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

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Annexes

Appendices

SECTION A. General description of project activity

A.1. Title of the project activity:

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22.5 MW grid connected wind farm project by RSMML in Jaisalmer, India.

Version 03

Date: 15/12/2007

A.2. Description of the project activity:

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Description

RSMML was constituted under Companies Act 1956 and is a Government of Rajasthan enterprise. The project activity, promoted by Rajasthan State Mines and Minerals Limited (RSMML), aims at substituting energy supplied by the state with renewable energy for captive purposes and sale to Ajmer DISCOM. The project activity is being undertaken to harness the available wind potential in Jaisalmer District vis-à-vis development of local economy. The project activity will establish 6 x 1250 kW (7.5MW) Suzlon Wind Energy Generators (WEG) and 25x600 kW (15 MW), Vestas RRB WEGs, totalling to 22.5 MW at Pohra village and Baramsar/ Pohra village respectively in Jaisalmer district of Rajasthan. These WEGs are interconnected to 33 KV end of 220 KV Grid Sub Station (GSS) Amarsagar at Jaisalmer.

Of the total, 90% of electricity generated by 6 No.s of 1250kW (7.5 MW) Suzlon make WEGs at Pohara village will be sold to Ajmer DISCOM and the balance 10% will be utilized for captive use. Whereas 40% electricity generated by the 25 No.s of 600 kW (15 MW) Vestas RRB WEGs at Baramsar/Pohra village will be sold to Ajmer DISCOM and rest 60% would be utilized for captive use.

Purpose of the project activity

The main purpose of the project activity is to generate electricity from wind power, a renewable source of energy for partly captive purposes and partly sale to the grid.

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

- To contribute to climate change mitigation efforts
- To enhance the commercialisation of wind turbines in the region
- To contribute to the sustainable development of the region, socially, environmentally and economically
- To reduce the prevalent regulatory risks for this wind power project trough revenues from the CDM

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 northern 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 1061.4 Million INR 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.*

Harnessing the wind is one of the cleanest, most sustainable ways to generate electricity. Wind power produces no toxic emissions and none of the heat trapping emissions that contribute to global warming, thereby leading to reductions in specific 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 up gradation of technological base.*

The project activity leads to the promotion of Suzlon Wind Electric Generators (WEGs) and Vestas WEG's in the region, demonstrating the success of wind based renewable energy generation, thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

The project is an attempt to provide a renewable source of electricity and at the same time help bridge the gap between the ever-increasing power deficits in the Northern Grid.

A.3. Project participants:

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Table 1: Project Participants

Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
India (Host Country)	Rajasthan State Mines and Minerals Limited. (Public entity)	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 project activity:

A.4.1. Location of the project activity:

>>The Wind farms are located in the State of Rajasthan in the North of India. They are clustered in two sites, one near the village of Pohra and the other at Baramsar Village in the District of Jaisalmer.

A.4.1.1. Host Party(ies):

>>Host Country: India

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

>>State: Rajasthan
District: Jaisalmer

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

>>
Villages: Pohra and Baramsar.

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

>>
The wind farm is located at villages Pohra and Baramsar at District Jaisalmer in the state of Rajasthan. The location has been chosen based on the available average wind power potential in the area established by the micrositing studies done by the Suzlon Energy Limited and Vestas RRB Limited, who are the two suppliers of WEGs.
The project area falls in the district of Jaisalmer and is situated in the villages of Pohra and Baramsar. The location details have been given as below. The nearest airport is at Jodhpur which is 308 km from Jaisalmer.

Table 2.Latitude and longitude of Pohra and Baramsar

Village	Latitude	Longitude	MSL
Pohra	27^0 02" N	70^0 57" E	150-325 m
Baramsar	26^0 35" N	70^0 35" E	279 m

Table 3: Particulars of lands demised to Suzlon Energy Limited

Sr.No	WEG No.(SEL)	No. of WEGs	Capacity	Date of comissioning	Village	Khasra Number
1	J-91	1	1250 kW	25.03.2006	Pohra	443
2	J-92	1	1250 kW	25.03.2006	Pohra	455
3	J-93	1	1250 kW	25.03.2006	Pohra	451
4	J-94	1	1250 kW	25.03.2006	Pohra	451
5	J-95	1	1250 kW	25.03.2006	Pohra	450
6	J-99	1	1250 kW	25.03.2006	Pohra	458

Table 4: Details of Vestas RRB WEG's

Sr.No	WEG No.(Vestas RRB)	No. of WEGs	Capacity	Date of comissioning	Village	Khasra Number
1	B1	1	600 kW	30.09.2006	Baramsar	1103
2	B2	1	600 kW	30.09.2006	Baramsar	1103
3	B3	1	600 kW	30.09.2006	Baramsar	1104
4	B4	1	600 kW	30.09.2006	Baramsar	1101
5	B5	1	600 kW	30.09.2006	Baramsar	1104
6	B6	1	600 kW	30.09.2006	Baramsar	1105
7	B7	1	600 kW	30.09.2006	Baramsar	1106
8	B8	1	600 kW	30.09.2006	Baramsar	1195
9	B9	1	600 kW	30.09.2006	Baramsar	1195
10	B10	1	600 kW	30.09.2006	Baramsar	1062
11	B11	1	600 kW	30.09.2006	Baramsar	1062
12	B12	1	600 kW	30.09.2006	Baramsar	1061
13	B13	1	600 kW	30.09.2006	Baramsar	1106
14	B14	1	600 kW	30.09.2006	Baramsar	1121
15	B15	1	600 kW	30.09.2006	Pohra	1084
16	B16	1	600 kW	30.09.2006	Pohra	1084
17	B17	1	600 kW	30.09.2006	Pohra	1084
18	B18	1	600 kW	30.09.2006	Pohra	1083
19	B19	1	600 kW	30.09.2006	Pohra	1078
20	B20	1	600 kW	30.09.2006	Pohra	1077
21	B21	1	600 kW	30.09.2006	Pohra	1077
22	B22	1	600 kW	14.10.2006	Pohra	1078

23	B23	1	600 kW	14.10.2006	Pohra	1078
24	B24	1	600 kW	14.10.2006	Pohra	1071
25	B25	1	600 kW	14.10.2006	Pohra	1013

Figure 1: Location of Rajasthan in India

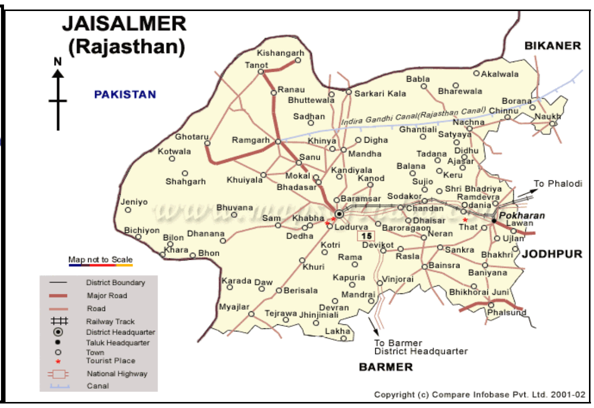

Figure 2: Rajasthan Map Jaisalmer district

Figure 3: District map of Jaisalmer showing the villages

A.4.2. Category (ies) of project activity:

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The project activity is considered under Zero emissions grid-connected electricity generation from renewable sources, the project activity has a capacity more than 15 MW and generates electricity in excess of 15 GWh per year (limit for small scale project). Therefore, as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies', the project activity may principally be categorized in:

Scope Number: 1
Sectoral Scope: Energy Industries (renewable/non-renewable sources).

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

>>
Technology

In wind energy generation, kinetic energy of the wind is converted into mechanical energy and subsequently into electrical energy. Wind turbines capture the wind's energy with two or three propeller-like blades, which are mounted on a rotor, to generate electricity. The turbines sit high atop towers, taking advantage of the stronger and less turbulent wind at 100 feet (30 meters) or more above ground. When the wind blows through the blades of the windmill, a pocket of low-pressure air forms on the downwind side of the blade. The low-pressure air pocket then pulls the blade towards it, causing the rotor to spin. The rotor turns the shaft that further spins the connected generator. The spinning of this generator produces the required electricity.

The technology is a clean technology since there are no GHG emissions associated with the electricity generation. Supply of wind generated electricity to the grid will replace the fossil fuel based generated electricity in the grid, thus lead to reduction of GHG emissions. The project installs Suzlon-make WEGs of individual capacity 1.25 MW and Vestas make WEG's of individual capacity of 600 kW.

The salient features of 1.25 MW Suzlon WEGs is as follows:

1. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (Cp)
2. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
3. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
4. Intelligent Control - Next generation technologies applied by extensive operational experience maximizes yield
5. Maximum Power Factor - High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99
6. Climatic Shield - Hermetically sheltered, advanced over-voltage and lightning protection system
7. Unique Micro-Pitching Control - Unmatched fine pitching with 0.1° resolution to extract every possible unit of power
8. Grid-friendly - Grid friendly design generates harmonics-free pure sinusoidal power
9. the following credentials of the vendor ensures quality:
    - ISO 9001:2000 for Design, Development, Manufacture and Supply of Wind Turbines
    - ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
    - Type certification by Germanischer Lloyd, Germany
    - Approved by the Ministry of Non-Conventional Energy Sources (MNES)

The salient features of 600 kW WEGs of Vestas RRB is as follows:

1. Are based on sturdy and proven design.
2. Specially suited for Indian climatic conditions.
3. Incorporate highly reliable components ensuring life time trouble free operation.
4. WEGs are equipped with microprocessor-controlled pitch regulation, ensuring continuous and optimal adjustment of the angles of the blades in relation to the prevailing wind.
5. Have an integrated power transmission mechanism.
6. Carefully designed electrical system to withstand erratic grid conditions.
7. A microprocessor based fully automatic control system.
8. Have an assured quality.
9. Able to deliver high plant load factors even in low/medium wind regimes due to the design parameters incorporated into them.
10. ISO 9001:2000 & ISO 14001:2004 certifications - Vestas RRB India Ltd. has been accredited with ISO 9001-2000 & ISO 14001:2004 certification for Manufacture, Installation and Servicing of Wind Electric Generators from Det Norske Veritas (DNV), Netherlands.

The detailed technical description of the turbines used in the project activity is furnished in Annex 5.

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

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

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Table 5: Estimated amount of Emission Reductions

S. No.	Years	Annual estimation of emission reductions in tonnes of CO2 e
1	2008-09	28291
2	2009-10	28291.
3	2010-11	28291
4	2011-12	28291
5	2012-13	28291
6	2013-14	28291
7	2014-15	28291
8	2015-16	28291
9	2016-17	28291
10	2017-18	28291
Total estimated reductions (tonnes of CO_2e)		282910
Total number of crediting years		10
Annual average over the crediting period estimated reductions (tonnes of CO2 e)		**28291**

A.4.5. Public funding of the project activity:

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The project has no recourse to any public funds.

SECTION B. Application of a baseline and monitoring methodology

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

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ACM0002 – "Approved Consolidated Baseline Methodology for grid connected electricity generation from renewable sources", Version 06 (19th May, 2006), Sectoral scope: 1.

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html).

The additionality of the project has been justified using the UNFCCC approved, "Tool for the demonstration and assessment of additionality".
Reference: Version 04, EB 36
http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

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

>>
The applicability criteria in the methodology ACM0002, "Consolidated baseline methodology for grid connected electricity generation from renewable sources" is as per the following:

" *This methodology is applicable to grid-connected renewable power generation project activities under the following conditions:*
• *Applies to electricity capacity additions from:*
• *Run-of-river hydro power plants; hydro power projects with existing reservoirs where the volume of the reservoir is not increased.*
• *New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m2.1*
• *Wind sources;*
• *Geothermal sources;*
• *Solar sources;*
• *Wave and tidal sources.*
• *This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;*
• *The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and*
• *Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities"(ACM0001).*
This baseline methodology shall be used in conjunction with the approved monitoring methodology ACM0002 ("Consolidated monitoring methodology for grid-connected electricity generation from renewable sources")."

Grid connected electricity generation from renewable source (wind energy) has been considered as the present project activity,

- For which geographic and system boundaries for the relevant grid (Northern) can be clearly defined and information on the characteristics of the grid is also available.
- The project activity also does not involve switching from fossil fuels to renewable energy at the project activity site.
- This baseline methodology has been used in conjunction with the approved monitoring methodology ACM0002 ("Consolidated monitoring methodology for grid-connected electricity generation from renewable sources").

Therefore ACM0002, "Approved Consolidated Baseline Methodology for grid connected electricity generation from renewable sources", Version 06 (19^{th} May, 2006) is applicable to this project.

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

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The project boundary is defined as the notional margin around a project within which the project's impact (in terms of GHG reduction) will be assessed. According to ACM0002 the spatial extent of this project activity includes the project site and all the power plants connected physically to the electricity system that the CDM power project is connected to. Thus, it essentially is the zone encompassing the WEG installations to the nearest grid interconnection point, which is available at a distance of 1.5 km from the project site.

Table 6: Main Emission Sources

	Source	Gas		Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	On-site fossil fuel consumption due to the implementation of the project	CO_2	Excluded	This source is not required to be estimated under ACM0002 for wind energy projects.
		CH4	Excluded	Estimates not required
		N2O	Excluded	Estimates not required

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. The Electricity Act of 2003 envisaged reorganisation of the state electricity boards (SEB's) into separate companies handling power generation, power transmission and electricity distribution. Many states have already implemented this reform Rajasthan being one of them.

Description of the project boundary:

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 7: States connected to different regional grids[1]

Northern	Western	Southern	Eastern	North-Eastern
Chandigarh	Chhattisgarh	Andhra Pradesh	Bihar	Arunachal Pradesh
Delhi	Gujarat	Karnataka	Jharkhand	Assam
Haryana	Daman & Diu	Kerala	Orissa	Manipur
Himachal Pradesh	Dadar & Nagar Haveli	Tamil Nadu	West Bengal	Meghalaya
Jammu & Kashmir	Madhya Pradesh	Pondicherry	Sikkim	Mizoram
Punjab	Maharashtra	Lakshadweep	Andaman-Nicobar	Nagaland
Rajasthan	Goa			Tripura
Uttar Pradesh				
Uttaranchal				

The proposed project falls under the Northern Grid in the state of Rajasthan, which is currently facing huge Demand Supply deficit. Since the CDM project would be supplying electricity to the Northern regional grid this regional grid has been taken as project boundary. The northern regional grid is largest in geographical area amongst the five region. It serves nines states/UT's and boasts off four central generating companies and one central transmission utility. Power is exchanged with neighbouring regions on an opportunity basis. Inter regional import increased by 20.36% in 2006. Electrically the power system of northern region comprises two major generation pockets and one load centre .The generation pockets are the coal based thermal power stations which are located in the south-eastern part of the region and the hydro stations at the north/north-west part of the region in the Himalayan belt. The load centre is in central part of the region compromising Delhi, Haryana, Punjab, Western U.P and Northern Rajasthan.

[1] Source: http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf

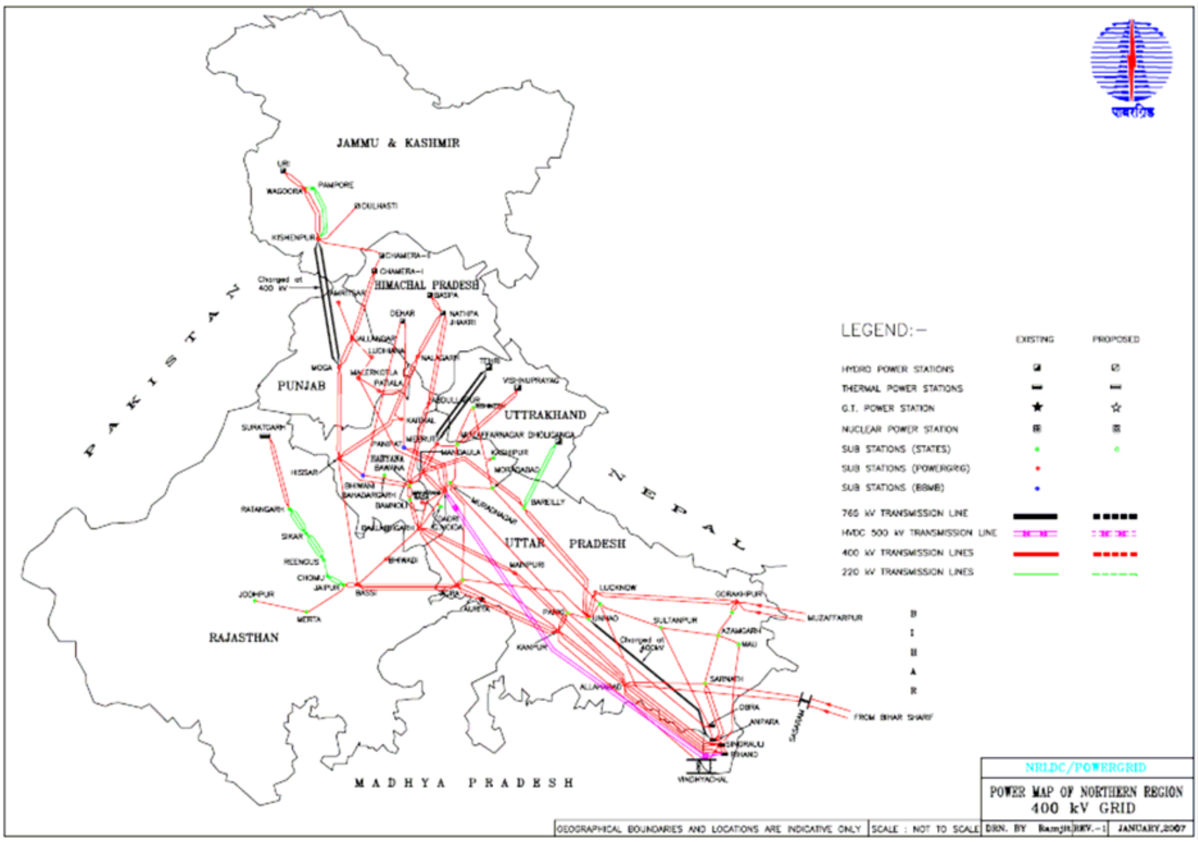

Figure 4: Power Map of the Northern Region Grid

Source: Annual Grid Report NRLDC 2005-06.

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

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The baseline for the project has been identified according to ACM0002 (version 06) where in the baseline for the project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

> "Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations"

.

The state of Rajasthan, at present is drawing up electricity from the Northern Grid to meet its energy demands. Therefore the baseline considered for this project is the emissions from the northern regional grid. The Northern Grid electricity is energy intensive and bears a small proportion of power being generated from clean energy sources, like wind, hydro, biomass etc. For the baseline, it will be unrealistic to assume that in the near future this share of power coming from the cleaner sources will increase manifold, thereby decreasing the baseline emissions considerably, because investment in cleaner technologies involves large financial capital and still suffer from technological problems which makes it unfeasible to introduce on a massive scale.

Description of the baseline scenario

The present total installed capacity of the power sector in India is 13,239 MW. Out of this 65% is contributed from thermal sources, 27.2% by hydro, and 2.9% by nuclear and only 5.86% by all the other renewables. (Source: http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf)These figures prove that energy supply in India is highly dependent on Thermal sources (Fig 5).

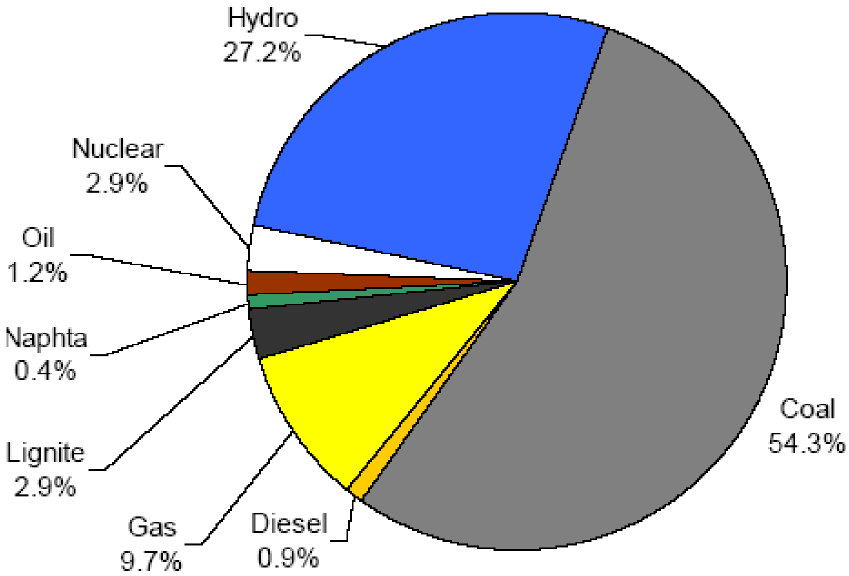


Figure 5: Break up of the sources of electricity generation in the country

In the northern region, thermal and hydro are the major sources of electricity generation with 58.7% and 35.7% of effective generation capacity respectively. Non-conventional including biomass and wind and excluding nuclear constitutes only 2% of the total.

In the state of Rajasthan, thermal again is the leader in electricity generation with approx. 62.5% of the contribution with non-conventional sources excluding hydro contributing 8.3% of the total (Northern Region Power Sector Profile, Ministry of Power, 2007 http://powermin.nic.in/indian_electricity_scenario/pdf/NR0407.pdf). 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.

The northern regional power system caters to the nation's most strategic places. High demand of power comes from different part of the region which includes domestic load, commercial load and agricultural load. The regional shortage of power in meeting the peak demand for 2005-2006 was approximately -11.23 %.The following table shows the power supply position of all the nine states in northern grid.

Table 8: Summary of Power Supply Position in the Northern Region.

Average Energy /day (Net)

राज्य/के.शा.	उपलब्धता मि.यु./प्रतिदिन	आवश्कयता मि.यु./प्रतिदिन	कमी मि.यु./प्रतिदिन	कमी %	State / U.T.
	Availability MU/Day	Requirement MU/Day	Shortage MU/Day	Shortage %	
चण्डीगढ़	3.26	3.26	0.00	0.00	Chandigarh
दिल्ली	58.10	58.86	0.75	1.28	Delhi
हरियाणा	59.54	66.30	6.76	10.20	Haryana
हिमाचल प्रदेश	11.58	11.70	0.13	1.08	H.P.
जम्मू और कश्मीर	21.00	29.52	8.52	28.86	J & K
पंजाब	90.07	97.23	7.15	7.36	Punjab
राजस्थान	84.41	88.08	3.66	4.16	Rajasthan
उत्तर प्रदेश	118.67	148.38	29.71	20.02	U.P.
उतरांचल	13.58	14.23	0.64	4.53	U'CHAL
एन.एफ.एफ.(रेल)	1.60	1.60	0.00	0.00	N.F.F./Rail
कुल	**462.96**	**521.55**	**58.59**	**11.23**	Total

Source: Annual Grid Report NRLDC 2005-06.

This shows that there has been an energy shortage in the northern region with demand outstripping supply in the past decade, so there is an indispensable need for power generation sources in the near term to meet the rising demand. The trend in addition of capacity in the region shows that this demand would be met by thermal generation sources (Fig.6).

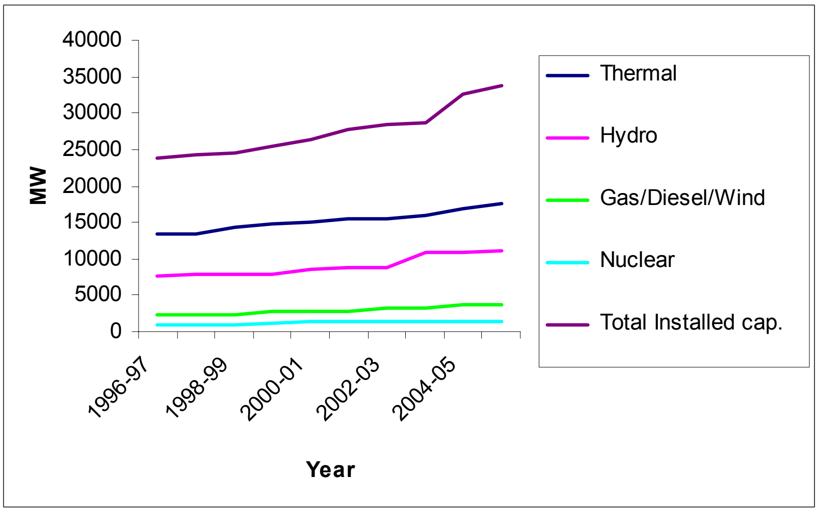


Figure 6: The trend of capacity addition in generation capacity from different sources in Northern grid.
Source: Annual Grid Report NRLDC 2005-06. (http://www.nrldc.org/docs/An05-06.pdf)

Rajasthan, which is a part of Northern grid, is largely dependent on thermal generation.

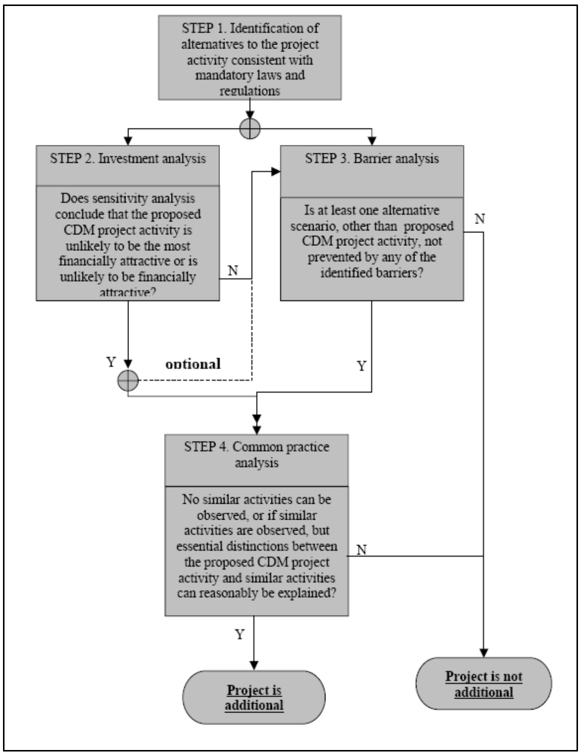
B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

>>

The project produces electricity in a clean manner, in other words, leads to zero GHG emissions. It 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. This in the business-as-usual scenario would have been met with the help of conventional fossil fuel based power plants. 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 captive power generation from non-conventional sources in the state. The project employs a non-GHG emitting technology (wind power).Thus it would displace usage of conventional fossil fuels in electricity generation and help in reducing emissions by 28291.7 tCO_2 e annually for the period of ten years.

ADDITIONALITY

As per the decision 17/cp.7 Para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered project activity. As per the selected methodology ACM0002, the project developer is required to establish that the GHG emission reductions due to the project activity are additional to those that would have occurred in the absence of the current project activity as per the "Tool for the demonstration and assessment of additionality":



Step 1. Identification of alternatives to the project activity consistent with current laws and regulations Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

Sub-step 1a. Define alternatives to the project activity:

The project activity was essentially conceived to generate clean energy, demonstrate the potential and sale of the generated electricity to the state electricity utility and captive consumption in 2003. The alternatives to the present project are:

1. Carry out the project activity without CDM benefit

As per the *Tool for the demonstration and assessment of additionality,* Version 04, EB 36, the first alternative considered for the project activity is to carry out the project activity without claiming for the CDM benefits. The feasibility of this alternative will be seen subsequently in this tool.

2. Do not implement the project activity. Continuation of the present situation

The second alternative for the promoter is that if the project proponent had not decided to go ahead with the present project under consideration, then the grid would continue to generate electricity from its existing sources.

3. Use of DG sets –
The project proponent could have also opted for Diesel Generator (DG) sets for captive use in the premises of their industries. However, this is not a feasible option because of the high diesel cost and further expected rise in the future. Therefore, in most industries the DG sets are kept as standby arrangements. The Report Of The Expert Committee On Fuels For Power Generation proves this point further by stating that the cost of generation for diesel generator sets is the highest among all the fuels (refer table below)

Ranking	Fuel and location	Cost of delivered energy Rs/ kwh
1	Gas Along Pipeline	1.49
2	Domestic Coal at Pit Head.	1.69
3	Domestic Coal at Load	1.88
4	Lignite at Pit Head.	2. 25
5	Imported Coal at Port	2.29
6	LNG at Port	2.29
7	Imported Coal at Load Centre	2.32
8	Naphtha at Port	4.46
9	Naphtha at Load Centre	4.36
10	Diesel at LC	5.96

Source: Report of The Expert Committee on Fuels for Power Generation

Thus, DG sets are definitely not a feasible option for the project promoters for captive consumption.

Therefore, the project promoter was left with only the first two credible alternatives.

Note: All the alternatives available to the project proponent will provide the same end product (electricity) and they are permitted under the prevailing laws of India.

Sub-step 1b. Enforcement of applicable laws and regulations:

1. The candidate CDM project without additional revenue stream of CDM – permitted
2. There is no requirement / mandate given to RSMML under which the generation of electricity is required.

Note: All the available options were open for the project proponents, and none of them has been made mandatory by the State or Union Government of India.

Step 2: Investment Analysis (Both step 2 and 3 have been carried out)

Sub-step 2a. Determine appropriate analysis method

The project uses wind generated electricity for partly sale to the grid and partly captive consumption. Since it has a mode of revenue apart from CDM related income, Simple Cost Analysis cannot be used. Between Investment Comparison Analysis and Benchmark Analysis, Benchmark Analysis has been chosen to be more appropriate because of insufficient alternatives.

Sub-step 2b – Option III. Apply benchmark analysis

The indicator used for benchmark analysis of this project is equity IRR as equity IRR is used as one of the indicators by the Rajasthan Electricity Regulatory Commission of India to determine the Tariff for Power generators.

Out of the two benchmarks available, the PP chose the most conservative value as the benchmark for doing the financial analysis for the project. The benchmarks available to PP have been enlisted below:

Firstly, the RERC assumed 16% as the equity IRR for wind power generators in their tariff policy of 2003. (Ref: *http://cdm.unfccc.int/Projects/DB/SGS-UKL1181723770.26/ReviewInitialComments/V5KR4I4HSFIVSYO7DDLQGHB3N3U9AU*). Considering that this value represents standard return in the market, it was considered as a suitable benchmark.

The second benchmark available to the PP was the cost of financing of the proposed CDM project activity. Principally this represents the opportunity cost of the capital. Thus, a project is viable only when its returns are higher than the opportunity cost of the capital invested. This is also in accordance with the CDM EB's Guidance on choosing the right discount rate or benchmark for appraising a project given in the paragraph 6(b) of the Additionality Tool, version 5.2. The paragraph states that benchmark can be based on *estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;*

RSMML, to find out the financial attractiveness of the project, conducted an exercise with the help of a financial firm, Aren and Associates, to calculate the cost of financing of the project. Since the project is entirely financed with the help of equity, the cost of financing is equivalent to the cost of equity. It was found that the cost of equity, adjusted to the risk of investing into power sector (Beta), was around 16.08%[2].

Calculation:

The cost of equity calculated by Aren &Associates is based on Capital Asset Pricing Model (CAPM). The CAPM model propagates a linear relationship between risk and return and is based on the portfolio theory of finance. The underlying philosophy of the method is that any investor investing its capital into a project will demand for a return which is:

- More than the risk free rate
- in accordance to the risk associated with the investment

The cost of equity of 16.08%, based on the CAPM method, was calculated with the help of the following formula:

$$Er_j = r_f + (Er_m - r_f)\beta_j$$

Where:
E (r_j) is the expected rate of return on equity (cost of equity)
r_f is the risk-free rate of return (e.g. return on government bonds)
E (r_m) is the expected rate of return of the market as a whole
β_j is the coefficient reflecting the volatility (risk) of the stock relative to the market, which measures the systematic risk of the stock.

The justification for the parameters and their values used to calculate the same has been given below:

RISK FREE RATE:

The risk free rate is the return that is assured on capital investment. Essentially, these are the financial instruments for investment sans any default risk. In case of India, the Government of India bonds or securities are considered as the most suitable representative for calculation of risk free rate in the market. Thus the risk free rate of return was drawn from the Weighted Average Yield of the Central Government

[2] Appendix 4 Letter by Aren & Associates

of India dated securities issued in 2004-05 (value available during the year of decision making) at 6.11 %[3].

EQUITY RISK PREMIUM:

The equity risk premium is the return that an investor expects over and above the risk free return for investing in a particular type of industry. To arrive at the equity risk premium for the project, the market risk premium was calculated and was further qualified with the help of a co-efficient representing the risk pertaining to the power sector. The parameters involved to calculate the risk premium has been explained below:

- **Annual Market Return**: The annual market return has been based on the publicly available BSE SENSEX[4] data. Given that the SENSEX features the most frequently traded stocks, the data is the most efficient data available. Return has been calculated based on historical data starting from the base year i.e. 1979. Thus, the time period chosen for calculating the annual return is from April 1979 till August 2005 (Year of conceiving the project). Thus, this is also the largest quantum of data (26.5 years) available among all the other indices. Therefore, BSE 30 was deemed to be the most appropriate equity index. The calculation has been done with the help of the Compound Annual Growth Rate (CAGR). The CAGR is a metric that measures the returns from the stock market investments over a period of time. It is a more accurate measure than simple average of returns and calculated as:

$$\textbf{CAGR} = \textbf{(ending amount / beginning amount)}^{(1\ /\ \#\ \text{of years})} - \textbf{1}$$

  The annual market return thus calculated is 17.93 % (1979-2005)

- **Market Risk Premium**: The market risk premium has been calculated by simply subtracting the risk free rate of 6.11% from the annual market return of 17.93%. The market risk premium has been calculated as 11.82%.

- **Beta :**

  One of the most important features of CAPM method is that it differentiates between the following:

  - Systematic risk- Also known as the non-diversifiable risk applicable to the market as a whole at macroeconomic level, such as inflation, tax rises, interest rates, etc
  - Unsystematic risk- Also known as diversifiable risk unique to an individual firm.

  The β in the CAPM equation helps account for the systematic risk by quantifying the sensitivity of a particular project type/sector with respect to the market returns. In calculation of cost of

[3] http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/65516.pdf, page 155

[4] The Bombay Stock Exchange (BSE) is the pioneer stock exchange of India, and the stock index SENSEX was first index launched by them in 1986 (base year – 1979). The SENSEX represents 30 component stocks representing large, well-established and financially sound companies across key sectors.

equity for a company or project, the beta, when multiplied to the risk premium helps in adjusting the expected returns to the risk associated with it. Beta is calculated as:

Equity Beta (βe) = Covariance (r, rm) / Variance (rm)
Where:
r is the return from the equity investment in a single stock
rm is the return from the equity investment in the well-diversified market portfolio[5]

Aren and associates have calculated an average beta based on power generation companies listed on the BSE instead of considering the beta of RSMML. This would help in achieving a beta value which is 'standard in the market'. Also, the benefit of calculating an average beta is that it helps in diminishing the effect of individual characteristic of each of the chosen companies. The justification for the use of this particular group of companies has been provided below.

Selection of companies:

As per the latest additionality tool, the benchmark and especially the Risk premium used in the calculation of required return on equity[6] should be in line with the specific project type. Since the project is wind power generation project, it would have been ideal to use the beta for companies engaged in wind power generation. However, till August of 2005 only one wind power company was listed on both the national stock exchanges i.e. BF Utilities. Therefore, the scope of the reference companies was extended to power generating companies in general. While companies in generation were a pre-requisite in order to capture the risk related to power generation (considered as project type by the PP), three year span data was considered to be sufficient to calculate the beta fairly. Based on this, power companies listed in BSE from the year 2002 onwards and engaged in power generation have been used to calculate the beta. These were Tata Power Limited, Reliance Infrastructure Limited, Neyveli Lignite Limited, Calcutta Electricity Supply Commission (CESC) and Gujarat Industries Power Company Limited (GIPCL)[7].

This group of companies also consists of companies engaged partly in generation from non-conventional sources. BF Utilities was not considered as part of this group of companies due to its small installed capacity (18.33 MW[8]) in comparison to the other companies. Besides, since the risk associated with wind projects is higher than conventional power projects, the beta calculated from these power generation companies is further conservative. The set of companies was considered appropriate as it also consists of companies which are a government undertaking. This helped in providing an appropriate beta for RSMML which is also a Government body.

The data for all these companies were regressed individually with the overall market data which gave the 'equity beta' or 'beta levered' (β_e) for all these companies. To remove the effect of

[5] http://www.bseindia.com/about/abindices/betavalues.asp

[6] Paragraph 14 of Guidance on the Assessment of the Investment Analysis.

[7] Historical market data for all companies can be found at http://www.bseindia.com/histdata/stockprc.asp
[8] http://www.bfutilities.com/InsidePage/Technology.htm

financial gearing of these companies, these 'equity beta' were then converted to 'asset beta' or 'beta unlevered' (β_a) using the capital structure of the respective companies. The average of these betas was calculated to be 0.84. Thus, the beta value of 0.84 represents the volatility of the returns to power sector with respect to the market returns. The above method helps in calculating a benchmark which is not linked to the subjective profitability expectation or risk profile of a particular project developer.

It is worth mentioning here that beta value of BF utilities was found to be 2.06 for a period of three years[9]. If this beta value was considered for calculation of the cost of equity, the benchmark would be around 23.13%. On the other hand, the average beta value, when BF Utilities was also considered, changed to 0.94 from 0.84 and as a result increases the benchmark to 17.22% from 16.08%. Thus, the beta of 0.84 is indeed a conservative value considered by the PP.

Further, since the beta values was calculated by Aren and Associates, the appropriateness of the beta value was also cross checked with the help of data from an alternate source[10]. The average of the beta values as per the Bloomberg of the same companies was found to be 0.867. The beta value of 0.84 is thus further conservative and was found to be appropriate for calculating the benchmark.

Conventionally, the asset beta which represents the power industry beta co-efficient is levered as per the capital structure of the concerned project activity with the help of the following formula:

$$\beta\ ep = \beta a * \{1 + (1 - T)*(D / E)\}$$

Where:
βa is the Asset beta or unlevered beta of the sector
βep is the Equity beta or levered beta of the project
T is the marginal tax-rate of the project
D / E is the debt-equity ratio of the project

However, since the present project has been financed entirely through promoter's equity, project parameters like the tax rate and the debt equity ratio will not affect the beta value. Therefore, the equity beta for the project would be equivalent to the asset beta i.e. 0.84 in this case (*$\beta\ ep = \beta a$*)[11].

On the basis of the values determined above, the equity risk premium was calculated as follows:

$E_p = (Er_m - r_f)\ \beta_j = (17.93\% – 6.11\%)*0.84 = 9.97\%$

[9] Snapshot of beta value of BF Utilities from Bloomberg and detailed Cost of Equity excel sheet with BF Utilities submitted to DOE (Appendix A and Appendix B)

[10] Data for Beta value from Bloomberg. Snapshots from Bloomberg provided as Appendix 5. Cost of Equity Calculation using this beta has been submitted to DOE (Appendix C).

[11] The average tax rate is calculated as the (total taxable income)/ (total tax payable). The tax rate of 20% mentioned in the Cost of Equity excel sheet is as per the tax rate for the overall business of RSMML. Whereas, the tax rate for present project activity is 31%. However, as mentioned above, the tax rate does not have any effect on the beta co-efficient and hence the benchmark remains the same as 16.08% irrespective of the tax rate.

The cost of equity for the project was therefore, calculated as per the following:

$E(r_j) = 6.11\%+9.97\% = 16.08\%$

The detailed excel sheet has been submitted as Appendix 6

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):

The return on equity or equity IRR for this project has been calculated to be 10.02 % without the CDM revenues, which is much lower than the prescribed rate by the RERC i.e. 16%. With CDM revenues, the equity IRR is increased to 10.82 %. The IRR calculation is given in excel sheet as Appendix 1 and Appendix 2.

The Input values used to calculate the IRR and the justification for same has been given in paragraphs below:

Project Cost: The project cost of approximately 1060 million has been assumed taking account the machinery cost and all the associated costs for putting up the project. These are inclusive of the service taxes, external lines, and administrative charges. The values can be verified from the Detailed Letters of Intent (DLOI) or the purchase orders placed, invoices etc.

Operation and Maintenance (O&M) costs: Considering that there are two separate suppliers for 7.5 MW and 15 MW of the project. The operation and maintenance costs have been considered according to the rates decided upon by both PP and the respective suppliers. In case of 15 MW, the O&M costs have been pre determined for the entire project lifetime and the same has been used in the financial analysis. This can be further verified from Annexure I of the DLOI placed on Vestas RRB.

In case of 7.5 MW, the O&M costs have been fixed uptil the sixth year and the same has been considered for the financial analysis. The values used can be verified from the DLOI placed on SUZLON Energy Limited by the PP. After the sixth year, the O&M costs for this phase of the project were to be decided on a mutual basis. Therefore, in the financial analysis, the O&M costs, from the seventh year onwards, are escalated at a conservative rate of 4% (against the industry practice of 5%[12]), in order to include the impact of inflation and other such phenomenon on O&M costs.

Insurance: The cost of insurance has been included in the contract price of the project, therefore, insurance is not considered in the financial analysis.

Tariff rate: A tariff rate is the rate at which the electricity generated from the project is sold for consumption. Hence it is a measure of the revenue generated from the project. In case of captive consumption, the electricity is not sold but consumed by the PP. In the absence of the project the PP would have continued using the electricity supplied by the grid at the cost of industrial tariff rate applied by the Electricity board. Thus, the revenue generated in case of captive power project is the capital saved

[12] This can be verified from the RERC 2006 tariff order for wind power projects, where in para 58 (page 19), assumptions for all three orders show that O&M escalation for wind power project has been constantly considered as 5% in all there three tariff orders..(http://cdm.unfccc.int/Projects/DB/SGS-UKL1181723770.26/ReviewInitialComments/V5KR4I4HSFIVSYO7DDLQGHB3N3U9AU)

by not using the grid's electricity. In such cases, the tariff rate used to carry out the financial analysis is the tariff rate applicable to the industry where the project generated electricity is used.

Since the project activity involves partly sale to EB and partly captive consumption, two types of tariff rates are applicable to the project.

Sale to EB - The tariff structure has been referred from the Tariff order by RERC[13] where in the tariff rate applicable for wind projects is Rs. 3.32/unit with escalation of Rs. 0.06/unit. The tariff freezes at Rs. 3.92 /unit from the tenth year onwards. The same can be referred from the Note sheet of RSMML[14] and the Power Purchase Agreement signed along with the DISCOM.

Captive consumption: In order to fairly incorporate the revenue earned by the captive consumption, the project proponent has used Rajasthan HT tariff rate multiplied by the energy supplied to the industrial unit in the investment analysis. The value of Rs. 4.01/kWh (rounded off to Rs. 4/kWh in investment analysis) has been derived from the energy bills[15] of the industry where the captive power is to be consumed. This tariff of Rs. 4/kWh, levied by the Ajmer DISCOM, is as per the 2001 Tariff order for supply of electricity published by the Rajasthan Electricity Regulatory Commission (RERC) for the Ajmer DISCOM, dated 24th March 2001[16]. Following this order, another Tariff Order for all DISCOMs was also placed on 17th of December, 2004 which ordered to continue with the existing HT consumer tariff rate. Since then, no order has been released by the utility and the rate of Rs. 4/kWh continues to be applicable. The HT bills (Bills for HT consumer[17]) of 2007 uses the same value and hence proves the same. The utilities however do not provide any further information related to the escalation that might occur in the electricity tariff rate in the future and thus, it depends purely on the government policies and market mechanisms. Moreover, the HT tariff rates are set by the distribution companies of the state who need strike a fine balance between the cost of power and consumer's capacity to pay. Thus, unprecedented rise in the tariff rates is not favored by the utilities. Therefore, not only is it extremely difficult to predict the changes in the HT tariff rates to be levied by an utility but also significant rise in the tariff rate was not considered very likely. Keeping the above factors in view, the tariff was not escalated any further in the financial analysis. The probability of any increase in the tariff rate has been taken care of in the sensitivity analysis.

Tax rates: The Income tax rate of 33.66% and the Minimum Alternate Tax (MAT) of 10 % have been assumed as per the Income Tax Act of 1961.

Tax incentives/benefits: Wind power projects in India are eligible for two types of direct tax benefits. The paragraph below discusses these two incentives and how they have been incorporated in the financial anlaysis for this project:

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[13] (Issued vide Energy Deptt. letter No.F.20(3)Energy/98/Pt.III dated 30.4.2003)

[14] Appendix 7- RSMML Note sheet of inter-office correspondence

[15] Appendix 8– 3 Bills for HT consumer, Ajmer Vidyut Vitran Limited dated 13/01/2005,13/07/2005,16/08/2005

[16] Appendix 9 - Ajmer DISCOM Tariff Order – 01 dated 24th March 2001, para 197 , table 19, http://www.rerc.gov.in/index1.htm (only relevant extracts provided)

[17] Appendix 10 – Bill for HT consumer, Ajmer Vidyut Vitran Limited dated 15/11/2007

- 80% Accelerated Depreciation as per the Income Tax Act of 1961 – The tax benefit is considered as a deferred tax liability and is incorporated as an inflow to the project in the financial analysis submitted to the CDM EB(row 7 IRR without CDM sheet).
- Tax Holiday for a period of 10 years out of the first fifteen years of operation. – Tax holiday for the project has been claimed from 3rd year till the 12th year (wherein only the MAT was paid and corporate tax was evaded. The same can be referred from cell F29 to O29 in the 'Cashflow sheet' of the financial analysis submitted to the EB.

Plant Load Factor

The Plant Load Factor (PLF) for the project has been considered as 16%. This is based the on the performance of the PP's previous project located at the same site as the present project, also a registered project. They realised that though the EPC contractors had projected higher generation during their earlier project the real-time average PLF was lower than 16 %[18]. An excel sheet showing the detailed calculation of the PLF from the project has been submitted to DOE (Appendix D). The PLF of 16% can be further justified with the help of the following:

- **2 MW Demonstration project in Jaisalmer by RRECL**: The purpose of a demonstration project is to show the potential investors, the techno-economic feasibility of wind power projects in the particular state. Thus, these are supposed to be pilot projects by the government, which are expected to pave the way for future investments. When the project was conceptualized in September 2005, only one demonstration wind power project was commissioned in the same site as the present project, by the Government of Rajasthan. This was the 2 MW wind power project in Jaisalmer. Based on the actual generation from 2000-2005[19] (detailed data provided in Annex 6), the PLF was calculated to be less than 16%, Therefore, the PP considered it safest to consider 16% as the projected PLF of the project.

- **Demonstration projects all over Rajasthan:** The PLF of 16% can be further verified from the data of all the demonstration projects set up the Government of Rajasthan. Across the state of Rajasthan, the PLF has not been very encouraging for all the demonstration project of the Government of Rajasthan. A PLF analysis from the year 1999-2000 to the year 2007-08[20], has further proven that PLF in state of Rajasthan is not very high and is rather lower than 16% in majority of the cases. The detailed analysis has been provided to the DOE.

- **Actual generation from the project:** The project has been commissioned in a phased manner in March (7.5 MW) and October 2006 (15 MW). Based on the actual generation, in year 2006-07, the PLF for the 7.5 MW phase of the project was found to be 15.45% (15 MW phase had not run for the full year of 2006-07). For the year 2007-08, the PLF for the entire project was calculated to be 14.8% approximately. The evidence for the same has been provided to DOE.

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[18] The PLF can be calculated from the monitoring report of the project "14.8 MW small-scale grid connected wind power project in Jaisalmer state Rajasthan, India by RSMML". The link for the same is the following: http://cdm.unfccc.int/UserManagement/FileStorage/ZJJLLVWX3BF1TXLVZ16ZA5XI4WHOX1

[19] Source: http://www.rrecl.com/ (Section 'Projects' – Sub-section 'Wind')

[20] Source: http://www.rrecl.com/ (Section 'Projects' – Sub-section 'Wind')

Residual Value: The residual value for project has been considered as per the Industry practice of 5% of the project cost in addition to the cost of land.

Since equity IRR is less favourable than the benchmark, the project activity is clearly not financially attractive. Thus, it would be more profitable for the project proponent to go ahead with the other alternative of carrying out the business-as usual scenario. Therefore, it is additional to the business as usual scenario.

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

As per to the *EB Guidance on the Assessment of Investment Analysis version 2*, sensitivity analysis should be carried out only for the variables that constitute more than 20% of the project cost of or the total project revenues. For the present project activity, the variable parameters that met the above mentioned criterion are the following:

- Plant Load Factor
- Tariff rates

Apart from the above, an additional sensitivity analysis has been done for the variable cost of O&M after the seventh year for the 7.5 MW phase of the project. The justification for each factor has been given below:

Plant Load Factor (PLF) – Since the project is a wind power project, it is dependent on the unpredictable regime of wind power throughout its lifetime. The PLF affects the generation of electricity which is the primary source of revenue in the project. Thus, being a critical parameter a sensitivity analysis has been carried out based on the variation of PLF from 16% to 22%.

The Rajasthan Electricity Regulatory Commission (RERC) in all its tariff orders considers a PLF of 22.37% for setting the tariff of the electricity supplied by the wind power plants. This can be verified from the list of assumptions used to calculate different tariff rates given in the paragraph 58 of the Tariff order of 2006[21]. Since the tariff rates fixed by the RERC is based on the cost plus basis. The value of 22.37% can be considered to be a PLF achievable in the state of Rajasthan. This forms the basis of fixing 22% (rounded off from 22.37%) as the upper limit for sensitivity analysis. Moreover, organizations like the INWEA (Indian Wind Energy Association) and SUZLON, based on the PLF of different sites, found that on an average, the PLF for wind power projects in Rajasthan varied from 15.14% to 22.21% (refer Para 66, page 20, Tariff order 2006). Thus, 22% was considered appropriate for sensitivity analysis.

In terms of generation, sensitivity analysis upto a PLF of 22% means an increase of more than 30% from the base case. This is also in line with the latest EB Guidance on the Assessment of Investment Analysis (EB 39, Annex 35, page 4) which states *'variations in sensitivity analysis should at least cover a range of +10% and – 10%'*. Thus, the sensitivity analysis carried out for the project activity is justified given above set of data.

The variation of the equity IRR based on the sensitivity analysis of PLF has been tabulated below:

[21] http://cdm.unfccc.int/Projects/DB/SGS-UKL1181723770.26/ReviewInitialComments/V5KR4I4HSFIVSYO7DDLQGHB3N3U9AU

PLF (%)	Equity IRR % (without CDM)	Equity IRR % (with CDM)
16	10.02	10.82
18	11.98	12.88
20	13.85	14.83
22	15.64	16.70

Tariff rates - As mentioned above, essentially two different tariff rates are applicable for the amount that is sold to the electricity board (Rs.3.32/kWh with an escalation of Rs 0.06) and the amount that is used for captive consumption (Rs. 4.00/kWh).

Tariff for sale to EB: The tariff structure has been fixed as per the Power Purchase Agreement for a period of twenty years (the project lifetime). Thus, no sensitivity analysis was carried out in this case.

Tariff for Captive power consumption: The tariff for captive consumption has been based on the electricity bills paid by the PP prior to the investment decision of the present project. Such HT industrial tariff rates are subject to change, depending on the tariff orders placed by the commission. It was realized that in case a change did occur in the HT tariff rates in the future, the project revenues may get considerably affected. However, a regular or constant increase or decrease in the rate cannot be predicted. Thus, the effect of possible increase of the HT tariff rate in the subsequent years can be captured only through a sensitivity analysis. Also, as mentioned in the justification of input parameters to the IRR calculations, it is practically impossible to predict the probable rise in the HT industrial tariff rate in future as it is governed by a number of complex factors. Therefore, for sensitivity analysis the HT industrial tariff has been varied upto 10%, in accordance to the EB *Guidance on the Assessment of Investment Analysis.* The results have been submitted in a tabular format below:

% of variation	Tariff rate (Rs/ kWh)	IRR
5%	Rs. 4.2	10.38%
10%	Rs. 4.4	10.74%

As can be seen, even after an increase of 10% in the levelized HT tariff rate of Rs. 4/kWh, the IRR remains far below the benchmark.

Operation and Maintenance costs: The operation and maintenance cost for the project is a source of annual outflow for the project. In the present case, the O&M costs for both the phases of the project (15 MW & 7.5 MW) have been referred from their respective Purchase Orders. In case of the 15 MW phase, the O&M costs for the entire project lifetime (20 years) has been pre-negotiated from the beginning of the project. Since there is no scope of any change in these costs, the sensitivity analysis was not carried out.

In case of the second phase of 7.5 MW, the O&M cost was fixed till the 6th year of the project. After the 6th year, the rates of O&M are to be mutually decided. Since the O&M costs for the initial years of the project were fixed before commencement of the project, the probability of change in the latter years was not considered to have a significant effect on the financials of the project. In fact, in accordance to the EB *Guidance on the Assessment of Investment Analysis version 2,* sum of the O&M costs (1177.344 lacs) from the seventh year till the 20th year do not even constitute 20% of the total project cost (10680 lacs). However, even then a sensitivity analysis has been carried out to account for any possible changes. It was found that when the O&M costs after the seventh year were decreased by 10%, the IRR increased only upto 10.06%.

Thus the above mentioned sensitivity analysis captures all the possible changes in the input values of calculating the returns to the project and it can be concluded that project is truly additional. The IRR calculation sheets submitted with the PDD has been revised as per the additional information given above.

Step 3: Barrier Analysis

Low Plant Load Factor (PLF):

Rajasthan suffers from one of the lowest load factors among all other states with wind potential. The table below shows the PLF considered by different state ERC's.

MPERC	22.5%
MERC	20% with deration of 5% during the life of the plant.
KERC	26.5%
TNERC	25.29% to 26.7%
GERC	23%

This is also the capacity factor considered by the RERC for determination of tariffs from wind power (Source: *In the matter of amendments to RERC (Power purchase & Procurement Process of Distribution Licensees) Regulations 2004 and RERC (Terms & Conditions for Determination of Tariff) Regulations 2004 under Section 61 & 86 of the Electricity Act 2003. And In the matter of review of the RERC order dated 31.3.06 in respect of power purchase from non-conventional energy sources in Rajasthan.*)which is way below states like Karnataka (26.5%) and Tamil Nadu (25.29% to 26.7%).

Investing in a state with higher PLF would have fetched the promoters' higher returns. Thus, low PLF is indeed barrier to the viability of the project.

Problems of Captive consumption:

The project entails partly captive consumption of the total electricity generated. Problems related to wheeling and banking in the state are a big hurdle for wind projects. The present wheeling charges are still at 10%, which is one of the highest among other states. The following table shows the wheeling charges of different states.

Andhra Pradesh	2%
Gujarat	4%
Karnataka	7.50%
Kerala	5%
Madhya Pradesh	2%
Maharashtra	2%
Rajasthan	**10%**
Tamil Nadu	5%
West Bengal	2%

The banking period is till the 31st of December of the calendar year. Since wind is an intermittent source of energy, the energy generated is often surplus of what is required for the captive purposes. This is where the time period of banking in any state becomes essential. It can so happen that the banked energy is not utilised during the stipulated time. A shorter banking period might result in higher unutilised energy. The fate of this energy depends to a large extent on the policies of the government, bringing great uncertainty which might also lead to loss of generated energy and thus revenue.

Note: A high wheeling charge affects the returns to the project greatly.

Regulatory barriers:

Investors of wind power projects have been experiencing huge amount of uncertainty due to the frequent change of tariffs in the state by the RERC. The present investor RSMML had conceptualised the present project in 2003 (Source: Inter office correspondence, Projects Division, Dated 12.9.03) and the commissioning of the turbines and the PPA was signed in 2006. Within these three years, several tariff orders have been issued by RERC. The changes have been shown in the flowchart below.

2003 – Rs. 3.32/ unit

↓

2004 – Rs. 2.91/ unit

↓

2006 – Rs. 3.25/ unit

Moreover, the RERC in 2006, in its draft order was contemplating to bring wind power under the purview of **competitive bidding**, although it was not implemented[22]. Under such circumstances of high uncertainty, the investment environment was completely dampened. Any change in tariff rates or

[22] Competitive bidding is a process of acquiring power at the cheapest rate possible. Wind power is yet to be technologically at par with conventional power and has a much higher cost of electricity than conventional sources. Therefore, wind power investors would not be able to compete with the low tariffs possible for conventional sources and would be at a loss if competitive bidding was applied to wind power.

implementation of competitive bidding could have changed the financial estimations for the project completely. RSMML, however still decided to go ahead with its project envisaging CDM benefits and its power to mitigate these risks to a certain extent. (Source: Inter office correspondence, Projects Division, Dated 12.9.03)

Such a non-conducive environment is prohibiting investment in RE sector for power generation, particularly in Rajasthan. The availability of additional revenue stream from CDM was therefore considered as a medium for mitigating the policy risks associated with the project activity.

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The following barriers are identified in Sub-step 3 a.

1. Low capacity factor
2. Problems of captive consumption
3. Regulatory barriers

The available alternatives to the project proponents as presented in Sub-step 1a are:

1. The candidate CDM project without additional revenue stream of CDM
2. No candidate CDM project activity (Business as usual scenario).

The above mentioned barriers will not affect the second alternative identified. That is, in case the investor decided to continue consuming electricity from the grid (the business as usual scenario), none of the barriers identified will be applicable.

Note: The non conducive environment for investment in renewable energy would be immaterial in case the investor continued to take electricity from the grid as all the onus of sustained generation of electricity would be on the grid and its sources of energy.

Since a major source of electricity to grid comes from thermal power plants which enjoy a capacity factor of 40 to 80%, the problem of low PLF in winds will also be ineffective.

Problems related to wheeling and banking will also not arise as no wheeling banking would take place.

Similarly, the rest of the identified barriers would arise only in case a separate project is put up. Since, in the business as usual scenario a separate project would not be put up, these barriers would also become immaterial.

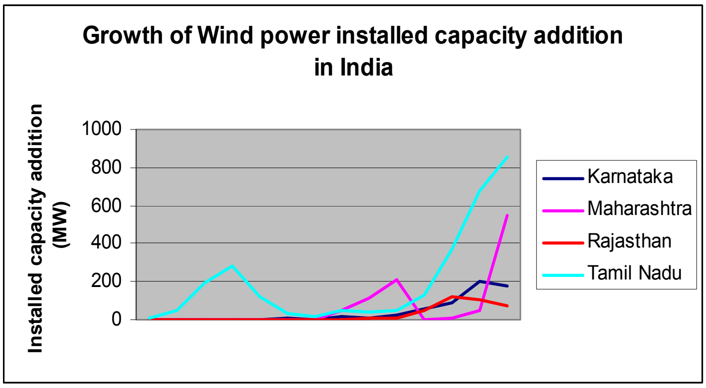
Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Wind power due to several inherent problems is not the commonly followed investment decision in Rajasthan and Northern Region in general till now. As of 31.03.06, Rajasthan contributed only 7% to the total installed capacity of wind power India. The following table gives the proportion of other states as well. (Source: Wind Power Directory, 2006)

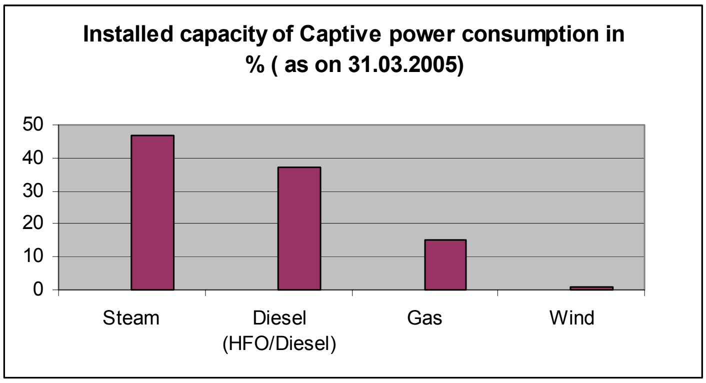
STATES	CONTRIBUTION
Tamil Nadu	54%
Maharashtra	19%
Karnataka	11%
Rajasthan	7%
Gujarat	6%

The trend of annual addition in the installed capacity of wind power has been shown in the figure below (1992-93 to 2005-06). Rajasthan even after having the fifth highest gross potential of estimated wind power has one of the lowest growths in addition of installed capacity of wind power.



Source: Wind power directory, 2006. Pg 5-2

The investor plans to use a portion of the electricity generated for captive consumption (Ref: Section A.2). Use of wind for captive consumption (1%) hasn't been a very common practice in the country as shown in the figure below.



Source: www.infraline.com

Note: It can be clearly seen that investment in wind electricity generation had considerably decreased in the state of Rajasthan as compared to other states of India. In the early years of this century, initiative from the state and central government had helped in generating comfort and interest of private sector investors for investment in power generation activities.

Though the trend has been going down again, investors like RSMML have started investing in wind power again. It is worth mentioning that RSMML is presently reaping the CDM benefits from their previous wind power project of 14.8 MW capacity (0243).

The use of wind power generated for captive consumption is also not very common in the country. Only 1% of the energy produced by wind is used for captive consumption.

Sub-step 4b. Discuss any similar options that are occurring:

The present RSMML project is one of the largest projects undertaken in Rajasthan by a single investor. The inception of the present project was done in 2003 itself. Till September 2005, approximate installed capacity for wind power was 316 MW. Out of this, almost 300 MW fetched for CDM revenue for a viable returns. Thus, negligible amount of project activity was taking place without CDM revenue.(Source: http://www.iges.or.jp/en/cdm/pdf/india/06/03.pdf, page 19). Therefore, setting up of wind farms without CDM benefit was not a common practice at all in Rajasthan

Note: Thus, no investor till now has set up wind power projects of capacity of this scale in Rajasthan without considering an additional revenue stream from CDM.

Thus, considering the above arguments, the project is indeed additional to the baseline scenario and cannot take place without CDM revenues.

In line with the *Specific guidelines for completing the Project Design* Document *(CDM – PDD)*, during the conceptualisation of this project in 2003, incentive from CDM was seriously considered in the decision to proceed with the project activity considering the barriers to project and the resultant low returns. The evidence of CDM consideration is available vide the extract of minutes of the 35th meeting of the board of directors of the Rajasthan state mines & minerals ltd held on 27 th September 2005. In addition to this document, other evidences are available in the form of Note sheet issued by DGM (project) on 14/08/03 and an inter office memo from Sr Manager (Elect) to GM (MIS) & DGM (Proj)

In accordance to the EB 41 guidance on Prior Consideration of CDM, the PP would like to provide the following list of chronological events:

	Activities	Mon-Year
1.	Inter Office correspondence*	08/09/2003 – 12/09/2003
2.	Management decision of investing in the project with CDM	27/09/2005
3.	Invitation of tender for 5 MW[23]	07/10/2005
4.	Fax of intent (5 MW)	15/12/2005
5.	Decision to go for tendering process for CDM (note sheet)	20/12/2005 – 08/01/2006
6.	Letter for CDM meeting by consultant	20/12/2005
7.	Detailed letter of intent(7.5MW)	08/03/2006
8.	Commissioning (7.5 MW)	25/03/2006

[23] For the rest 2.5 MW a repeat order was placed and therefore no invitation of tender is available for the same

9.	Tender for 15 MW	21/04/2006
10.	Fax of intent 15 MW	09/06/2006
11.	Detailed letter of intent(15MW)	24/06/2006
12.	Invitation bid for CDM	11/07/2006
13.	Receipt of work order by Senergy Global Limited	07/09/2006
14.	Commissioning of 15 MW	30/09/2006-08/10/2006
15	Meeting with DNA	25/04/2007
16.	Offer by validators	27/04/2007 – 30/04/2007
17.	Validator appointed	03/05/2007
18.	HCA	04/06/2007

*Letters written in red are CDM related decisions

All the documents for the above list are attached chronologically with this PDD as Appendix 11 and Appendix 12

The PP, Rajasthan State Mines and Minerals Limited (RSMML), is a Government of Rajasthan undertaking. Being a public entity, it was essential for the PP to carry out all dealings and appointments through the transparent but time-taking process of tendering. Therefore, progress of any project activity in such organizations is usually slower than other private organizations.

As mentioned in the table above, the proposal for present wind power project was put in July 2003 itself. However, considering the bad performance of their previous project, the PP did not have the confidence to go ahead with the project. It was the idea of receiving revenues from CDM that help them regain confidence to go ahead with the project. Thus, the Management of RSMML took a decision to undertake their upcoming wind power projects with the help of CDM revenues in September 2005. Following this, the tendering process of setting up the first phase of the project was immediately initiated. The tender was awarded to Suzlon Energy Limited only in December 2005 through the Fax of Intent. The detailed agreement was not yet finalized.

Simultaneously, the PP had also undertaken the preliminary due diligence of the developing CDM market. In December 2005, it was being contemplated to award the work of CDM registration of the project to a leading CDM consultancy firm on the basis of their offer received. However, considering the high consultancy fee quoted by them, the PP instead decided to go for tendering process in January 2006 as it would help them in receiving the most competitive offer. In July 2006, the invitation of tender for CDM registration was published in the leading newspapers. The time taken to send out the invitation was due to the time taken to prepare suitable terms and conditions and such is usual for undertaking any tender. This process was critical to reduce the transaction cost and maximize the returns in this project. The work was awarded to Senergy Global Limited in September 2006 after several rounds of negotiation between the two parties. It was only once the development of the Project Design Document (PDD) for the project was nearing completion that the process of appointing a Validator was initiated. In April 2007, offers from validators were received and the final appointment took place in May 2007. The gap of May 2007 to July 2007 is the time taken for web-hosting of the project and preparation of the Draft Validation Report (DVR).

It also needs to be considered that CDM market was in a nascent stage during this time and dedicated departments for carrying out CDM activities were not found in any organization. This was also the case with RSMML. Thus, host of activities related to the project was being simultaneously carried out.

Moreover, being a government organization, it is mandatory for the PP to go through extensive discussion before undertaking each step of the project. Thus, the delay is justified given the above set of conditions.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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ACM0002 – "Approved Consolidated Baseline Methodology for grid connected electricity generation from renewable sources", Version 06 (19^{th} May, 2006), Sectoral scope: 1.

The consolidated baseline methodology for grid connected electricity generation from renewable sources (ACM0002) describes a stepwise approach to apply the methodology to the project activity.
Baseline emission factor is calculated as combined margin, consisting of a combination of operating margin (OM) and build margin (BM) factors.

Approved consolidated monitoring methodology ACM0002/ Version 06 (19^{th} May, 2006)
Sector Scope: 1, "Consolidated monitoring methodology for zero-emissions grid connected electricity generation form renewable sources" by CDM Meth Panel. The monitoring methodology lists the parameters that need to be monitored for estimating the baseline and project emissions as well as leakage.

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

a) EGy

Data / Parameter:	$EG_{y,}$
Data unit:	kWh
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	31.5 Million units
Justification of the choice of data or description of measurement methods and procedures actually applied :	- 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 - 100% of the data is monitored - The data will be archived electronically
Any comment:	The value has been considered as per the PLF of the area.

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, version 06
Value applied	0.8971; Details of the data values are given in the baseline calculation in Annex 3 "
Justification of the choice of data or description of	- Emission factor is used in the calculation of emission reductions. - The emission factor is calculated. - The data is calculated yearly

measurement methods and procedures actually applied :	- 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 3, 15th December,2007[24]
Value applied	0.9867; 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 3, 15th December,2007
Value applied	0.6283; Details of the data values are given in the baseline calculations in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	- This is used in the calculation of emission factor 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

B.6.3. Ex-ante calculation of emission reductions:

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The methodology which has been used for calculation of baseline is ACM0002.The approach selected in the baseline methodology checks the additionality of the project activity and determines the baseline emission factor for selected baseline scenario.

The baseline for the project has been identified according to ACM0002 (version 06) where in the baseline for the project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

"Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations"

Since the project supplies electricity to the Northern grid, emissions generated due to the electricity generated by the Northern regional grid as per CM calculations will serve as the baseline for this project.

The consolidated baseline methodology for grid connected electricity generation from renewable sources (ACM0002) describes a stepwise approach to apply the methodology to the project activity. Baseline emission factor is calculated as combined margin[25], consisting of a combination of operating margin (OM) and build margin (BM) factors in accordance with the following three steps:

Step 1: **Calculating the Operating Margin emission factor ($EF_{OM,y}$)**

The consolidated methodology ACM0002 provides four options for calculating the operating margin, and guidance for how to choose which options for the corresponding project activity. The options are:

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch Data Analysis OM, or
d) Average OM.

The methodology (ACM0002) relies on Dispatch data analysis as its first methodological choice, this method is based on the data on the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating. This however is not possible due to lack of availability of this activity data to the project developers.

The choice of other options for calculating the operating margin emission factor depend on the generation of electricity from low cost/must run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

Table 9: Share of Must-Run (% of Net Generation)

Regional Grid	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	Average of last 5 years
North	**25.9%**	**25.7%**	**26.1%**	**28.1%**	**26.8%**	**28.1%**	**26.96%**
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%	9.78%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%	21.72%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%	9.32%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%	47.52%
All India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%	18.08%

(Source: CO2 Baseline Database, CEA, Government of India)

[25] For the calculation of CM, data for OM and BM has been taken from the latest CO_2 Baseline Database published by CEA (Central Electricity Authority (CEA), version 03, 15th December,2007.

The above table clearly shows that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) for the northern regional grid is only 26.96% which is much lesser than 50% of the total generation.

Thus the average emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation and detailed data to apply Simple adjusted OM is not available.

The **Simple Operating Margin** can be used for the proposed project activity because low-cost/must run resources constitute less than 50% of total generation.

The data for calculating Simple OM has been taken from the following:
CO_2 baseline database, Central Electricity Authority (CEA)
Version: 3.0
Date: 15th December 2007

The detailed description of the procedure will be found in the following URL:
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

The consolidated baseline methodology for grid connected electricity generation from renewable sources (ACM0002) describes a stepwise approach to apply the methodology to the project activity.

Calculating the Simple Operating Margin emission factor ($EF_{OM,y}$)

The operating margin emission factor has been calculated using 3 year data vintage.
The $EF_{OM,Y}$ is estimated to be:
For the year 2004-2005 the $EF_{OM,Y}$ is 0.9745 tCO_2/MWh
For the year 2005-2006 the $EF_{OM,Y}$ is 0.9936 tCO_2/MWh
For the year 2006-2007 the $EF_{OM,Y}$ is 0.9920 tCO_2/MWh

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be 0.9867 tCO_2/MWh. The data would be calculated on an *ex- ante Basis.*

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

The $EF_{BM,y}$ is estimated as 0.6283 tCO_2/MWh (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation) for the year 2006-07. Again the ex-ante basis of calculating the build margin has been chosen.

Step 3. Calculation of Baseline Emission Factor EF_y

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

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

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

The Baseline Emission factor EF_y is estimated as 0.8971 tCO_2/MWh.

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.

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.

$BE_y = EG_y. EF_y$

Where.

EG_y = 31.5 milllion units

Baseline Emissions = 28291 tCO2e/yr

The detailed calculation of the number of CERs has been given in Excel sheet

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, Net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis.

$ERy = BE_y$ = 28291 tCO_2e/yr

The project activity will evacuate approximately 31.5 Million units of renewable power annually to the power deficit Northern Region Grid and the annual emissions reductions are equal to 28291 tCO2. The detailed excel sheet of CER calculation will be submitted as Appendix 3.

B.6.4 Summary of the ex-ante estimation of emission reductions:
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Table 10: Ex-ante estimation of emission reductions

Year	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of Leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2008-09	0	28291	0	28291
2009-10	0	28291	0	28291
2010-11	0	28291	0	28291
2011-12	0	28291	0	28291
2012-13	0	28291	0	28291
2013-14	0	28291	0	28291
2014-15	0	28291	0	28291
2015-16	0	28291	0	28291
2016-17	0	28291	0	28291
2017-18	0	28291	0	28291
Total (tonnes of CO_2e)	0	282910	0	282910

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

B.7.1 Data and parameters monitored:

The following parameter will be monitored during the project activity:
a) EGy

Data / Parameter:	EG_y net (EGy export – EGy import)
Data unit:	MWh/kWh
Description:	Net electricity supplied to the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	31.5 Million Units.
Description of measurement methods and procedures to be	- 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

applied:	- 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 reduction. Sales record to the grid and other records are used to cross check this data and hence ensure consistency.
Any comment:	Electricity is supplied by the project activity to the grid. This is double checked by receipt of sales. The data would be archived for 2 years beyond the crediting period.

Data / Parameter:	$EG_{y\ export}$
Data unit:	MWh/kWh
Description:	Total Electricity supplied to the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	31.5 Million units
Description of measurement methods and procedures to be applied:	- 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 - 100% of the data is monitored
QA/QC procedures to be applied:	The electronic meters are calibrated annually to ensure correct readings throughout the project life.
Any comment:	This data will be used for calculation of emission reductions after the subtraction of the electricity imported from the grid. The data would be archived for 2 years beyond the crediting period.

Data / Parameter:	$EG_{y\ import}$
Data unit:	MWh/kWh
Description:	Electricity intake from the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Nil
Description of measurement methods and procedures to be applied:	- The electricity is measured with the help of electronic meters - The data is measured hourly and recorded monthly - 100% of the data is monitored - Electricity import is subtracted from the total electricity exported to the grid ($EG_{y\ export}$) to reach the Net electricity supplied to the grid by the project (EG_y net)
QA/QC procedures to	The electronic meters are calibrated annually to ensure correct readings throughout

be applied:	the project life.
Any comment:	Electricity import is subtracted from the total electricity exported to the grid ($EG_{y\ export}$) to reach the Net electricity supplied to the grid by the project (EG_y net), on the basis of which the emission reductions are calculated. However, for the purpose of calculating the expected emission reductions in the section B.5, value of electricity imported has not been considered separately ; instead net electricity. (refer footnote 2)

Data / Parameter:	$EG_{controller}$
Data unit:	MWh/kWh
Description:	Electricity generated at the controller end (machine)
Source of data to be used:	CMS data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Nil
Description of measurement methods and procedures to be applied:	- The electricity is measured with an integrated electronic meter - The data is recorded monthly - 100% of the data is monitored
QA/QC procedures to be applied:	The electronic meters are calibrated annually by the EPC contractor to ensure correct readings throughout the project life.
Any comment:	The controller meters are used as a back up. Thus, this data would be used for verification purposes only in case the main meters at the substation fail.

B.7.2. Description of the monitoring plan:

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The parameter that needs to be monitored every year in this project is the electricity generated each year throughout the crediting period i. e. ten years. Thus the monitoring plan would include the following:

- Metering and related issues
- Measuring leakages
- Operation and maintenance practices/structure
- Data collection and Archiving

Metering and related issues:

1. The proposed CDM project activity requires evacuation facilities for connection to grid and the evacuation facility 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 metering equipment at the delivery point is in accordance with the relevant provisions of the metering code and is situated at the Amarsagar substation.
4. The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.

5. 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). All the machines in the project will be connected to the feeder.
6. There are two energy meters installed at the substation. In the event that the main metering system is not in service due to maintenance, repair or testing, then the backup metering system (Check meter) shall be used during the period the main metering system is not in service. Both the meters and the metering boxes are sealed by RVPNL.
7. 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.
8. The meters will be tested for accuracy annually by the RVPNL.
9. Calibration of the machines would be taken care of during the annual testing of the meters.
10. 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. The generation data of individual machine can be monitored as a real-time entity at CMS. This controller meter is also calibrated in equal intervals.
11. The controller reading is sent to the utility every month for the purpose of cross checking.
12. Wherever, more than one Power Producer(s) are injecting energy produced by them using the common evacuation/ injection system and through the common metering equipment with RVPNL, the joint meter reading taken at common evacuation/ injection system shall be supported by meter readings of individual power producers using such common evacuation/injection system. Based on this break up limited to total energy injection, the power supplied from the individual power plant shall be regulated for the purpose of apportioning the electricity exported to the grid.

<u>Measuring leakages</u>

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.

<u>Operation and Maintenance Practices and Structure:</u>

The operation and maintenance for the project has been assigned to Suzlon Energy Limited and Vestas RRB India Ltd. for 7.5 MW and 15 MW respectively. The following is a list of some of the services undertaken by both the companies in order to ensure the efficient running of the plant.

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.

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.

Performance review will be carried out for both the parts of the entire project regularly. In case of any problem, both the companies will be taking action as soon as possible. They shall also be liable to replace any part(s) that may fail or show signs of defects for the entire life term of the project. The O&M team at the site takes care of these performance reviews to maintain generation of electricity from this renewable source and will carry out the GHG audits at the site.

Data Collection and Archiving:

The monthly data of electricity generated is colleted in both print and electronic form. However, the data in electronic form is archived throughout the life time of the project. The electricity records are maintained regularly by the team at the site.

The responsibility of registration of the project has been assigned to

Gopal Gandhi
Dy. General Manager (Proj./ Elect)
RSMML,
4, Meera Marg,
Udaipur, Rajasthan, India
PIN- 313004

Mr. Gopal Gandhi has been assigned overall supervision of the project performance including the following:
- Performance review of WEG installations
- Arranging for annual verification of the installations for issuance of CERs.

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

>>
Date of completion of baseline study and monitoring methodology: 07/03/2007
Contact Name and Address:
Senergy Global Limited
Ground Floor, Eros Corporate Plaza, Eros Corporate Tower
Nehru Place
New Delhi – 110019,
India
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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:

>>
15/12/2005

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

>>
20 years and 0 months

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

Fixed crediting period of 10 years and 0 months duration has been chosen

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:

>>
Either 01/04/2008 or from the date of registration (whichever is later)

C.2.2.2. Length:

>>
10 years and 0 months with no renewal

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
Also, in the redefined EIA notification i.e. S.O. 1533 (http://envfor.nic.in/legis/eia/so1533.pdf), dated 14th September 2006, Ministry of Environment & Forests (MoEF), Govt. of India, the wind projects are not included in the list of projects that has to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities and hence no EIA study was conducted.

Although an EIA is not required, the possible environmental impacts listed below were analysed:

- Energy generation and emission reduction
- Nature: presence of bird migration tracks, disturbance of breeding grounds (during construction and operation).
- Landscape: possible reflections, disturbance of the landscape
- Noise: acceptable noise levels for nearby living inhabitants, vulnerable nature areas, etc., by means of a global sound profile.
- Soil and water: possible emissions to soil and water, setting of the ground, hydrology
- Security/safety aspects
- Physical use of space of the wind farm, roads and transmission lines

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.

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 environmental impacts are not significant.

SECTION E. Stakeholders' comments

>>

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

>>

The stakeholders involved in the complete project activity were

- State Electricity Utility (RVPNL) - for evacuation of generated electricity.
- State Revenue Department – for granting permission to commission and operate the wind farm facility at the revenue land "Gochar Bhumi – common land" allotted on lease to the project proponent.
- The villages Pohra and Baramsar are the nearest villages to the project site. A stakeholder meeting revealed no negative remarks about the project.

The stake holder meeting was held on the 26th January, 2006 and the media used for the invitation is Public notice boards around the villages and Dy commissioner office at Jaiselmer.

The state electricity utility and the revenue department were approached for implementation of the project activity.

The permission of implementation and operation were granted on the basis of the policy regulation laid down by the state government of Rajasthan for "Promotion of Electricity Generation from Wind".

The state government was therefore the empowered competent authority for granting any such permission.

E.2. Summary of the comments received:

>>

The EPC contractor and the project proponent fulfilled all the criteria's as set out by the competent authority, thus no comments have been received for implementation of the project.

The copies of permissions, licences and agreements are available for verification of the operation entity.

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

>>

As no comments have been received, no account has been taken.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Rajasthan State Mines and Minerals Limited.
Street/P.O.Box:	4,Meera Marg
Building:	Corporate office
City:	Udaipur
State/Region:	Rajasthan
Postfix/ZIP:	313004
Country:	India
Telephone:	+91 294 2528681-5, 2527379
FAX:	+91 294 2523170, 2521727
E-Mail:	rsmml@sancharnet.in
URL:	http://www.rsmm.com
Represented by:	Mr. Gopal Gandhi
Title:	Deputy General Manager – (Proj./ Elect).
Salutation:	Mr.
Last Name:	Gandhi
Middle Name:	
First Name:	Gopal
Department:	
Telephone :	+91-294-2527379, 2521724
Direct FAX:	
Direct tel:	
Personal E-Mail:	gopalgandhi@rsmm.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

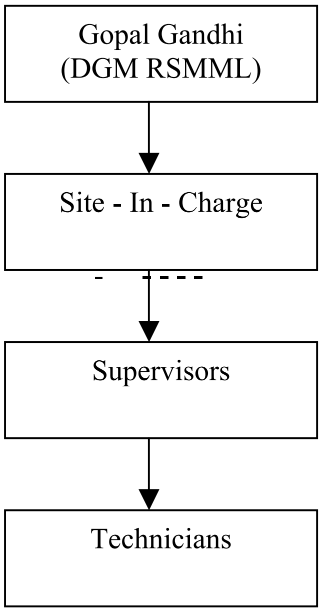
BASELINE INFORMATION

LINK:
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Last Accessed: 15. 03 .2007

Annex 4

MONITORING INFORMATION

Operation and Maintenance Structure



Annex 5

TECHNICAL DESCRIPTION OF THE TECHNOLOGY UTILISED IN THE PROJECT

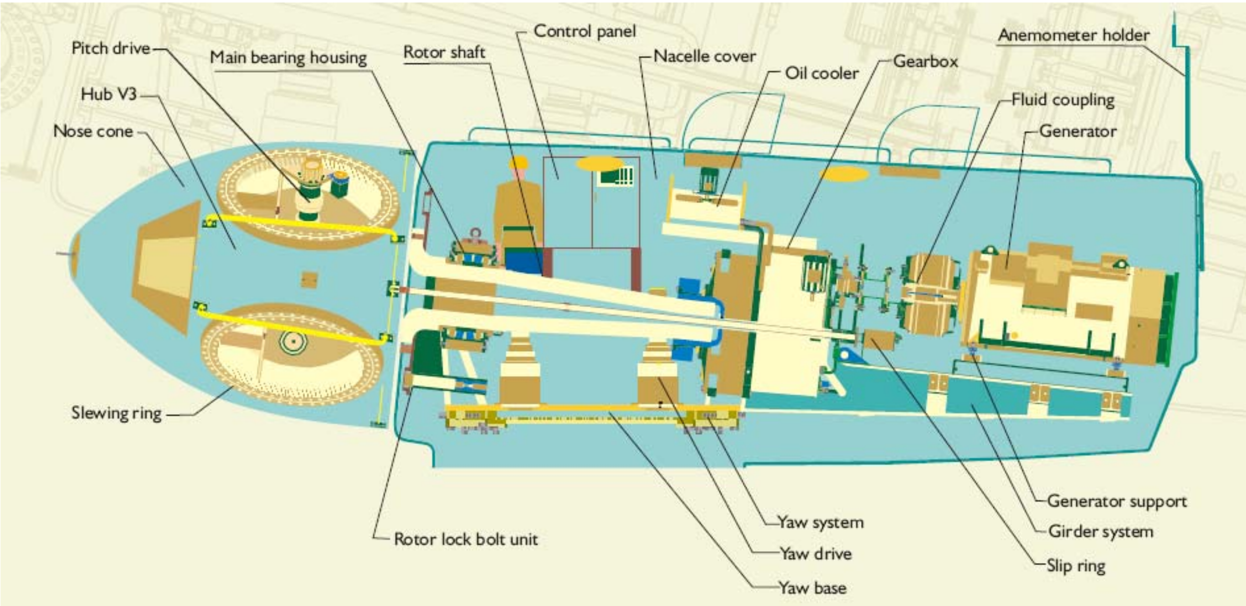
1.25 MW WEG SEL: Technical Description

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

General Data	
Wind speed at rated output (m/sec)	11.2m/s
Cut in wind Speed	4 m/s
Cut out wind speed	20 m/s
Hub height	74.5 m
Rotor speed	13.5/20.3 rpm
Regulation	Pitch System
Voltage (V)	690 V
Voltage variation	± 15 %
Rated Output	1250 kW
Type	Active Pitch Regulated, upwind
Designed max. Temperature (Deg.C)	60°C
Designed life (years)	20 years
Gear	
Type/ Model	3 stage (1planetary, 2 Helical)
Gear Ratio	74:917:1
No. of steps	3 steps
Generator	
Rated power output (kW)	1250/250 kW
Voltage	690 V
Coupling	Fluid
Frequency	50 Hz
Make	Siemens/Loher/Equivalent
Tower	
Height	72m
Type	Tubular Tower
Material	Welded steel plate
Yawing System	

Type	Active electrical
Gear Box ratio	1:74.9
Yawing motor (kW)	1.5 Kw X 4 motors
Brake System	
Aero dynamic	3 independent systems with balde pitching
Rotor	
Blade material	Fibre Glass/ epoxy
number blades	3
Rotor diameter	69.1 m
Swept Area	3750 m²
Length of Blade	33.5 m

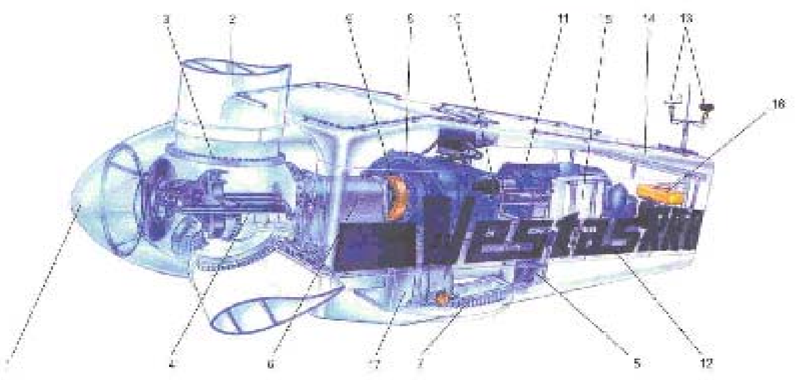
Technical description of technology used in WEG SEL



Pawanshakthi 600 KW WEG Vestas RRB: Technical Description

Overall Data	
Wind speed at rated output	15m/s
Cut in wind speed	4 m/s
Cut out wind speed	25 m/s
Survival wind speed	70 m/s
Rotor speed	26.2 rpm
Hub height	50m
Regulation	Pitch
Volatge (V)	690 V
Current (Amps)	578 Amps.
Type	Pawanshakthi 600 KW
Gear Box	
Type	Planetary/Helical
Gear Ratio	01:58.2
Number of steps	3
Maximum power transmission	660KW
Generator	
Rated power output	600 KW
Type	Single Wound Asynchronous
Voltage	690 V
Revolutions	1527 rpm
Frequency	50 Hz
Rotor	
Number of blades	3
Diameter	47 m
Swept Area	1735 m2
Length of blade	23.5m each
Blade Material	Fibreglass Reinforced Polyester (FRP)
Brake System	
Aerodynamics	Full feathering of blades
Mechanical	Disc Brake
Yawing System	
Type	2 yaw gears with Sun gear yaw sliding system
Yawing Motor (kW)	1.5

Technical description of the technology used in Vestas RRB WEG



Structure Of Machinery

1. Nose Cone
2. Rotor Blades
3. Blade Bearing
4. Traverse Connecting Rod
5. Yaw Gear
6. Shaft Arrangement
7. Yaw Top
8. Gear Box
9. Shrink Disc
10. Transmission Shaft
11. Generator
12. Hydraulic Unit

13. Windvane & Anemometer
14. Nacelle Cover
15. VMP Top Control Unit
16. Mini Crane (for 500KW, 600KW only)
17. Nacelle Frame

Annex 6

Generation data of 2MW demonstration project by RRECL in Jaisalmer

Capacity of Fram : 2 MW   No of Machine : 8   Capacity of each machine : 250 KW
Genration Started : 14.8.1999 Date of Comm : 5.4.2000 Name of Site : Amarsagar
Name of O&M contactor : BHEL   Period of O&M : 5 Years

Sr No	Month	Genration in Kwhr
	Monthly Genration in Year 1999-2000	
1	Aug-99	122680
2	Sep-99	180240
3	Oct-99	50730
4	Nov-99	36540
5	Dec-99	49710
6	Jan-00	104850
7	Feb-00	107280
8	Mar-00	114720
	Total Genration	766850
	Monthly Genration in Year 2000-2001	
1	Apr-00	256500
2	May-00	628080
3	Jun-00	608670
4	Jul-00	445230
5	Aug-00	467870
6	Sep-00	306360
7	Oct-00	96810
8	Nov-00	69780
9	Dec-00	69090
10	Jan-01	62670
11	Feb-01	105510
12	Mar-01	129270
	Total Genration	3245840
	Monthly Genration In Year 2001-2002	
1	Apr-01	230280
2	May-01	663260
3	Jun-01	360450
4	Jul-01	344910
5	Aug-01	322650
6	Sep-01	204180
7	Oct-01	75000
8	Nov-01	81330
9	Dec-01	66270
10	Jan-02	68550
11	Feb-02	115020
12	Mar-02	135840
	Total Genration	2567730
	Monthly Genration In Year 2002-2003	
1	Apr-02	250800
2	May-02	588470
3	Jun-02	541650
4	Jul-02	689010
5	Aug-02	423120
6	Sep-02	306180
7	Oct-02	58600
8	Nov-02	69810
9	Dec-02	71130
10	Jan-03	72150
11	Feb-03	116760
12	Mar-03	134550
	Total Genration	3302130
	Monthly Genration in Year 2003-2004	
1	Apr-03	166080
2	May-03	328980
3	Jun-03	597480
4	Jul-03	308730
5	Aug-03	315810
6	Sep-03	282690
7	Oct-03	38310
8	Nov-03	67880
9	Dec-03	60630
10	Jan-04	78780
11	Feb-04	95870
12	Mar-04	72300
	Total Genration	2413320

Annex 7

List of Tables

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