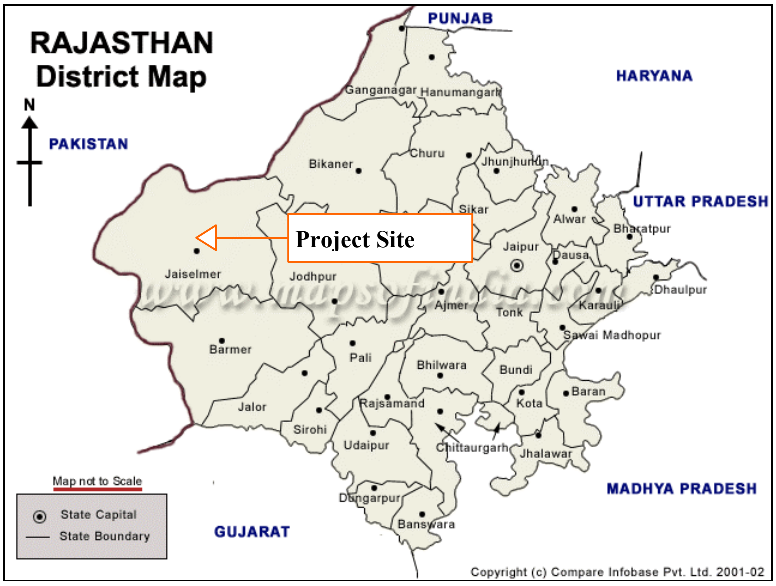
Geographical positioning (Jaisalmer) - Lat 26.42N to 26.54N / Long 69.36E to 70.55E

Identification of WEGs

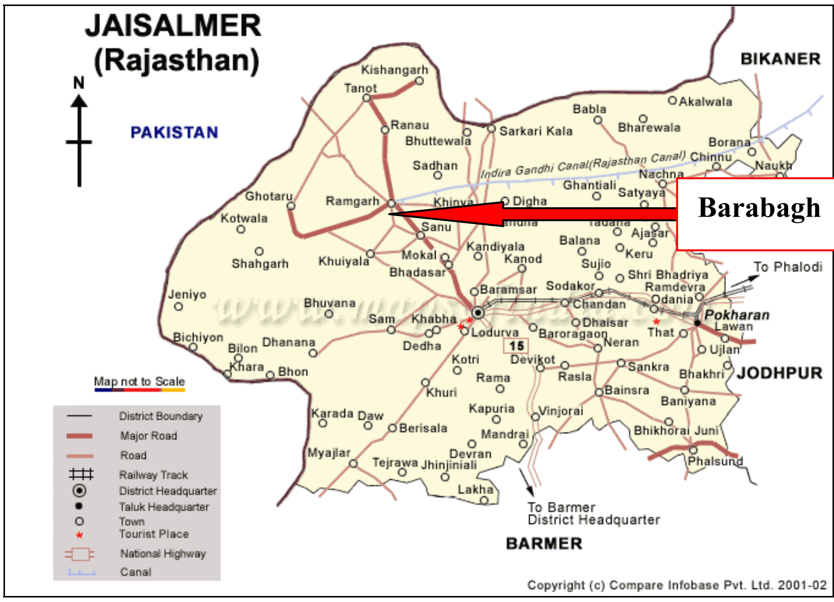
S.No.	Turbine Number	Khasra Number	Capacity (MW)	Status
1.	KIL 1	445/480	0.23	Commissioned
2.	KIL 2	442/478	0.23	Commissioned
3.	KIL 3	442/478	0.23	Commissioned
4.	KIL 4	442/478	0.23	Commissioned
5.	KIL 5	442/478	0.23	Commissioned
6.	KIL 6	442/478	0.23	Commissioned
7.	KIL 7	439	0.23	Commissioned
8.	KIL 8	443	0.23	Commissioned
9.	KIL 9	443	0.23	Commissioned
10.	KIL 10	443	0.23	Commissioned
11.	KIL 11	443	0.23	Commissioned
12.	KIL 12	445/480	0.23	Commissioned

Location of Rajasthan in India

Rajasthan State Map



District map of Jaisalmer



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

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Type and Category

Since, the capacity of the proposed project is 2.76 MW, which is less than the maximum qualifying capacity of 15 MW, the project activity has been considered as a small scale CDM project activity and UNFCCC indicative simplified modalities and procedures are applied. The project activity utilizes the wind potential for power generation and exports the generated electricity to the grid. According to small-scale CDM modalities the project activity falls under:

Project Type: I Renewable energy project
Project Category: I D Grid connected Renewable electricity generation
Version: 10 (23rd December, 2006)
Reference: Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b)

Technical Specifications of Product

The wind farm commissioned consists of 12 wind turbines of capacity 0.23 MW of the Enercon –30 make. The cluster, which is located in the Jaisalmer district of Rajasthan, India, is linked to the Northern Grid. The wind farm has been developed under the consultation and technological guidance of Enercon India Private Limited.

Enercon wind turbines have three rotor blades, made of epoxy resin, which rotate around a horizontal hub connected to a generator. They have no gearbox or drive train, making them much quieter than conventional gearbox turbines, because they don't produce the mechanical and tonal noise produced by high-speed drive components.

The variable speed mechanism of the Enercon machines enables the turbine to optimize the energy extraction, increasing the reliability and efficiency of the turbine. Power is controlled automatically as the

wind speed varies, with all moving parts on the machines rotating at the same speed of between 18 and 38 rpm depending on the prevailing wind conditions and turbine model. The turbines automatically stop at very high wind speeds to protect them from damage. Wind sensors are used to constantly monitor the wind direction and the tower head turns to line up with the wind.

The Wind Energy Converters E-30 features variable speed and active pitch control. The reliability and the effectiveness of the Enercon E-30 WEGs used at the wind farm can be gauged from the fact that the same WEGs have been installed at the Mawson Center in the Antarctic.

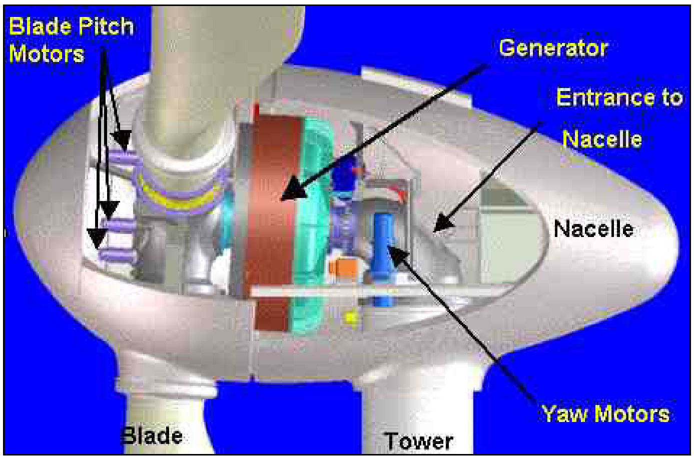
Furthermore, the E 30 model is certified by the Centre for wind energy technology (C-WET) and has been granted the Type approval certificate. Thus, these WEGs shall have an operational lifetime of 20 years.
http://www.cwet.tn.nic.in/html/departments_cs.html

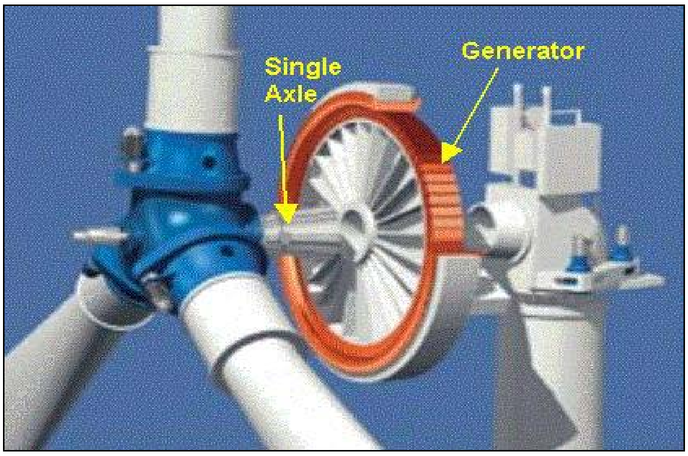
One of the key benefits of ENERCONCARE is its online Daily Generation Report (DGR). Through VSAT and CMS, the contractor is able to provide reports of electricity, generated by each and every WEG on realtime basis.

Technical specifications of E – 30

- Optimized system-orientated converter concept
- Converter design optimized for functionality
- Above-average yield
- High-grade grid tolerance

Diagrammatic representation of E 30 turbine





Technical Description of E 30

Cut in wind speed	2.5 m/sec
Cut out wind speed	25 m/sec , 10 min average
Hub height	50 m
Rotor Speed	18-50 rpm
Voltage	415 V
Frequency	50 Hz
Rated power output	230 KW
Generator type (Dual wound/2 generators)	Synchronous
Tower height	48 m
Safety system	DIN 32770
Yawning system type	Active electromechanical
Brake system	Independent control system for each blade
Blade material	GRP/Epoxy resin
Rotor diameter	30 m
Swept area	707 sq. m
Length of blade	13.8 m

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 Research & Development unit of Enercon GmbH.

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

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S. No.	Year	Annual Emission Reduction tCO_2e
1	01/07/2007 – 30/06/2008	4782
2	01/07/2008 – 30/06/2009	4782
3	01/07/2009 – 30/06/2010	4782
4	01/07/2010 – 30/06/2011	4782
5	01/07/2011 – 30/06/2012	4782
6	01/07/2012 – 30/06/2013	4782
7	01/07/2013 – 30/06/2014	4782
8	01/07/2014 – 30/06/2015	4782
9	01/07/2015 – 30/06/2016	4782
10	01/07/2016 – 30/06/2017	4782
Total estimated reductions (tonnes of CO_2e)		**47820**
Total number of crediting years		**10**
Annual average over the crediting period of estimated reductions (tones of CO2 e)		**4782**

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

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The project has no recourse to any public funds. The Installations are financed through a mix of Loans and In-house equity.

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

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This is the only project of the Entrepreneur in the area. The project is not part of any other project run by the family.

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

SECTION B. Application of a baseline and monitoring methodology

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

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Project Type: I	Renewable energy project
Project Category: I D	Grid connected renewable electricity generation (Latest amended version 10– 23rd December 2006)
Reference:	Appendix B of the Simplified Modalities & Procedures for small scale CDM project activities.

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

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The project category is renewable electricity generation for a grid system, which is also fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind). Hence, the applicable baseline, as per Clause 29 of Appendix B, indicative simplified baseline and monitoring methodologies is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2/kWh) calculated in a transparent and conservative manner.

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

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

B.3. Description of the project boundary:

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

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

B.4. Description of baseline and its development:

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The project category is renewable electricity generation for a grid system, which is also fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind). Hence, the applicable baseline, as per ACM0002 is the kWh produced by the renewable generating unit multiplied by an emission factor (measured in kgCO2/kWh) calculated in a transparent and conservative manner.

Approach

The baseline methodology approach 48(a) called "existing actual or historical emissions, as applicable" has been applied in the context of the project activity. The approach selected in the baseline methodology checks the additionality of the project activity and determines the baseline emission factor for selected baseline scenario. In the absence of the CDM project activity, the electricity that is being sold to the grid by this project would have been generated by the operation of grid-connected power plants and by the additions of new generation sources, as reflected in the combined margin calculations.

Baseline Scenario

The total installed capacity of the power sector in India is 1,27,925 MW. Out of this 65.7% is contributed from thermal sources,26.4% by hydro,3% by nuclear and only 4.8% by all the other renewables. These figures prove that energy supply in India is highly dependent on Thermal sources.

In the northern region thermal and hydro are the major players in electricity generation with 52.09% and 33.43% of effective generation capacity respectively. Non-conventional including biomass and wind and excluding nuclear constitutes only 1.08% of the total.

For the year 2005-06 thermal contributed up to 72.93% of the electricity generated while the non-conventional sources excluding nuclear and hydro contributed only 0.28%.

In the state of Rajasthan thermal again is the leader in electricity generation with approx. 72% of the contribution with non-conventional sources excluding nuclear and hydro contributing 11% of the total. Thus clearly the baseline scenario is dominated by thermal sources at both national and regional level with almost negligible amount being contributed non-conventional sources.

Rajasthan, which is a part of Northern grid, is largely dependent on thermal generation. Like most other States in the country, the power system in Rajasthan is characterized by problems of frequent service interruptions, high system losses, unexpected voltage and frequency swings, restrictions on demand, poor cost recovery and heavy commercial losses. The State is also facing chronic power shortage, both in terms of peaking availability as well as energy availability, where the shortage (%) has gone up to 3.5 in 2005-06 from 0.80 in 2004-05. The State's power scenario is unlikely to improve in the next few years and shortages, both in terms of MW and energy, would continue till the end of the 10^{th} Five Year Plan.

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

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

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Justification for application of simplified methodologies to the project activity

The installed capacity of the project is 2.76 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 energy potential. Hence, the type and category of the project activity matches with I.D. as specified in Appendix B of the indicative simplified baseline and monitoring methodologies for small-scale CDM project activities.

The project has been envisaged to generate electricity from WEGs in Rajasthan and the generated electricity is being sold to the state electricity utility through an Energy Purchase Agreement. The generated electricity will be wheeled utilizing the available evacuation facility of Rajasthan Rajya Vidyut Prasaran Nigam Ltd. (the state electricity utility) and will be further supplied to distribution companies.

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

Since wind power is GHG emissions free, the wind power generated will save the anthropogenic green house gas (GHG) emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to carbon-di-oxide (CO_2) only. The project will displace the fossil fuel based grid electricity with the wind-based electricity, contributing to GHG reductions estimated to the tune of 4782 tCO_2e (tonnes of carbon dioxide equivalent) per year. With a 10 year crediting period, the project is expected to reduce approximately 47820 tCO_2e thereby generating equivalent amount of Certified Emission Reductions (CERs).

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 / first of its kind investment in the state of Rajasthan:

The wind farm is an initiative of the visionary Kalani Industries and is the first Private Wind farm set up in the state of Rajasthan. The first phase of the project was commissioned in March 2001. Given this background it is evident that the wind farm was an honest attempt to help with sustainable development of the Country by providing clean renewable energy from Wind turbines. The promoters of the wind farm showed their willingness to take the risk involved not only with application of new technology but also the risk involved in being the first private participants into the power generation area which had so far been dominated by the Public Sector. Details of this can be found on the following web link as read on 29th December 2005. http://static.teriin.org/energy/wind.htm (snapshot provided in annexure 5).

The generation guarantee given by the EPC contractor for each WEG in the project is 5.6lac kWh/annum. Till date, the average annual generation from the total project has been approximately 50.8 lac kWh as against the expected 67.2 lac kWh given from the generation guarantee.

The actual generation records based on the joint meter readings (JMR) taken by the state electricity utility and the representative of Kalani Industries Limited (the basis of billing) are reproduced below:

Operating period (2.76 MW)	**Net generation in kWh**	**Actual average PLF obtained**
June 2001 to December 2001	28, 99,950 kWh	20%
January 2002 to December 2002	61, 29,765 kWh	25%
January 2003 to December 2003	45, 98,730 kWh	19%
January 2004 to December 2004	55, 85,040 kWh	23%

January 2005 to December 2005	46, 66,275 kWh	19%
January 2006 to December 2006	44, 08,501 kWh	18%

The project activity has completed 5 complete calendar years and the table above clearly shows the actual PLF obtained from the total project. For all the operating years, the generation has been below the guaranteed production, and since year 2004, there has been a decreasing trend in the overall generation. While investing in the project, the proponent was not aware of the critically low PLF that could be faced by the project and took a voluntary decision to invest in the activity without much knowledge of the uncertainties. Clearly, the reduced generation obtained over the years has had a significant impact on the income stream of the project and CDM revenue may help to offset these losses to a considerable extent.

- The Ministry of Non-conventional Energy Sources (MNES- Government of India) has identified the following states for implementation of wind turbines namely Tamil Nadu, Karnataka, Gujarat, Madhya Pradesh, Maharashtra and Rajasthan. Except Rajasthan, in all other states the generation of electricity is happening because of coastal region / dual monsoons – main & receding. In the state of Rajasthan, the generation of electricity is possible through formation of winds because of temperature difference between day & night. The chance of inconsistent temperature profile is higher as compared to monsoons and thus there is a likelihood of higher generation fluctuations in the state of Rajasthan as compared to any other state.
- Till the financial year end 2000, only 2 MW installations had occurred in the state of Rajasthan in comparison to the much higher capacity installations ranging from 26 MW to 50 MW in Andhra Pradesh, Tamil Nadu and Maharashtra[1].

Thus the above can be summarised as:
- **First commercial project in the district of Jaisalmer.**
- Higher project risks as performance from turbines was uncertain.
- Strengthening of the local grid in Jaisalmer (contributing to tourism related activities within the city premises).

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.

[1] Directory on Indian Wind Power 2002

April 2003 – October 2004[2]:
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[3]:
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.

Additionality of the project should also be read in light of the following realities.

The state of Rajasthan has no Coal resources to generate power using conventional measures. It has to therefore rely upon imports from states to meet it power supply. Non-conventional projects are therefore a blessing to the state as they not only provide generation capacity but also support sustainable development in the state. However, given the seasonal nature of power generation and the cost analyses these projects are not commercially viable. Thus the establishment of such projects requires external cash flows, which would make them commercially viable and therefore lead to growth in the Sector.

The table below gives a clear understanding of the role of wind power in the State of Rajasthan. As can be seen the dependence of the State on Wind power generation is projected to grow. This growth is both a factor of the Government initiative and also of the Individual Investor, like the CDM project, who realize that it is essential to bring about a shift from Conventional Power resource to sustainable development through Non-Conventional sources like wind.

[2] Policy for promotion of electricity generation from wind, 2003. (Issued vide Energy Deptt. letter No.F.20(3)Energy/98/Pt.III dated 30.4.2003)

[3] Policy for promotion of electricity generation from non conventional energy sources. (Issued vide Energy Deptt. Letter No.F.20(4)Energy/2004 dated 25.10.2004

Year	Commission's estimate	Percentage of gross energy input to be purchased by utilities in Rajasthan from renewable energy sources proposed by	
		InWEA	RREC
2005-06	2.22%	1.46%	2.24%
2006-07	2.28%	2.01%	4.17%
2007-08	2.34%	2.77%	4.29%
2008-09	2.41%	3.82%	4.42%
2009-10	2.48%	5.26%	4.54%
2010-11	2.55%	7.26%	4.67%
2011-12	2.63%	10%	4.81%

Source: Rajasthan Electricity Regulatory Commission, Jaipur, 31st March, 2006

The CDM project also falls in the same segment and therefore is dependent on additional cash flows from sale of CERs to justify the feasibility of non-convention power generation.

Thus, the project was the first commercial installation in Rajasthan in the year 2001, carried out with the prime motive of generating electricity from clean energy sources coupled with sustainable development and growth of local economy, as against investments made in higher wind potential locations that would have generated better financial returns.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The project category is renewable electricity generation for a grid system, which is also fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind). Hence, the applicable baseline, as per Clause 29 of Appendix B, indicative simplified baseline and monitoring methodologies is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in 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 weighted 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."

Details of Baseline data:
Operating margin emission factor and Build Margin emission factor calculations:
Data of Operating and Build Margin for the three financial years from 2002 to 2005 has been obtained from -
'The CO_2 Baseline Database for the Indian Power Sector'
Ministry of Power: Central Electricity Authority (CEA)
Version 1.1
Dated: 21st December 2006
This database is prepared as per ACM0002 version 6.

Conservativeness

- The need to ensure conservativeness of calculations in situations of uncertainty is a fundamental principle in the CDM. Assumptions are conservative if they tend to reduce the number of emission reductions being credited to a CDM project activity. The following approaches and assumptions contribute to the conservativeness of the baseline database:
- The quality of station-level data was ensured through extensive plausibility testing and interaction with the station operators.
- In cases of data gaps at station level, standard data from CEA was used. For example, standard auxiliary power consumption was assumed for a number of gas-fired stations. Comparison with monitored values shows that these standard values are rather conservative, i.e. they lead to a somewhat lower heat rate and hence lower emissions than observed in many plants.
- Where required, the emission factors of thermal units were also derived from standard CEA values (design heat rate plus 5%). Again, these values are conservative (i.e. relatively low) compared to the heat rates observed in practice. See Section 4.3 for details on the build margin calculation.
- The fuel emission factors and oxidation factors used are generally consistent with IPCC defaults. For coal, the emission factor provided in India's Initial National Communication was used (95.8 t CO2/TJ on NCV basis), being somewhat lower than the IPCC default for sub-bituminous coal (96.1 t CO2/TJ).7

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

>>

a) EGy

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value applied	6 Million units
Justification of the choice of data or description of measurement methods	- Electricity measured is used in calculation of emission reductions. - The electricity is measured with the help of electronic meters both by the operator and the grid representative. - The data is measured hourly and recorded monthly

and procedures actually applied :	- 100% of the data is monitored - The data will be archived electronically
Any comment:	Electricity is supplied by the project activity to the grid. This is double checked by receipt of sales.

b) EFy

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

c) $EF_{OM,y}$

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Operating margin emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 1.1, 21st December 2006
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is used in calculation of emisson factor Ey - The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as indicated in the simple OM baseline method

d) $EF_{BM,y}$

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Build margin emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 1.1, 21st December 2006
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the	- This is used in the calculation of emission factor Ey.

choice of data or description of measurement methods and procedures actually applied :	- The emission factor is calculated. - The data is calculated yearly - 100% of the data is monitored - The data will be archived electronically
Any comment:	Calculated as indicated in the simple OM baseline method Specific emissions of all remaining units in the build margin were derived from conservative standard heat rate values. For units falling into the BM, the emissions were taken as equal to that of the respective station.

e) Net GEN

Data / Parameter:	Net Generation$_s$
Data unit:	GWh/annum
Description:	Electricity generation of each power source/plant
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 1.1, 21st December 2006
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is required for calculations of emissions from power producers. - The data is obtained from the power producers, dispatch centers or latest local statistics. - The data is measured yearly - 100% of the data is monitored - The data will be archived electronically.
Any comment:	In cases of data gaps at station level, standard data from CEA was used which were lower than the monitored levels.

f) Identification of power source / plant for the OM

Data / Parameter:	
Data unit:	Text
Description:	Identification of power source / plant for the OM
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 1.1, 21st December 2006
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- The data is estimated yearly - 100% of the data is monitored - The data will be archived electronically.
Any comment:	The Database includes all grid-connected power stations having an installed capacity above 5 MW in case of hydro and above 10 MW for other plant types. Data covers both power stations of public utilities and independent power producers (IPPs).

i) Identification of power source / plant for BM

Data / Parameter:	

Data unit:	Text
Description:	Identification of power source / plant for the BM
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 1.1, 21st December 2006
Value applied	Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- The data is estimated yearly - 100% of the data is monitored - The data will be archived electronically.
Any comment:	The Database includes all grid-connected power stations having an installed capacity above 5 MW in case of hydro and above 10 MW for other plant types. Data covers both power stations of public utilities and independent power producers (IPPs).

B.6.3 Ex-ante calculation of emission reductions:

>>

The baseline calculations are carried out as under:

The baseline is calculated using the combined margin approach. The baseline emission factor is calculated in the following steps:

Step 1: Calculation of Operating Margin Emission Factor
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 0.9984 tCO_2/MWh
For the year 2003-2004 the $EF_{OM,Y}$ is 0.9868 tCO_2/MWh
For the year 2004-2005 the $EF_{OM,Y}$ is 0.9743 tCO_2/MWh

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be **0.9865 tCO_2/MWh**.

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,Y}$
The $EF_{BM,y}$ is estimated as **0.5335 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 ($EF_{BM,y}$):

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

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

Baseline Emission factor: **0.8732 tCO_2/MWh**

Step 4 : Calculation of Baseline Emissions (BE_y)

Baseline emissions due to displacement of grid electricity are the product of the baseline emission factor (EF_y) calculated in step 3, times the electricity supplied by the project activity to the grid (EG_y), over the crediting period.

$$BE_y = EG_y . EF_y$$

Baseline Emissions = 4782 tCO2e/yr

Step 5 : Calculation of Emission Reductions (ER_y)

The emission reductions by the project activity during a given year y is the difference between Baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y).

$ERy = BE_y – PE_y – L_y$

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

Total project activity emissions, including leakage are zero for the project activity.
Therefore, Net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis. The project activity will evacuate approximately 6 Million units of renewable power annually to the power deficit Northern Region Grid and the annual emissions reductions are equal to 4782 tCO2.

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

>>

Year	**Estimation of baseline emissions (tonnes of CO_2e)**	**Estimation of project activity emission reductions (tonnes of CO_2e)**	**Estimation of Leakage (tonnes of CO_2e)**	**Estimation of emission reductions (tonnes of CO_2e)**
01/07/2007 – 30/06/2008	4782	0	0	4782
01/07/2008 – 30/06/2009	4782	0	0	4782
01/07/2009 – 30/06/2010	4782	0	0	4782
01/07/2010 – 30/06/2011	4782	0	0	4782
01/07/2011 – 30/06/2012	4782	0	0	4782
01/07/2012 – 30/06/2013	4782	0	0	4782
01/07/2013 – 30/06/2014	4782	0	0	4782
01/07/2014 – 30/06/2015	4782	0	0	4782
01/07/2015 – 30/06/2016	4782	0	0	4782
01/07/2016 – 30/06/2017	4782	0	0	4782
Total estimated reductions (tonnes of CO_2e)	**47820**	0	0	**47820**

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

>>

Data / Parameter:	EG_y
Data unit:	MWh/KWh
Description:	Electricity wheeled to the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value of data	6 Million Units
Description of measurement methods and procedures to be applied:	- The electricity is measured with the help of electronic meters at the wind farm substation. - The data is measured hourly and recorded monthly - 100% of the data is monitored - The data will be archived electronically
QA/QC procedures to be applied:	This data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to cross check this data and hence ensure consistency.
Any comment:	Electricity is sold to the grid through the project activity. This is double checked by receipt of sales.

B.7.2 Description of the monitoring plan:

>>

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

Monitoring Plan

The project proponent has undergone a comprehensive operation and maintenance agreement with Enercon India Limited on 25/06/2001. The organizational setup implemented by them for the monitoring of generation due to the project activity is provided as Annex 4. The regular operation and maintenance activities undertaken by the contractor are as follows:

1 Routine Maintenance Services

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

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

2 Security Services

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

3 Management Services

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

4 Technical Services

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

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

Metering of the generated electricity:
The generated electricity from the windmills is evacuated at the state electricity utility for the complete project lifespan. The promoter has entered into a power purchase agreement (PPA) with the state electricity utility. Thus throughout the project cycle (crediting period) the electricity generated from the project will be monitored by both the project proponent and the SEB.

1. At the state utility (RRVPNL), recording of the electricity fed to the grid will be carried out jointly at the incoming feeder. Machines for sale to utility will be connected to the feeder.
2. The primary monitoring system is at the project site where, the generated electricity before entering into the grid, at the grid interconnection point, is measured by digital, sealed meters, on a monthly basis. There are two meters connected here, the main meter and the check meter. For all practical purposes, the readings from the main meter shall be referred to for generation records. These meters are calibrated for accuracy and dependability on regular intervals by the RRVPNL (as per the PPA). The last calibration was conducted in February 2006 for both the Main and Backup metering equipment. Records are available with the proponent.
3. The joint measurement is carried out on the first day of every month in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading, which forms the basis of payment by the SEB to the proponent.
4. In the event that the main metering system is not in service as a result of maintenance, repairs or testing, then the backup metering system, or the check meter, shall be used for generation recordings.
5. The secondary monitoring system will provide a backup (fail-safe measure) in case the primary monitoring is not carried out/ not functioning adequately, and would be done at the individual WEG level. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the wind farm through a fibre optic cable network. The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

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

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

>>

Date: 02/04/2007

Senergy Global Private Limited - Not a Project Participant
9th Floor, Eros Corporate Tower,
Nehru Place
New Delhi 110 019
Ph: +91 11 4180 5501/02
Fax: +91 11 4180 5504

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

05/01/2001

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

>>

20 Years 0 months

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

C.2.1. Renewable crediting period

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

>>

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:

>>

01/07/2007 (or date of project registration)

C.2.2.2. Length:

>>

10 Years 0 months “without renewal”

SECTION D. Environmental impacts

D.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 14th September 2006, specific activities are required to undertake environmental impact assessment studies. These can be viewed at the following link:
http://envfor.nic.in/legis/eia/so1533.pdf

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.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

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

SECTION E. Stakeholders' comments

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

>>

The site selected for implementation of the project activity has been categorized as Gochar Bhumi – Common Land. Thus, there is no human occupancy within 2 km of the occupied land. Being barren and devoid of any inhabitation, no stakeholder survey could be carried out in the immediate surroundings of the wind farm.

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

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

E.2. Summary of the comments received:

>>

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

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

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Kalani Industries Limited
Street/P.O.Box:	Treasure Island
Building:	11 M.G Road
City:	Indore
State/Region:	Madhya Pradesh
Postfix/ZIP:	452 001
Country:	India
Telephone:	+91 731 420 3008/3009
FAX:	+91 731 252 7769
E-Mail:	mail@kalanigroup.com
URL:	http://www.kalanigroup.com
Represented by:	P S Kalani
Title:	Chairman
Salutation:	Mr.
Last Name:	Kalani
Middle Name:	Swaroop
First Name:	Prem
Department:	
Mobile:	+91 9826081163
Direct FAX:	+91 731 420 3010
Direct tel:	+91 731 420 3006/3007
Personal E-Mail:	mail@kalanigroup.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

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Annex 3

BASELINE INFORMATION

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**1.1**
DATE	**21 Dec 2006**
BASELINE METHODOLOGY	**ACM0002 / Ver 06**

EMISSION FACTORS

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.72	0.73	0.74	0.71	0.71
East	1.09	1.06	1.11	1.10	1.08
South	0.73	0.75	0.82	0.85	0.79
West	0.90	0.92	0.90	0.90	0.92
North-East	0.39	0.38	0.37	0.36	0.30
India	0.82	0.83	0.85	0.85	0.84

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.72	0.73	0.74	0.71	0.72
East	1.09	1.03	1.09	1.08	1.05
South	0.74	0.75	0.82	0.85	0.79
West	0.90	0.92	0.90	0.90	0.92
North-East	0.39	0.38	0.37	0.36	0.46
India	0.82	0.83	0.85	0.85	0.84

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.98	0.98	1.00	0.99	0.97
East	1.22	1.22	1.20	1.23	1.20
South	1.02	1.00	1.00	1.01	1.00
West	0.98	1.01	0.98	0.99	1.01
North-East	0.67	0.66	0.68	0.62	0.66
India	1.02	1.02	1.02	1.03	1.03

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.98	0.98	1.00	0.99	0.98
East	1.22	1.19	1.17	1.20	1.17
South	1.03	1.00	1.00	1.01	1.00
West	0.98	1.01	0.98	0.99	1.01
North-East	0.67	0.66	0.68	0.62	0.81
India	1.01	1.02	1.01	1.02	1.02

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.72

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North					0.53
East					0.90
South					0.72

West	0.78
North-East	0.10
India	0.70

West	0.78
North-East	0.10
India	0.70

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.76	0.76	0.77	0.76	0.75
East	1.06	1.06	1.05	1.07	1.05
South	0.87	0.86	0.86	0.86	0.86
West	0.88	0.89	0.88	0.88	0.90
North-East	0.39	0.38	0.39	0.36	0.38
India	0.86	0.86	0.86	0.86	0.86

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	0.76	0.76	0.77	0.76	0.75
East	1.06	1.05	1.04	1.05	1.04
South	0.87	0.86	0.86	0.86	0.86
West	0.88	0.89	0.88	0.88	0.89
North-East	0.39	0.38	0.39	0.36	0.45
India	0.86	0.86	0.86	0.86	0.86

GENERATION DATA

Gross Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	144,292	151,185	155,385	165,735	168,438
East	58,936	64,048	66,257	75,374	85,776
South	128,983	131,902	136,916	138,299	144,086
West	162,329	165,805	177,399	172,682	183,955
North-East	5,314	5,292	5,811	5,880	7,904
India	499,854	518,231	541,766	557,970	590,158

Net Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	135,230	141,415	144,741	155,043	157,290
East	53,350	58,097	59,841	68,428	77,968
South	121,144	123,612	127,780	128,165	134,691
West	150,412	153,125	164,448	159,780	170,726
North-East	5,185	5,169	5,669	5,758	7,776
India	465,321	481,417	502,480	517,174	548,451

20% of Net Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	27,046	28,283	28,948	31,009	31,458
East	10,670	11,619	11,968	13,686	15,594

EMISSION DATA

Absolute Emissions Total (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	97,863,848	102,743,113	106,777,065	109,980,786	112,199,697
East	58,025,890	61,436,757	66,595,529	75,515,998	83,956,860
South	88,728,956	92,484,478	104,180,940	108,406,007	105,960,087
West	135,147,507	141,597,621	148,313,340	144,127,175	157,781,065
North-East	2,009,681	1,976,535	2,090,087	2,088,985	2,294,430
India	381,775,882	400,238,503	427,956,961	440,118,951	462,192,140

Absolute Emissions OM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	97,863,848	102,743,113	106,777,065	109,980,786	112,199,697
East	58,025,890	61,436,757	66,595,529	75,515,998	83,956,860
South	88,728,956	92,484,478	104,180,940	108,406,007	105,960,087
West	135,147,507	141,597,621	148,313,340	144,127,175	157,781,065
North-East	2,009,681	1,976,535	2,090,087	2,088,985	2,294,430
India	381,775,882	400,238,503	427,956,961	440,118,951	462,192,140

Absolute Emissions BM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					17,108,583
East					14,303,611

South	24,229	24,722	25,556	25,633	26,938
West	30,082	30,625	32,890	31,956	34,145
North-East	1,037	1,034	1,134	1,152	1,555
India	93,064	96,283	100,496	103,435	109,690

South	19,525,581
West	26,881,491
North-East	206,514
India	78,025,780

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

	2000-01	2001-02	2002-03	2003-04	2004-05
North	25.9%	25.7%	26.1%	28.1%	26.8%
East	10.8%	13.4%	7.5%	10.3%	10.5%
South	28.1%	25.5%	18.3%	16.2%	21.6%
West	8.2%	8.5%	8.2%	9.1%	8.8%
North-East	42.3%	42.1%	45.8%	41.8%	55.4%
India	19.2%	18.9%	16.3%	17.1%	18.0%

Net Generation in Operating Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	100,189	105,076	106,940	111,449	115,151
East	47,570	50,308	55,377	61,378	69,746
South	87,100	92,085	104,441	107,396	105,584
West	138,071	140,173	150,889	145,264	155,731
North-East	2,992	2,995	3,071	3,350	3,469
India	375,923	390,638	420,718	428,838	449,681

Net Generation in Build Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					32,067
East					15,818
South					27,195
West					34,587
North-East					2,052
India					111,718

20% of Gross Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North	28,858	30,237	31,077	33,147	33,688
East	11,787	12,810	13,251	15,075	17,155
South	25,797	26,380	27,383	27,660	28,817
West	32,466	33,161	35,480	34,536	36,791

IMPORT DATA

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

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

Share of Net Imports (% of Net Generation)

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

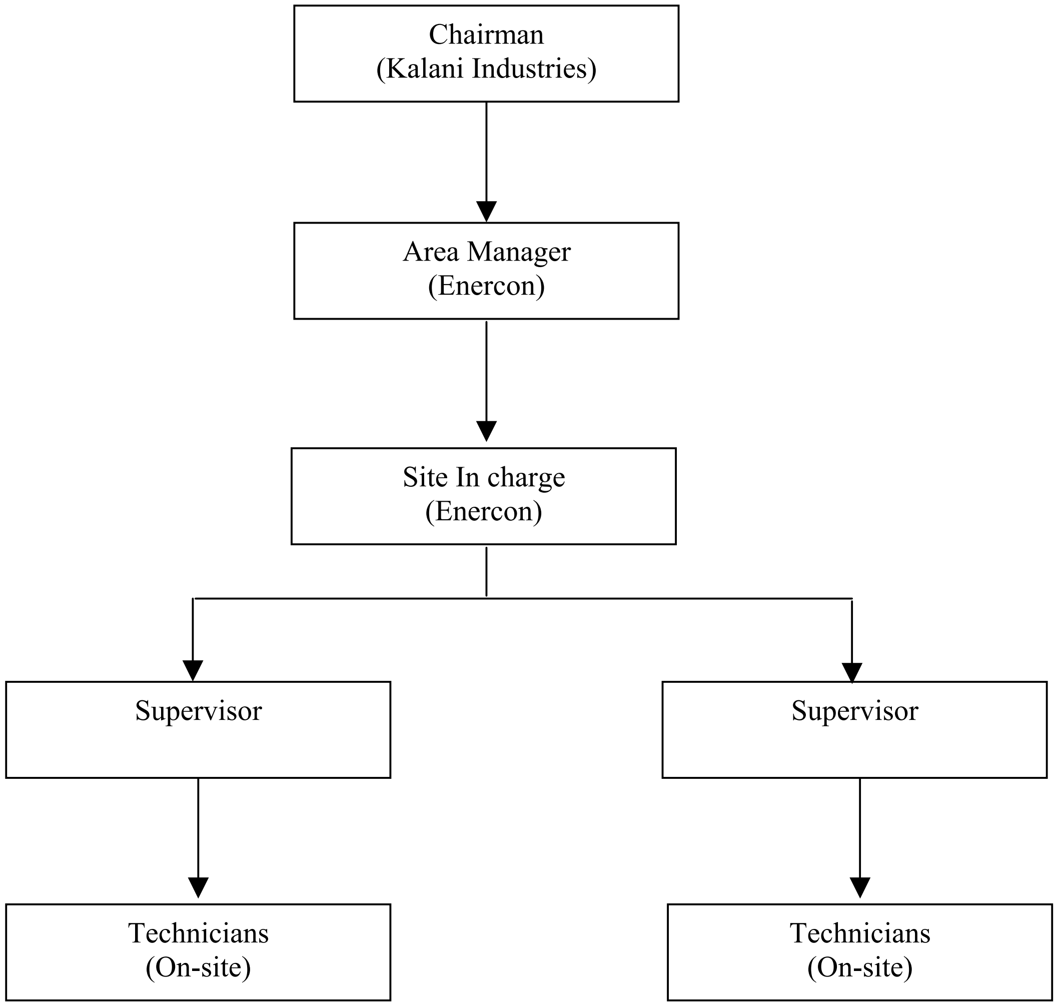
North-East	1,063	1,058	1,162	1,176	1,581
India	99,971	103,646	108,353	111,594	118,032

Gross Generation in Build Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05
North					34,034
East					17,239
South					29,052
West					36,831
North-East					2,067
India					119,222

Annex 4

MONITORING INFORMATION



Annex 5

TERI Report, March 2001

Blow, winds, blow.

March 2001

The wind, one of nature's most abundant resources, is a form of solar energy. It is renewable, nonpolluting, universally available, and when used as fuel, free. In short, wind is a stream of moving air molecules circulated by the sun's unequal heating of the earth's surface (*Naar John, The New Wind Power, Middlesex, 1982, p33*). The author goes on to define the great 'power' of the wind. The power in the wind is the sum total of all the moving molecules of air, and according to the law of fluid dynamics, is proportional to the speed of the wind. The amount of air in constant circulation around the earth is estimated to be 5 quadrillion tonnes. If we could extract 10% of the global energy potential of the wind, we would comfortably meet the world's energy requirements from that source alone.

Wind power installation is the latest mantra in Maharashtra's endeavour to improve the power generation scenario. The Maharashtra government, which has many firsts to its credit in the infrastructure sector, is keen to make a mark in the development of unconventional energy. As of now, the state is lagging far behind Gujarat and Tamil Nadu, which have an installed capacity of 168.405 MW and 75.970 MW capacity, respectively,in this form of energy. There are 21 sites for wind farm projects in Maharashtra. In Satara, the projects are to the tune of 72.615 MW, with a total investment of Rs 350 crore (*The Observer of Business and Politics, 3 July 2000*)

The Rajasthan government is trying to tap the potential of the desert and harness wind energy to tackle the state's power problems. Last year, REDA (Rajasthan Energy Development Agency), a wholly-owned unit of the state government, installed a 2 MW demonstration project at Amarsagar in Jaisalmer district. The project has so far produced seven lakh units of electricity. In the next three years, the state government expects to attract investment of Rs 500 crore in the private sector for the generation of 100 MW of electricity from wind energy. It has already received 10 proposals for producing 236 MW of power. High speed wind is available in the desert for most part of the year and with the success of the Amarsagar project, the government is planning capacity addition with participation from the private sector. Asian Wind Turbine of Chennai is expected to set up 2.25 MW capacity wind energy units at Devgarh in Chittorharh district. It will have three Denmark made generators of 750 KW each (*The Times of India, 7 July 2000*)

Wind energy is one of the clean, renewable energy sources that hold out the promise of meeting a significant portion of energy demand in the direct, grid-connected modes as well as stand-alone and remote 'niche' applications (water pumping, desalination, and telecommunications) in developing countries like India. It is estimated that wind power in many countries is already competitive with fossil power (capital cost, 40 million rupees per MW) when external/ social costs are also accounted for. International organizations estimate that wind power will become competitive in a short time frame (2005/2010)) with both fossil and nuclear in a narrow economic sense, without taking into account its competitive advance in external or social costs. Two perspectives form the economics of

grid-connected wind power. The first is that of public authorities or energy planners, making assignments of different energy sources. Here the focus is on levelized cost in, for example, Rs/kWh. Such calculations do not include factors determined by society or governments, such as inflation or taxation. The second perspective is that of the private or utility investor, where inflation, interest rates, the taxation system, amortization period, etc. must be included. Consequently, the economics of wind energy differs greatly from country to country. Here the focus is on cash flow in each project, on payback time, and present value of the investment. The generation cost from wind energy is then basically determined by the following parameters: total investment cost, which comprises cost of wind turbines, project preparation costs, and cost of the infrastructure; operation and maintenance cost; average wind speed at the particular site; availability; technical lifetime; amortization period; and real interest rate.

By the end of March 1999, over 1025 MW of grid-connected wind farms were operational; installed capacity additions during 1994–95 and 1995–1996 being about 200–250 MW annually. The total generation from wind power projects, including demonstration and commercial projects, has now reached 3.7 billion units. The completed projects include about 52 MW of demonstration wind farm projects installed by the government during the late 1980s and early 1990s. The current optimism with regard to wind power generation owes itself largely to the demonstration effect of such wind farms. These initial concerted efforts/actions were supported by multilateral and bilateral funding agencies, particularly DANIDA (Danish International Development Cooperation Agency).

India is sitting on huge wind power potential, estimated at 45 000 MW, which can be developed only by a 'performance-driven' long-term wind power policy, say energy experts. Currently, investments in wind power in the country are incentive-driven. Many corporate houses, including Mohan Breweries and Distilleries Ltd, IPCL (Indian Petro Chemicals Ltd), and Ajanta Clocks Ltd have availed themselves of fiscal incentives and set up wind power plants. The total wind power capacity installed in the country is estimated at 1080 MW (as on 31 March 1999), of which 1025 MW is in the private sector and 55 MW as demonstration projects. The largest installed capacity, 758 MW, is in Tamil Nadu. Investments in wind power are being provided with a benefit of up to 100% depreciation (*The Financial Express, 30 April 2000*)

Wind power potential is steadily making its presence felt, with almost all the new wind power projects coming up in the private sector, confining the government's role to that of a catalyst, providing technical guidance and financial assistance. Of the current installed capacity, over 970 MW has been funded through private sector investments. Funds from the World Bank and the Global Environmental Facility, with cofinancing from DANIDA, have been used (through the Indian Renewable Energy Development Agency) to provide credit for about 250 MW. After a period of explosive growth that pushed India's wind energy utilization up to the world's third highest, investment fell sharply from mid-1996 to the end of 1998.

The Rs 220-crore Suzlon Energy Ltd, a manufacturer of wind turbine generators, has decided to diversify into wind energy generation. Mr Harish Shah, Director (Finance), said the company, which had Sudwind Energiesysteme GmbH, Germany, as its technology partner, was reworking its strategy whereby the next three years would witness the company getting into generation as a strategic business area. As on date, Suzlong has sold wind turbines of 350 kW capacity each with a total installed capacity of 90.14 MW. The

maximum number of wind energy plants sold till date have been in Maharashtra at 66.50 MW (*The Hindu Business Line, 8 September 2000*)

Rajasthan's wind power policy has started attracting private entrepreneurs. The Indore-based Kalani Industries Ltd has become the first company to be permitted by the state government to set up a wind power project. The company plans to set up a 3-MW power project in the first phase and increase its capacity to 25 MW. Estimated to cost Rs 15 crore, the wind mill is likely to start generating power by March 2001. Four companies - the Rajasthan State Mines and Minerals Ltd, the Suzlon Energy Ltd of Ahmedabad, the Enercon (India) Ltd of Mumbai, and the Hindustan Zinc Ltd - are in race to set up wind farms (*The Business Standard, 11 January 2001*).

The TERI opinion

The Government of India has an active wind power policy, since 1992, which has led to India becoming the fifth country in the world in wind power installation (approximately 1300 MW). The major drive for investment in wind power is for tax concessions and wheeling of electricity, either for captive use by the process industries or for third-party sales. Tax incentives given by the government is more towards investment than towards performance. This is evident by the size of individual wind projects. Though some governments at the state level have started favouring quasi performance-linked incentives, they are either facing problems or the projects have not formalized.

The call for the day is to have large scale wind power projects in an IPP (independent power producer) mode, which can lead to large-scale penetration of wind energy. But such projects have not yet been tried out in India, and investors are hesitant for the following reasons.

- Higher risk perception
- The project viability is based on energy generation than on tax benefits
- Such scale of projects are not yet tried out in India
- Higher interest rate

The interest rate in vogue for wind projects without tax benefits leads to an IRR (internal rate of return) than WACC (weighted average cost of capital) and DSCR (debt service coverage ratio) of more than 2.

The above barriers can be overcome by formulating a proper policy and institutional framework, along with performance linked incentives. In addition, adequate capacity building & awareness generation has to be induced at the operational level (regulators, utilities etc.). Further, capital flow from clean climate instruments can also play an instrumental role in propagation of such projects.