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

CONTENTS

Annexes

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

2.5 MW Bundled Wind Power Project in Maharashtra (India)
Date: 18/02/08
Version - 01

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

The Wind Power Project of 2.5 MW installed capacity enabling generation of electricity by state-of-art 1.25 MW Wind Turbine Generators (WTGs) in the State of Maharashtra was installed by Raj Infrastructure Development (India) Pvt. Ltd. (Pune) and Raj Promoters & Civil Engineers. Pvt. Ltd, Pune. However, the bundled CDM project activity has been proposed by Raj Infrastructure Development (India) Pvt. Ltd.

The bundled project activity consists of 2 sub-bundles described as below:

Sub-Bundles	No. x Capacity	Name of Promoter	WTG Manufacturer	Date of Commissioning	Location
I	1 no. x 1.25 MW	Raj Promoters & Civil Engineers. Pvt. Ltd.	SUZLON	30 September, 2006	WTG No. – J 116 Gut No. – 16 Compartment No. – 442 Sr. No. –64039585 Village – Isharde Taluka – Sakri District – Dhule
II	1 no. x 1.25 MW	Raj Infrastructure Development (India) Pvt. Ltd.	SUZLON	13 August, 2006	WTG No. – J 129 Gut No. – 90 Compartment No. – 141 Sr. No. –64039789 Village – Chhadvel Taluka – Sakri District – Dhule

The electricity generation from this project will contribute to annual GHG reductions estimated at 4307 tCO_2e. Although the project life is envisaged as 20 years, it is proposed that the project activity needs to mitigate the risks involved in renewable energy technology for the first 10 years. The project activity will evacuate approximately 4.32 GWh of renewable power annually to the power deficit Western Region Grid.

Purpose of the project activity:

The main purpose of the project activity is to generate electrical energy through sustainable means using wind power resources, to utilize the generated output for selling it to the state electricity utility and to contribute to climate change mitigation efforts.

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

- To enhance the propagation of commercialisation of 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 project through revenues from the CDM.

Contribution of project activity to sustainable development:

Government of India has stipulated following indicators for sustainable development in the interim approval guidelines[1] for CDM projects.

1. Social well-being

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

2. Economic well-being

The project contributes to the economic sustainability around the plant site, which is promotion of decentralization of economic power, leading to diversification of the national energy supply, which is dominated by conventional fuel based generating units. The generated electricity is fed into the Western Regional Grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers 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.

3. Environmental well-being

The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely - fossil fuel) based power plants, thereby contributing to the reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. As wind power projects produce no end products in the

[1] Designated National Authority (CDM India) web site: http://cdmindia.nic.in/host_approval_criteria.htm

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.

4. Technological well-being

The project activity leads to the promotion of renewable energy generation by wind, demonstrating the success of wind turbine generators in the region, which feed the generated power into the nearest sub-station, thus increasing energy availability and improving quality of power under the service area of the substation. Hence, the project leads to technological well-being.

In view of the above, the project participant considers that the project activity profoundly contributes to the sustainable development.

A.3 Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	Raj Infrastructure Development (India) Pvt. Ltd.	No.

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

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

A.4.1.1 Host Party(ies):

India.

A.4.1.2 Region/State/Province etc.:

Maharashtra.

A.4.1.3 City/Town/Community etc:

Dhule.

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

Unique identification of Project Activity		
Sub-Bundles	**I**	**II**
Site/Village	Isharde (1 x 1.25 MW)	Chhadvel (1 x 1.25 MW)
WTG Location No.	J 116	J 129
Gut No.	16	90
Compartment No.	442	141
Sr. No.	64039585	64039789
Latitude	17.6167, (DMS)- 17°37’0” N	17.6167, (DMS)- 17°37’0” N
Longitude	77.9500, (DMS)- 77°57’0” E	77.9500, (DMS)- 77°57’0” E

Figure 01- Location Map

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

As defined under Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the project activity proposes to apply following project types and categories:

- **Type : I – Renewable Energy Projects**
- **Project Category : I.D. – Grid connected renewable electricity generation (Version 13: EB 36)**

Technology Used:

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind has considerable amount of kinetic energy when blowing at high speeds. This kinetic energy when passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the shaft connected to the generator also rotates, thereby producing electricity.

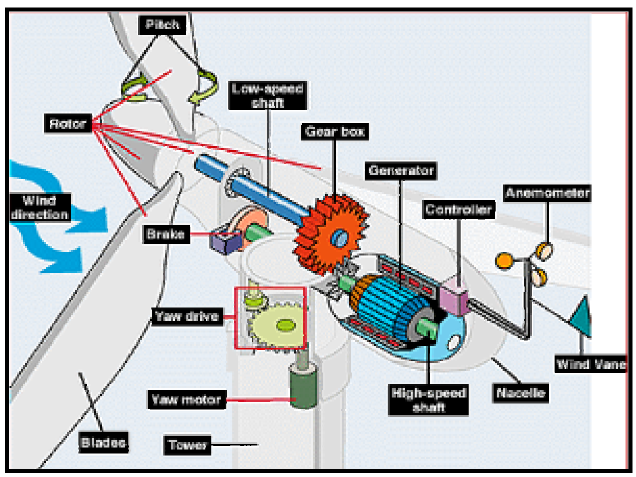


Figure 02: Major Mechanical Parts of a Wind Turbine

The technology is a clean technology since there are no GHG emissions associated with the electricity generation. The project installs Suzlon make WTGs of individual capacity 1.25 MW (2 machines).

Salient Features of 1.25 MW (S 70) WTG

Sr. No.	Particulars	Specifications
1.	Rotor diameter	69.1 m
2.	Hub height	74 m
3.	Installed electrical output	1250 kW
4.	Cut-in wind speed	3 m/s
5.	Rated wind speed	12 m/s

6.	Cut-out wind speed	20 m/s
7.	Rotor swept area	3750 m^2
8.	Rotational speed	13.2/19.8
9.	Rotor material	GRP
10.	Regulation	Pitch
11.	Generator	Asynchronous Generator, 4/6 poles
12.	Rated output	250/1250 kW
13.	Rotational speed	1010/1515 rpm
14.	Operating voltage	690 V
15.	Frequency	50 Hz
16.	Protection	IP 56
17.	Insulation class	H
18.	Cooling system	Air cooled
19.	Gear box	3-stage gearbox, 1 planetary & 2 helical.
20.	Gear box manufacturer	Winergy
21.	Gear ratio	77.848
22.	Nominal load	1390 kW
23.	Type of cooling	Oil cooling system
24.	Yaw drive system	4 active electrical yaw motors
25.	Yaw bearing	Polyamide slide bearing
Safety system		
26.	Aerodynamic brake	3 times independent pitch regulation
27.	Mechanical brake	Spring power disc brake, hydraulically released, fail safe. Microprocessor controlled, indicating.
28.	Control unit	Actual operating conditions, UPS back-up system
39.	Tower	Tubular
31.	Design standards	GL/IEC

Note: This project does not involve any technology transfer. It is an indigenous technology implemented for project activity.

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

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
2008	3877
2009	3877
2010	3877
2011	3877
2012	3877
2013	3877
2014	3877
2015	3877
2016	3877
2017	3877
Total estimated reductions	**38770**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (t of CO_2 eqiv.)	**3877**

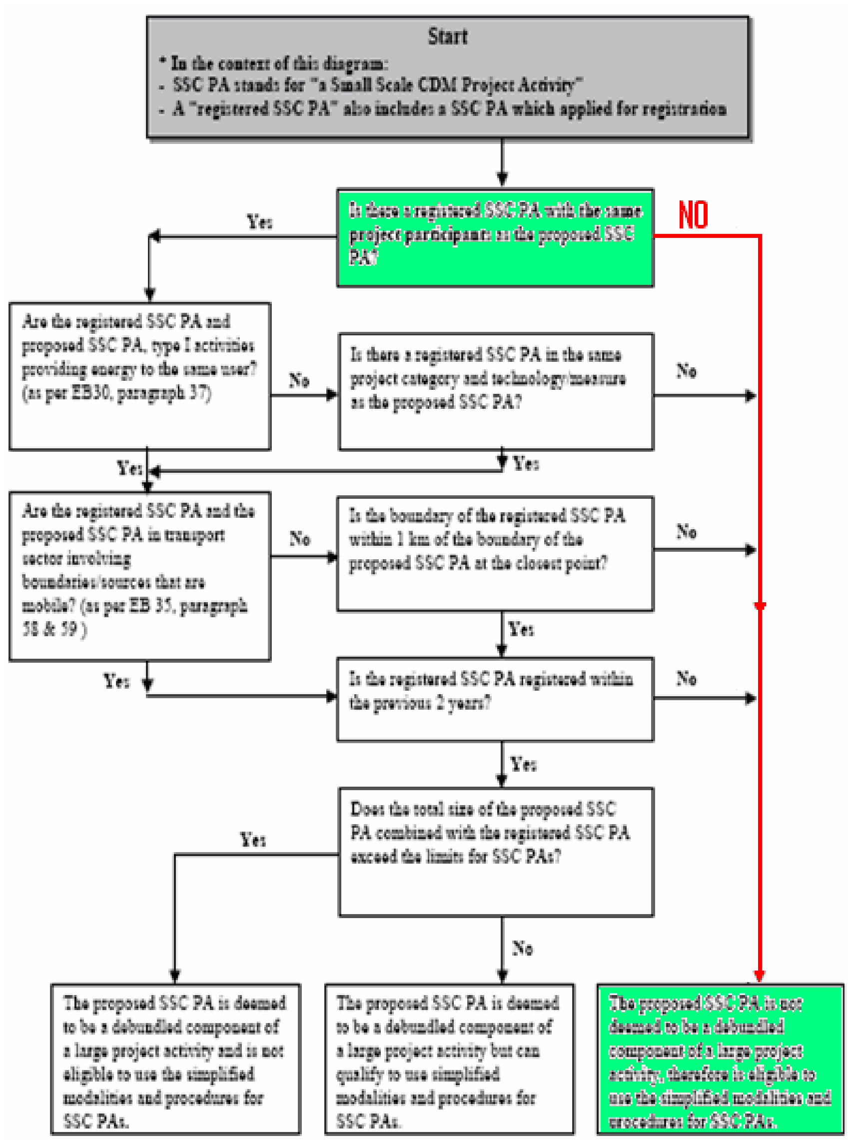
A.4.4 Public funding of the small-scale project activity:

- The project has not received any public funding from Annex I countries and Official Development Assistance (ODA).
- The project is a unilateral project.

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

According to Annex 27 of EB 36 report '**Compendium of guidance on the debundling for SSC project activities**' paragraph 2, a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

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



There is no small scale project registered with UNFCCC in the project proponent's name (as shown with the red line in the flow chart above). Therefore, the proposed project activity is not a debundled component of a larger CDM project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Project Type : I – Renewable Energy Projects

Project Category: D – Grid connected renewable electricity generation (Version 13: EB 36)

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities i.e. 'indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories –Version 10'.

This methodology also refers to:

- ✓ Tool to calculate the emission factor for an electricity system (Version 01, EB 35)
- ✓ Additionality tool for small scale project activities (Attachment A to Appendix B, Version 06: 30 September 2005)

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

The project category is grid connected renewable electricity generation system hence as per appendix B- 'indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, Version- 10' of the simplified modalities and procedures for small scale CDM project activities (FCCC/KP/2005/8/ADD.1), the proposed CDM project falls under category **I.D – Grid connected renewable electricity generation.** The applicability of the project activity as small scale as per approved methodology AMS I.D. has been demonstrated below:

Applicability criteria	Project case
This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	The project is a wind power project supplying electricity to Western Regional Grid, hence applicable to this category.
If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	There is neither non-renewable component added, nor co-firing is required for the proposed project activity. The renewable project capacity is 2.5 MW, well below the limit of 15 MW.
Combined heat and power (co-generation) systems are not eligible under this category.	The project activity is wind mill project and not a combined heat and power (co-generation) system.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable, the entire wind turbines are new and this project is not capacity enhancement or up gradation project.

Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	Not applicable. This project is not a retrofit or modification of existing facility.

The above comparison confirms that the chosen methodology is applicable for this project activity**.**

B.3 Description of the project boundary:

Project boundary specified in the Appendix B of simplified modalities and procedures is that encompasses the physical, geographical site of the renewable generation source. This includes the wind turbine installation, pooling and sub-stations. The proposed project activity evacuates the power to the Western Region Grid. Therefore, all the power plants contributing electricity to the Western Grid are taken in the connected (project) electricity system for the purpose of baseline estimation.

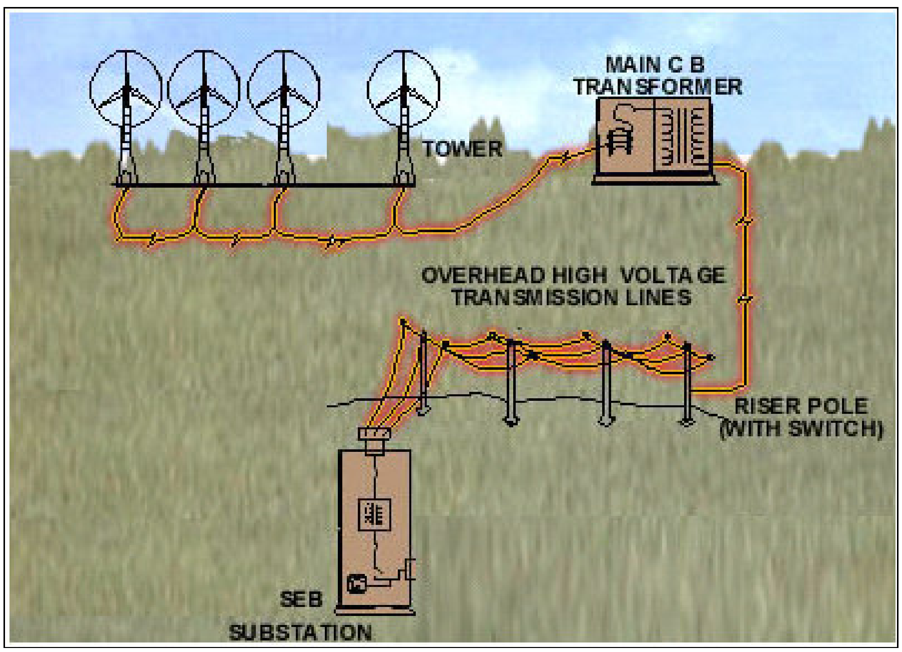


Figure 03- Project Boundary

List of gases included in project boundary:

	Source	Gas	Status	Justification/Explanation
Baseline	Electricity generation, in the grid.	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
Project activity	Supplemental fossil fuel consumption at the project site.	CO_2	Excluded	In case of wind projects there is no supplemental fossil fuel consumption at the project site.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Supplemental electricity consumption (Electricity import).	CO_2	Included	Electricity drawn from the grid is taken in to account while determining the net export by the project activity to the grid. This reflects in the energy generation bills.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification.

B.4 Description of baseline and its development:

Baseline Scenario for electricity generation:

The baseline scenario for electricity generation is the electricity supplied by the CDM project activity would have been supplied by the operation of the power plants connected to the grid and by addition of new generation sources. These generation sources will be depicted in OM and BM calculations as part of the combined margin method for calculation of the baseline emission factor. The calculation of the baseline emission factor using the combined margin methodology has been detailed in Section B.6.1.

Grid System for the Project Activity

The Western Region of India comprises of following States and Union territories viz. Gujarat, Madhya Pradesh, Chhattisgarh, Maharashtra, Goa, Daman & Diu, and Dadra & Nagar Haveli.

The installed generating capacity of Western Region at the end of the previous year (i.e. 2005-06) was 35,118.95 MW. During the year 2006-07, generating capacity of 3815.93 MW was added, thus making the installed capacity of Western Region at the end of year 2006-07 as 38934.88 MW (effective capacity 36954.64 MW). The total installed capacity comprises of Hydro – 6918.83 MW (17.77 %), Gas – 5842.31 MW (15 %), Coal- 22441.50 MW (57.64 %), Nuclear – 1840 MW (4.73 %), RES[2] – 1874.76 MW (4.81 %) and Diesel – 17.48 MW (0.045

[2] Renewable Energy Sources (RES) - includes Small Hydro Project, Biomass Gasifier, Biomass Power, Urban & Industrial Waste Power.

%). Total energy generated in Western Region during 2006-07 was 198,765.38 MUs against generation of 188,240.87 MUs during 2005-06, thus registering a growth of 5.59%. 72% of the total generation in the year 2006-07 was from thermal power plants.[3]

The power sector in India including the Western region is driven by thermal power stations as it is evident by the figures above. A list of future capacity additions based on the energy demand has been planned by Central Electricity Authority (CEA) and these plans are revised from time to time based on demand projections. Detailed projections are available for the eleventh plan period, i.e. 2007 till 2011 in the report of working group on power (11^{th} plan). As per the report, to bridge power shortages in the country in the business-as-usual scenario, nearly 82,369 MW of fresh capacity addition would be required at the end of 11^{th} year plan (inclusive of renewable energy sources), more than 72% of which is likely to be fossil fuel based and only 16% would be renewable energy based[4].

The proposed project activity can evacuate approximately 4.67 Million Units of clean electricity per year. Taking into account energy shortages and current trend of investment in fossil fuel based energy generation in the region, in absence of the project activity, an equivalent amount of electricity would have been generated using fossil fuel based power plants. Thus, the electricity generation from the project activity displaces the energy generated using fossil fuel fired power plant and leads to a sizeable amount of emission reduction over a period of 10 years (Crediting period). In the proposed baseline, Western Region grid is used as the reference region for estimating the current generation mix.

Baseline Estimation:

Baseline methodology for project category *I.D* has been detailed in paragraphs 7-11 of the approved small scale methodology *AMS I.D*. (Version 13, EB 36). Paragraph 9 of the approved methodology applies to this project activity, which states that:

For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'.

OR

b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

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[3] http://www.wrpc.nic.in/AnnualReport0607/chapter2.pdf

[4] http://www.cea.nic.in/ (working group on power 11^{th} plan, table 1.37, 1.38, (page no. 44, 47, 48) chapter 1)

Baseline emission reductions have been estimated using combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in 'Tool to calculate the emission factor for an electricity system Version 01 (EB 35)'.

In the proposed baseline, Western Region grid is used as the reference for estimating the current generation mix.

Following information is used for baseline determination:

Sr. No.	Key information/data used for baseline	Source of data/information
1.	Electricity generated	As per generation guaranteed by the technology provider.
2	Grid emission factor (Western Region)	CO_2 Baseline Database –Version 3, 15 December 2007 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

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

✓ **Justification for additionality of the project :**

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

✓ **Investment Barrier:**

This source of energy has not been exploited widely in India. It is only during the last couple of years that a commercial exploitation of wind energy started in a big way. Wind energy has been the most unpredictable of all the other common sources of generating energy i.e. coal, diesel etc. Further wind turbines generation plant has the lowest load factor of all other sources.

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Project proponent has chosen the activity for their urge of sustainable development, despite being not very financially rewarding as compared to the usual business returns. In India, investment in Govt. Securities generate a return of 6.50 to 7.50 %, long term Bank Deposits earn about 7% plus, SBI & Term Lending rates were around 10% plus. (Ref: Reserve Bank of India – Handbook of Statistics on Indian Economy Table 74) Investment in infrastructure project have long gestation period. Uncertainties in the future cash flows are high. Wind power projects are comparatively more risky than these because wind, the main source for generating the energy is not very predictable and totally beyond anybody's control. Further grid availability can fall short much beyond the levels considered in the calculations. As per MERC tariff order, Govt of Maharashtra for private sector participation in renewable energy generation return on equity should be minimum 16%. [Ref: Maharashtra Electricity Regulatory commission orders 23

November 2003] Hence with a minimum of risk premium of say 9%, equity investors' expectation of (7% + 9%) 16% can be assumed to be a very reasonable expectation.

The project set up by the proponent generates Equity Return of 11.35%. This return is arrived at on the assumption that estimated generation of units; operation & maintenance expenses and all other variables materialize as expected. The main variable, which can adversely affect equity IRR, is saleable units. This can be due to either non- availability of wind, grid connections or technical problems with windmill.

Sensitivity Analysis:

Saleable units decreased by	**-2.5%**	**-5.0%**	**-7.5%**	**-10%**
Equity IRR (without CDM)	11.66%	9.98%	9.30%	8.61%
Equity IRR (with CDM)	12.32%	11.57%	10.82%	10.08%
Saleable units increased by	**2.5%**	**5.0%**	**7.5%**	**10%**
Equity IRR (without CDM)	12.04%	12.73%	13.43%	14.13%
Equity IRR (with CDM)	13.84%	14.61%	15.38%	16.16%

Wind power projects provide lower IRR as these projects entail high project cost and low PLF. To promote these technologies state government provides incentives like accelerated depreciation, wheeling of power to user etc, however even with these incentives the return from wind energy projects is lower than that from the other generation options. Clearly the project is not very attractive with existing power pricing policy of the state.

Regulatory and other barriers:

Availability Based Tariff (ABT): All SERCs have been advised to introduce the ABT regime at the state level[5]. According to the ABT, all future tariffs shall be determined on the basis of a confirmed delivery by the generator. Here, the producer shall be required to provide prior schedules of the quantity of electricity expected to be generated from the source, over a time frame of 24 hours and, at an interval of every 15 minutes. In case the electricity generated is lower than the specified amount, the producer shall be penalized for the deficit electricity at the UI (Unscheduled Interchange) rate prevailing at that time. Introducing the ABT to Maharashtra for investors in renewable energy occurs as a barrier. Investment in wind carries has an inherent risk, as the generation cannot be guaranteed (because there is no control over the fuel supply –

[5] According to Section 5.7.b of the National electricity Policy (Feb 2005) "Availability Based Tariff (ABT) regime introduced by CERC at the national level has had a positive impact. It has also enabled a credible settlement mechanism for intra-day power transfers from licenses with surpluses to licenses experiencing deficits. SERCs are advised to introduce the ABT regime at the State level within one year".

wind). This could lead to a situation where the MSEB may prefer to buy energy from risk free energy sources such as thermal power plants. As per the ATB the MSEB buys this safe energy for Rs. 5.70 per kWh whereas the price for wind energy is Rs. 3.50 per kWh. The investors were aware of the possibility of ABT being introduced in Maharashtra at the time of purchase of the WEGs, and also that even at lower prices they were at a risk of not selling his energy.

State Power Sector Performance Ranking: The state of Maharashtra is not the best suitable destination for investment in power sector. According to the performance rating of the state power sectors across all states carried out by ICRA / CRISIL at the instance of the Ministry of Power (MoP), Maharashtra is placed only sixth amongst the states with wind potential. This rating is taken from the report of 2004. Though a third review of the report based primarily on the data obtained till December 2005, has been released in June 2006, when the commissioning of the project took place there was only data of 2004 available and therefore this data is considered. It is clear from the report that investment in the states of Andhra Pradesh, Karnataka, Tamil Nadu and Gujarat are better options than Maharashtra. Based on their analysis carried out for all the states in India, the results specific to the states with available wind potential are summarized in Table below:

Table : Score of the ICRA / CRISIL Report on State Power Sector

Rank	State	State Govt.	SERC	GENERATION	T&D	Financial Risk	Others	Commercial Viability	Total
Maximum score		**17.00**	**13.00**	**6.0**	**21.00**	**23.00**	**5.00**	**15.00**	**100**
1	Andhra Pradesh	8.75	10.75	4.75	11.75	14.75	2.75	3.25	56.75
2	Karnataka	9.50	9.50	5.50	7.25	13.75	3.75	2.00	51.25
3	Gujarat	9.69	2.50	3.75	9.30	15.50	3.75	6.50	50.99
4	Rajasthan	9.00	4.00	5.20	7.25	12.63	3.75	-	41.83
5	Tamil Nadu	4.75	9.00	3.00	9.50	9.63	1.75	2.00	39.63
6	**Maharashtra**	**7.25**	**4.00**	**4.00**	**4.50**	**12.25**	**1.25**	**4.50**	**37.75**
7	Kerala	4.00	0.50	2.50	13.00	10.00	3.00	1.25	34.25
8	Madhya Pradesh	6.90	3.00	2.00	6.10	4.75	-	2.00	24.75

Furthermore, the 2006 edition of the Report on State Power Sector Performance Ratings shows that Maharashtra is not the best state to invest in, even today. The report lists various problems that are being faced in the Maharashtra power sector. The report states that the problems in the power sector have led to stagnancy in the generation capacity of the state for the last 5 years. Addition to power generation by the private sector in this period has been minimal. There has also been an increase in the rate of failures in the distribution network. The issuance of tariff orders has been delayed and all these problems have resulted in the MSEB incurring an accumulated loss of a whopping INR 19.08 billion as on March 31 2005.

The two ICRA reports of 2004 and 2006 clearly suggest that Maharashtra, as of today as well as during the time the investor purchased the WEGs, was not the best state for investment in the power sector and the project proponent has undertaken a considerable risk while investing in this state.

CDM benefit sharing: The PPA signed for the present project between the investors and the Maharashtra State Electricity Distribution Company (MSEDCL) consists of clause (Article 18) which says,

"*MERC shall be approached to review the tariff structure once the project becomes eligible for CDM or similar credits and much mechanism for sharing of CDM or similar credits between the seller and the MSEDCL. The decision of the MERC will binding on both the parties.*"

Benefit sharing of this sort decreases the net expected revenues to the project and thus affects the returns. Moreover, no fixed proportion of the CDM sharing has been mentioned, thus causing huge uncertainty in the returns to the project. In such a case, a healthy benefit from CDM will ensure that any legible proportion of benefit sharing stated by the MERC does not affect the returns to the project greatly.

The following is an extract from the MERC order in the matter of application filed by the (i) Maharashtra state electricity board [MSEB], (ii) Shri prater g. Hogade, (iii) Renewable energy developers Association of Maharashtra [REDAM], and (iv) Indian wind energy Association [INWEA] For Procurement of wind energy & wheeling for third party-sale and/ or self-use, 2002, which discusses the regulatory commission's policy to introduce the concept of CDM benefit sharing.

"The Commission understands that several renewable energy projects may be eligible for the benefits available through the "Clean Development Mechanism" under Kyoto Protocol. While these benefits are not available to a large number of projects which are on the verge of commercial viability, they can be availed of in future. Since the consumer is supporting the renewable energy projects by way of higher tariffs, it is essential that any such credits secured by a project should be shared on an equitable basis by the developer with the utility and its consumers. The Commission shall review the tariff structure for RE Projects that become eligible for CDM or similar credits, and devise a system, which will enable sharing of benefits between the consumers and the project developers at that stage."

The extract also mentions that once the project has been registered as a CDM project the tariff for the project would be reviewed. Thus, uncertainty also lies in the tariff which would be applicable to the entire project. Though the investors are eligible for the entire CDM benefits for investing into clean technology yet they would be entitled to only a small portion of it because of the policy of sharing with the utility. Moreover, the financial returns to the project initially conceived would also change if and when the commission revises the tariff applicable. Thus a great deal of uncertainty exists even after the investors become entitled to CDM benefits.

Operational Barriers:

A Wind farm at Dhule has faced variety of risks during in the recent past. Some of them are enlisted below:

Right of way – The problem of right of way is basically characterized by mass scale protests by the nearby villagers against the operation of the WEGs[6]. This can lead to ceased operation of WEGs i.e. no generation of electricity and even transferring of these WEGs to other areas. Such problems have recently cropped up in the Dhule district in the state of Maharshtra in spite of obtaining No Objection Certificates (NOC) from the village panchayats. Thus, incidences like these in the state of Maharashtra act as a great barrier to smooth implementation of the project.

Cable Theft – Power generation in the Dhule region has been affected badly due to repetitive cable thefts. It is theft of power transmission cables used to connect the generator and transformer via control panel. It consist of two types i.e. G1 & G2 cables with copper (100 % purity) inside & covered with rubber Insulation. Due to repeated cable theft and non-availability of required cables, results in running of WTG in either G2 mode or complete stoppage of the WTG. Apart from power transmission cables earthing cables are also been stolen, causing stoppage of WTG during severe lightning. In addition to this other components like Control / Capacitor Panels and Power Panels were severely damaged. HT- Yard consisting of CT/PT, Transformer and VCB panels were also damaged.

Grid related problems – Wind generated electricity do not form part of the base load to the grid. The infrequent nature of wind power is the main reason behind it. In case of low demand or the requirement of maintaining the grid stability, wind power is often disconnected from the grid. This leads to loss of the generated electricity and thus loss to the revenue earned by the investors. There are various other grid related problems which face wind power for example poor grid availability, grid outages etc. For instance, on the 25th February, 2007 and on 28th February, 2007, a major grid disturbance occurred where in the 400 kV and 220 kV lines in Western Maharashtra tripped. Below is an extract from the press release of the incident: *“Preliminary reports indicate that a fault occurred around Phadge, Nagothane, and Bableshwar area of Maharashtra causing multiple line trippings. These trippings led to islanding of Gujarat, Western Maharashtra and Mumbai system and loss of generation of around 4000 MW in Western grid including Tarapur nuclear station.”* Such incidences cause loss of the generated electricity. Although the loss is applicable to all sources, it is more crucial for a renewable energy sources as these are not as competitive and efficient on other grounds like technology, cost of electricity etc.

The project proponent was aware of the various barriers associated with project implementation. However it was felt that the additional revenue against the sale consideration of carbon credits generated due to the project activity would help in augmenting these barriers to certain extent.

B.6 Emission reductions:

B.6.1 Explanation of methodological choices:

Baseline Estimation:

[6] http://forums.bharatrakshak.com/viewtopic.php?t=2869&start=40&sid=907fccac520aa09e90c0f205b7b82245
http://www.earthtimes.org/articles/show/56721.html

As discussed in section B.4 of the PDD, Grid Emission Coefficient (or CO_2 Emission factor) have been estimated using combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)' .

✓ **Calculation of emission coefficient for the grid electricity (or CO_2 Emission factor):**

Emission coefficient for the grid electricity source is determined as follows:

Emission coefficient for the grid electricity is calculated as Combined Margin (CM) which is the combination of Operation Margin (OM) and Build Margin (BM) factors according to the following six steps:

Step 1: Identification of the relevant electric power system:

Central Electricity Authority (CEA), Ministry of Power, Government of India (Host Country) has given the delineations of the project electricity system and the connected electricity system in India, (as shown in table below). As per CEA the Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan).

Geographical Scope of five regional grids:

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
Utter Pradesh				
Uttaranchal				

For the purpose of calculating the emission reductions achieved by any CDM project, the 'Tool to calculate the emission factor for an electricity system' requires that the "project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints". This implies that the grid emission factors could be most appropriately calculated at the level of the five regional grids. As per the delineation given by CEA, Maharashtra State falls into the Western Regional Grid.

Step 2: Selection of an Operating Margin (OM) method

For calculation of operating margin four options are available:

(a) Simple operating margin;
(b) Simple adjusted operating margin;
(c) Dispatch data analysis operating margin;
(d) Average operating margin

CO_2 Baseline Database Version 3, Date – December 2007, published by Central Electricity Authority (hereafter CEA Database) has been referred for the values of OM. As per the *"Tool to calculate the emission factor for an electricity system"* (Version 01, EB 35), any of the four methods can be used, however, the simple OM method can be used only if the low-cost/must run resources constitute less than 50% of the total grid generation in: 1) average of the five most recent years, or 2) based on long term averages for hydroelectricity production.

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

	2002-03	2003-04	2004-05	2005-06	2006-07
North	26.1%	28.1%	26.8%	28.1%	27.1%
East	7.5%	10.3%	10.5%	7.2%	9.0%
South	18.3%	16.2%	21.6%	27.0%	28.3%
West	8.2%	9.1%	8.8%	12.0%	13.9%
North-East	45.8%	41.9%	55.5%	52.7%	44.1%
India	**16.3%**	**17.1%**	**18.0%**	**20.1%**	**20.9%**
Average of five years for WR					**10.40%**

Table reference- CEA Baseline Database, Version 3

In Western region the low-cost/must run resources constitute only 10.40 % (as demonstrated above) of the total grid generation in average of the five most recent years, hence simple OM has been opted for.

Step 3: Calculation of operating margin emission factor ($EF_{grid,OM,y}$) for the region based on simple OM

OM (Simple OM) values have been taken from CEA Database as discussed above. The *"Tool to calculate the emission factor for an electricity system"* (Version 01, EB 35) has been used in the CEA Baseline Database for the calculation of operating margin.

Simple Operating Margin emission factor (Western Region) in tCO_2/GWh (incl. imports)	
Year	**Simple OM (WR)**
2004-2005	1010
2005-2006	1000
2006-2007	990
Average of 3 years	1000

Table reference- CEA Baseline Database, Version 3

As per the *"Tool to calculate the emission factor for an electricity system"* (Version 01, EB 35), the calculation of OM has been done *ex ante* based on the most recent 3 years for which data is available at the time of PDD submission.

Step 4: Identification of the cohort of power units to be included in Build Margin (BM)

BM calculation is based on 20% most recent capacity additions in the grid based on net generation. 20% of the most recent capacity additions have been shown in Annex 3. Power plant registered as CDM project activities have been excluded from the sample group *m*. Capacity additions from retrofits of power plants have not been included in the calculation of the build margin emission factor.

Note: In line with the "Tool to calculate the emission factor for an electricity system" (Version 01, EB 35), power plant registered as CDM project activities should be excluded from the sample group m. However, If group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power units that are built more than 10 years ago then: (i) power units that are built more than 10 years ago from the group must be excluded; and (ii) grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system should be included. However, in Western Region group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor are not older than 10 years. Hence grid connected power projects registered as CDM project activities have not been included in the sample group m.

20% of Net Generation (GWh)

	2002-03	**2003-04**	**2004-05**	**2005-06**	**2006-07**
North			31,458	33,641	35,845
East			15,594	17,203	18,764
South			26,935	27,666	30,441
West			34,145	35,201	37,099
North-East			1,552	1,531	1,366
India			109,685	115,241	123,513

Table reference – CEA Baseline Database, Version 3

Net Generation in Built Margin (GWh)

	2002-03	**2003-04**	**2004-05**	**2005-06**	**2006-07**
North			32,064	34,340	36,511
East			15,818	17,567	18,907

South	28,513	28,228	30,442
West	35,257	35,425	38,242
North-East	2,055	1,793	1,437
India	113,707	117,353	125,538

Table reference- CEA Baseline Database, Version 3

Vintage of data is based on option 1 of step 4. (Refer *"Tool to calculate the emission factor for an electricity system"* -Version 01, EB 35). BM calculation has been done *ex-ante* and hence BM value will remain fixed and need not be monitored during the crediting period.

Step 5: Calculation of build margin ($EF_{grid,BM,y}$) emission factor for the region (ex ante)

BM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 3, December 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Govt. of India.

Build Margin emission factor (Western Region) in tCO_2/GWh

Year	BM (WR)
2006-2007	590

Table reference- CEA Baseline Database, Version 3

Note: Details of power plants considered for BM calculation has been given in Annex- 3

Step 6: Calculation of combined margin (CM) emissions factor or the emission coefficient for the grid electricity ($EF_{grid,CM,y}$):

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where,

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

For wind power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

Hence,

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times 0.75 + EF_{grid,BM,y} \times 0.25 \quad \text{..........................Equation I}$$

$$= 1000 \times 0.75 + 590 \times 0.25$$

= 750 + 147.5

= 897.5 tCO_2/GWh

Emission Reduction Calculation:

Paragraph 9 of the approved methodology states that:

For all other systems, the baseline (**BE** $_{electricity,\ y}$) is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh). Hence baseline emissions or CERs generated by the project are estimated as under:

$BE_{electricity,\ y} = EG_y \times EF_{grid,CM,\ y}$ ……………………………………..Equation II

Where,

EG_y = Net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh, and
$EF_{grid,CM,\ y}$ = Grid emission coefficient for the electricity displaced due to the project activity during the year y (tCO_2/MWh).

- **Emission Reduction (ER_y):**

The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions through substitution of electricity generation with fossil fuels (BE_y) and project emissions (PE_y)

$ER_y = BE_{electricity,\ y} - PE_y$ …………………………………..Equation III

Where:

ER_y = the emission reductions of the project activity during the year y in tons of CO_2.
BE_y = the baseline emissions due to the displacement of electricity during the year y in tons of CO_2
PE_y = the project emissions during the year y in tons of CO_2

Since, the project emissions for this project (**PEy**) is zero,

$ER_y = BE_{electricity,\ y}$ …………………………………..Equation IV

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

(Copy this table for each data and parameter)

Data / Parameter:	**$EF_{grid,CM,\ y}$**
Data unit:	tCO_2/ GWh
Description:	CO_2 Combined Margin emission factor for the Western Region Grid
Source of data used:	CO_2 Baseline Database –Version 3, 15 December 2007 by Central

	Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	$EF_{grid,CM,y} = EF_{grid,OM,y} \times 0.75 + EF_{grid,BM,y} \times 0.25$ = 1000 X 0.75 + 590 X 0.25 = 750 + 147.5 = 897.5 tCO_2/GWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	Estimated as per 'Tool to calculate the emission factor for an electricity system-Version 1' using values of OM and BM values as shown above.
Any comment:	

Data / Parameter:	**$EF_{OM,y}$**
Data unit:	tCO_2/ GWh
Description:	CO_2 Operating Margin emission factor for the Western Region Grid (Three years average has been taken)
Source of data used:	CO_2 Baseline Database –Version 3, 15 December 2007 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	**Simple Operating Margin Emission Factor (Western Region) in tCO_2/GWh** **Year** — **Simple OM** 2004-2005 — 1010 2005-2006 — 1000 2006-2007 — 990 **Average of 3 years** — 1000
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Central Electricity Authority, Ministry of Power, Government of India prepares the data.
Any comment:	This database is an official publication of Government of India for the purpose of CDM baselines. It is based on most recent data available to the Central Electricity Authority and hence authentic. Promoter has opted for *ex ante* method to calculate operating margin and hence it will remain fixed through out the 10 years of crediting period and hence need not be monitored every year.

Data / Parameter:	**$EF_{BM,y}$**
Data unit:	tCO_2/ GWh

Description:	CO_2 Build Margin emission factor for the Western Region Grid 2006-2007
Source of data used:	CO_2 Baseline Database –Version 3, 15 December 2007 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	**Build Margin emission factor (Western Region) in tCO_2/GWh** **Year** / **BM** 2006-2007 / 590
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Central Electricity Authority, Ministry of Power, Government of India prepares the data.
Any comment:	This database is an official publication of Government of India for the purpose of CDM baselines. It is based on most recent data available to the Central Electricity Authority and hence authentic. Promoter has opted for *ex ante* method to calculate build margin and hence it will remain fixed through out the 10 years of crediting period and hence need not be monitored every year.

B.6.3 Ex-ante calculation of emission reductions:

Emission Reduction Calculation:

- **Grid emission coefficient ($EF_{grid,CM,y}$):**

As per the calculation detailed in section B.6.1, $EF_{grid,CM,y}$ = 897.5 tCO_2/GWh

- **Net quality of electricity supplied by the project (EG_y):**

Parameter sub bundle	Unit	Value I	Value II	Reference
Annual generation from the project	Mn.Units (MUs)	2.8	2.8	Guaranteed generation as per P.O dated Jan 9, 2006
Correction for Long Term Wind Unavailability	Percent	10%	10%	As per P.O dated Jan 9, 2006
Approximate Grid Non Availability Loss	Percent	5%	5%	Assumption
Salable units par year projected	Mn.Units (MUs)	2.38	2.38	Calculated
Total	Mn.Units		4.76	Calculated

	(MUs)			

Total power generation by all the turbines = 4.32 GWh/yr (or MUs/yr)

Total baseline emission reductions ($BE_{electricity, y}$) **in tCO_2 as per equation II:**

$BE_{electricity, y} = 4.32 * 897.5 = 3877.2$ tCO_2/yr

Where, $EF_{grid, y} = 897.5$ tCO_2/GWh

- **Emission Reduction (ER_y):**

As per equation III and IV

$ER_y = BE_{electricity, y}$ = 3877.2 ≈ 3877 **tons of CO_2/year**

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

Year	Estimation of Project Activity Emission Reduction (tonnes CO_2e /yr.)	Total Baseline Emissions (tonnes CO_2e /yr.)	Estimation of Leakage (tonnes CO_2e / yr.)	Estimation of Emission Reduction (tonnes CO_2e /yr.)
2008-09	0	3877	0	3877
2009-10	0	3877	0	3877
2010-11	0	3877	0	3877
2011-12	0	3877	0	3877
2012-13	0	3877	0	3877
2013-14	0	3877	0	3877
2014-15	0	3877	0	3877
2015-16	0	3877	0	3877
2016-17	0	3877	0	3877
2017-18	0	3877	0	3877
Total	**0**	**38770**	**0**	**38770**

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

B.7.1 Data and parameters monitored:	
(Copy this table for each data and parameter)	
Data / Parameter:	Energy
Data unit:	KWh or GWh
Description:	Net electricity supplied to the Western region electricity grid.

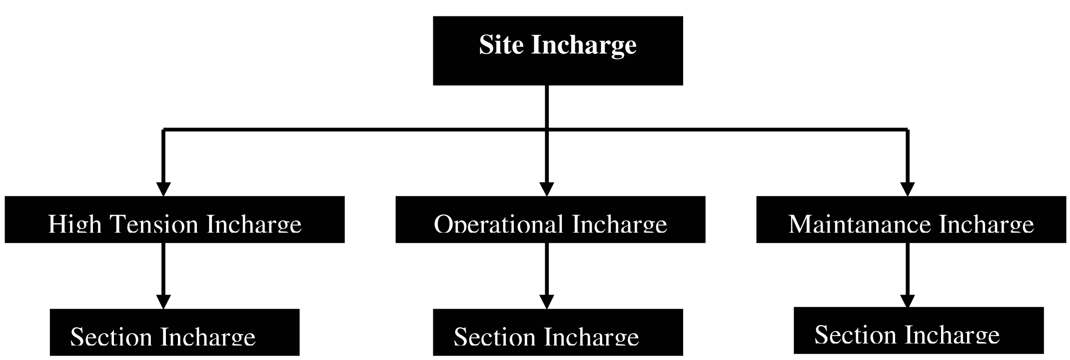
Source of data to be used:	Invoice- electricity sell to regional electricity board
Value of data	--
Description of measurement methods and procedures to be applied:	The data can be very accurately measured. The meters (tri vector meter) installed measure mentioned variable on a continuous basis. Every month these meter readings will be recorded by plant personnel, these records will be archived for crosschecking yearly figures.
QA/QC procedures to be applied:	The data can be very accurately measured. The meters installed on sub stations (grid interconnection point) will be used to measure mentioned variables on a continuous basis. The meters at the sub station will be two-way meters and will be in custody of State Electricity Utility. SEB officials will take the readings (joint meter reading) in these meters and the same reading may be used to determine the net power exported to the grid and determine the extent of mitigation of GHG over a period of time. A Bulk meter installed at the sub station gives the line loss.
Any comment:	

B.7.2 Description of the monitoring plan:

The project participant signed an operation and maintenance agreement with the supplier of the wind turbines i.e. M/s Suzlon Energy Limited (hereafter Suzlon). The performance of the turbines, safety in operation and scheduled /breakdown maintenances is responsibility of Suzlon and are organized and monitored by them. So the authority and responsibility of project management lies with the O & M contractor.

ISO 9001:2000 standard has been adopted by Suzlon, who is responsible for monitoring, calibration and O & M of the project. Training is an essential part of the ISO system. To comply with the ISO standard the training has to be provided to personnel according there responsibility with in organization.

The organizational hierarchy of Suzlon for O& M management is as follows –



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

- The proposed project activity requires evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state power utility.
- The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue.
- The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
- The primary recording of the electricity fed to the state utility grid will be carried out jointly at the incoming feeder of the state power utility. Machines for sale to utility will be connected to the feeder.
- 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.
- 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 WTGs. Each WTG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm through a wireless Radio Frequency (RF) network (SCADA). The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

The project proponents have signed an "Operation and Maintenance" agreement with the supplier of the wind turbines for the operation of the wind turbines. The O & M management structure is as follows:

Routine Maintenance Services:

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

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

Security Services: This service includes watch and ward and security of the wind turbines and the equipment.

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 utility of power generated at promoter's wind turbines and supplied to grid from the meter/s maintained by utility for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

Technical Services:

a) Visual inspection of the WTGs 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.

All the relevant data & reports for maintaining accuracy in future monitoring and reporting of GHGs emission reductions is with the project participant, which follows Quality Management System (QMS) procedure as per ISO 9001.

Raj Group has appointed a full time project in-charge to manage the overall project activity after commissioning. The project in-charge supervises the functioning of the wind farm in close coordination with the officials & technical personnel of M/S Suzlon Energy Limited.

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

Completion Date: 18 February 2008.

Name of person/entity determining the baseline: M/s Raj Infrastructure Development (India) Pvt. Ltd. and their consultant. Consultant is not a project participant as meant in Annex I. Contact details of Raj Infrastructure Development (India) Pvt. Ltd. is given in Annex I

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:

9-01-06 (Based on Purchase order to SUZLON Energy Limited for supply of 2 x 1.25 MW machines)

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

20 years.

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

C.2.1. Renewable crediting period

Not opted.

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

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

Opted for.

C.2.2.1. Starting date:

The starting date of the crediting period shall be 01/09/2008 or a date not earlier than the date of registration.

C.2.2.2. Length:

10 years, 0 months.

SECTION D. Environmental impacts

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

Wind energy projects are considered environmentally safe and as per Host party- India no EIA is required.

There are no negative environmental effects envisaged for the project. These wind turbines are situated on a hillock and during construction no trees were uprooted; also there are no effects on any endangered species in the region. Wind turbines are considered as zero GHG emitting projects, so there will be no pollution caused by this project. However during construction phase some pollution may have been caused by vehicle coming to plant location. But as the project is operational now there are no major effects on the environment post start-up.

D.2 If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an

environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

There are no negative environmental effects envisaged for the project.

SECTION E. Stakeholders' comments

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

The project promoter identified local communities, farmers, and villagers, as the stakeholders with an interest in the CDM activities. The meeting was conducted separately for both the sites. Accordingly, issued letters to all the respective stakeholders requesting to attend meeting or depute representatives at respective venues:

Sub-Bundles	Promoter	WTG Location	Venue	Date and Time
I	Raj Promoters & Civil Engineers. Pvt. Ltd.	WTG No. – J 116 Gut No. – 16 Compartment No. – 442 Sr. No. –64039585 Village – Isharde Taluka – Sakri District – Dhule	Village- Vasant Nagar District- Dhule	05/12/2007, 11:30 AM
II	Raj Infrastructure Development (India) Pvt. Ltd.	WTG No. – J 129 Gut No. – 90 Compartment No. – 141 Sr. No. –64039789 Village – Chhadvel Taluka – Sakri District – Dhule	Village-Bramhanvel District- Dhule	05/12/2007, 11:30 AM

The agenda of the meeting was fixed as follows:

- Welcome
- Description of the project.
- Queries and responses from the proponent and the stakeholders.
- Vote of thanks.

The stakeholder's view is Raj Group in its own small way is contributing positively to local economy & development.

E.2 Summary of the comments received:

Stakeholders had no objections from installations of WTGs instead they have openly said that wind power projects helped to them by-

- Additional revenue generated through land / lease to outsiders like contractors & their employees.
- Job opportunities for day -to - day maintenance and security of WTGs
- Development of roads.
- No any adverse impact on rains, agriculture.

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

The stakeholders have given positive feedback and thus no measures were required to be taken.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Raj Infrastructure Development (India) Pvt. Ltd.
Street/P.O.Box:	Senapati Bapat Road
Building:	410, Pride Silicon Plaza
City:	Pune
State/Region:	Maharashtra
Postfix/ZIP:	411 016
Country:	India
Telephone:	(020) 25635050, 25636060
FAX:	(020) 25633030
E-Mail:	rajgrouppune@reddiffmail.com
URL:	
Represented by:	
Title:	Dr. Rajendra G. Hiremath
Salutation:	Mr.
Last Name:	Hiremath
Middle Name:	Gurupadya
First Name:	Rajendra
Department:	Finance
Mobile:	98220 46604
Direct Fax:	
Direct Tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

- The project has not received any public funding and Official Development Assistance (ODA).
- This is a unilateral project.

Annex 3

BASELINE INFORMATION

Baseline Estimation:

As discussed in section B.4 of the PDD, Grid Emission Coefficient (or CO_2 Emission factor) have been estimated using combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in 'Tool to calculate the emission factor for an electricity system (Version 01, EB 35)' .

✓ **Calculation of emission coefficient for the grid electricity (or CO_2 Emission factor):**

Emission coefficient for the grid electricity source is determined as follows:

Emission coefficient for the grid electricity is calculated as Combined Margin (CM) which is the combination of Operation Margin (OM) and Build Margin (BM) factors according to the following six steps:

Step 1: Identification of the relevant electric power system:

Central Electricity Authority (CEA), Ministry of Power, Government of India (Host Country) has given the delineations of the project electricity system and the connected electricity system in India, (as shown in table below). As per CEA the Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan).

Geographical Scope of five regional grids:

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
Utter Pradesh				
Uttaranchal				

For the purpose of calculating the emission reductions achieved by any CDM project, the 'Tool to calculate the emission factor for an electricity system' requires that the "project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints". This implies that the grid emission factors could be most appropriately calculated at the level of the five regional grids. As per the delineation given by CEA, Maharashtra State falls into the Western Regional Grid.

Step 2: Selection of an Operating Margin (OM) method

For calculation of operating margin four options are available:

(a) Simple operating margin;
(b) Simple adjusted operating margin;
(c) Dispatch data analysis operating margin;
(d) Average operating margin

CO_2 Baseline Database Version 3, Date – December 2007, published by Central Electricity Authority (hereafter CEA Database) has been referred for the values of OM. As per the *"Tool to calculate the emission factor for an electricity system"* (Version 01, EB 35), any of the four methods can be used, however, the simple OM method can be used only if the low-cost/must run resources constitute less than 50% of the total grid generation in: 1) average of the five most recent years, or 2) based on long term averages for hydroelectricity production.

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

	2002-03	2003-04	2004-05	2005-06	2006-07
North	26.1%	28.1%	26.8%	28.1%	27.1%
East	7.5%	10.3%	10.5%	7.2%	9.0%
South	18.3%	16.2%	21.6%	27.0%	28.3%
West	8.2%	9.1%	8.8%	12.0%	13.9%
North-East	45.8%	41.9%	55.5%	52.7%	44.1%
India	**16.3%**	**17.1%**	**18.0%**	**20.1%**	**20.9%**
Average of five years for WR					**10.40%**

Table reference- CEA Baseline Database, Version 3

In Western region the low-cost/must run resources constitute only 10.40 % (as demonstrated above) of the total grid generation in average of the five most recent years, hence simple OM has been opted for.

Step 3: Calculation of operating margin emission factor ($EF_{grid,OM,y}$) for the region based on simple OM

OM (Simple OM) values have been taken from CEA Database as discussed above. The *"Tool to calculate the emission factor for an electricity system"* (Version 01, EB 35) has been used in the CEA Baseline Database for the calculation of operating margin.

Simple Operating Margin emission factor (Western Region) in tCO_2/GWh (incl. imports)

Year	**Simple OM (WR)**
2004-2005	1010
2005-2006	1000
2006-2007	990
Average of 3 years	1000

Table reference- CEA Baseline Database, Version 3

As per the *"Tool to calculate the emission factor for an electricity system"* (Version 01, EB 35), the calculation of OM has been done *ex ante* based on the most recent 3 years for which data is available at the time of PDD submission.

Step 4: Identification of the cohort of power units to be included in Build Margin (BM)

BM calculation is based on 20% most recent capacity additions in the grid based on net generation. 20% of the most recent capacity additions have been shown in Annex 3. Power plant registered as CDM project activities have been excluded from the sample group *m*. Capacity additions from retrofits of power plants have not been included in the calculation of the build margin emission factor.

Note: In line with the "Tool to calculate the emission factor for an electricity system" (Version 01, EB 35), power plant registered as CDM project activities should be excluded from the sample group m. However, If group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power units that are built more than 10 years ago then: (i) power units that are built more than 10 years ago from the group must be excluded; and (ii) grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system should be included. However, in Western Region group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor are not older than 10 years. Hence grid connected power projects registered as CDM project activities have not been included in the sample group m.

20% of Net Generation (GWh)

	2002-03	**2003-04**	**2004-05**	**2005-06**	**2006-07**
North			31,458	33,641	35,845
East			15,594	17,203	18,764
South			26,935	27,666	30,441
West			34,145	35,201	37,099
North-East			1,552	1,531	1,366
India			109,685	115,241	123,513

Table reference – CEA Baseline Database, Version 3

Net Generation in Built Margin (GWh)

	2002-03	2003-04	2004-05	2005-06	2006-07
North			32,064	34,340	36,511
East			15,818	17,567	18,907
South			28,513	28,228	30,442
West			35,257	35,425	38,242
North-East			2,055	1,793	1,437
India			113,707	117,353	125,538

Table reference- CEA Baseline Database, Version 3

Vintage of data is based on option 1 of step 4. (Refer *"Tool to calculate the emission factor for an electricity system"* -Version 01, EB 35). BM calculation has been done *ex-ante* and hence BM value will remain fixed and need not be monitored during the crediting period.

Step 5: Calculation of build margin ($EF_{grid,BM,y}$) emission factor for the region (ex ante)

BM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 3, December 2007. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Govt. of India.

Build Margin emission factor (Western Region) in tCO_2/GWh

Year	BM (WR)
2006-2007	590

Table reference- CEA Baseline Database, Version 3

Note: Details of power plants considered for BM calculation has been given in Annex- 3

Step 6: Calculation of combined margin (CM) emissions factor or the emission coefficient for the grid electricity ($EF_{grid,CM,y}$):

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where,

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

For wind power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

Hence,

$EF_{grid,CM,y}$ = $EF_{grid,OM,y}$ X 0.75 + $EF_{grid,BM,y}$ X 0.25 ……………………….**Equation I**

= 1000 X 0.75 + 590 X 0.25

= 750 + 147.5

= 897.5 tCO_2/GWh

Emission Reduction Calculation:

- **Grid emission coefficient ($EF_{grid,CM,y}$):**

As per the calculation detailed in section B.6.1, $EF_{grid,CM,y}$ = 897.5 tCO_2/GWh

- **Net quality of electricity supplied by the project (EG_y):**

Parameter	Unit	Value	Value	Reference
sub bundle		I	II	
Annual generation from the project	Mn.Units (MUs)	2.8	2.8	Guaranteed generation as per P.O dated Jan 9, 2006
Correction for Long Term Wind Unavailability	Percent	10%	10%	As per P.O dated Jan 9, 2006
Approximate Grid Non Availability Loss	Percent	5%	5%	Assumption
Salable units par year projected	Mn.Units (MUs)	2.38	2.38	Calculated
Total	Mn.Units (MUs)		4.76	Calculated

Total power generation by all the turbines = 4.32 GWh/yr (or MUs/yr)

Total baseline emission reductions ($BE_{electricity,y}$) **in tCO_2 as per equation II:**

$BE_{electricity,y}$ = 4.32 * 897.5 = 3877.2 tCO_2/yr

Where, $EF_{grid,y}$ = 897.5 tCO_2/GWh

- **Emission Reduction (ER_y):**

As per equation III and IV

$ER_y = BE_{electricity, y} = 3877.2 \approx 3877$ tons of CO_2/year

Plants included in BM Calculation:
(Source: CEA Baseline Database- Version 3)

NAME	UNIT_NO	DT_Comm	CAPACITY MW AS ON 31/03/2007	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2006-07 NET GENERATI GWh
KORBA-IV	7	30-Mar-07	250	WR	CHATTISGARH	STATE	CSEB	THERMAL	COAL	OIL	
VINDH_CHAL STPS	10	8-Mar-07	500	WR	MADHYA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	
PARLI	6	16-Feb-07	250	WR	MAHARASHTRA	STATE	MAHAGENCO	THERMAL	COAL	OIL	
MADHIKHEDA	2	9-Sep-06	50	WR	MADHYA PRADESH	STATE	MPGCL	HYDRO			
BANSAGAR (IV)	2	30-Aug-06	10	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
MADHIKHEDA	1	28-Aug-06	20	WR	MADHYA PRADESH	STATE	MPGCL	HYDRO			
BANSAGAR (IV)	1	20-Aug-06	10	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
TARAPUR	4	18-Aug-06	540	WR	MAHARASHTRA	CENTER	NPC	NUCLEAR	NUCLEAR		1
VINDH_CHAL STPS	9	27-Jul-06	500	WR	MADHYA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	
RATNAGIRI GAS	7	14-May-06	260	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	
RATNAGIRI GAS	6	7-May-06	240	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	
RATNAGIRI GAS	5	30-Apr-06	240	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	
DHUVARAN CCPP	3	17-Mar-06	72	WR	GUJARAT	STATE	GSECL	THERMAL	GAS	n/a	
S.SAROVAR RBPH	5	7-Mar-06	200	WR	GUJARAT	STATE	SSVNL	HYDRO			
AKRIMOTA LIG	2	19-Dec-05	125	WR	GUJARAT	STATE	GMDCL	THERMAL	LIGN	OIL	
S.SAROVAR RBPH	4	13-Oct-05	200	WR	GUJARAT	STATE	SSVNL	HYDRO			
S.SAROVAR RBPH	3	30-Aug-05	200	WR	GUJARAT	STATE	SSVNL	HYDRO			
TARAPUR	3	4-Jun-05	540	WR	MAHARASHTRA	CENTER	NPC	NUCLEAR	NUCLEAR		1
S.SAROVAR RBPH	2	30-Apr-05	200	WR	GUJARAT	STATE	SSVNL	HYDRO			
AKRIMOTA LIG	1	31-Mar-05	125	WR	GUJARAT	STATE	GMDCL	THERMAL	LIGN	OIL	
INDIRA SAGAR	8	23-Mar-05	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
S.SAROVAR RBPH	1	1-Feb-05	200	WR	GUJARAT	STATE	SSVNL	HYDRO			
INDIRA SAGAR	6	29-Dec-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
S.SAROVAR CHPH	5	15-Dec-04	50	WR	GUJARAT	STATE	SSVNL	HYDRO			

NAME	UNIT_NO	DT_Comm	CAPACITY MW AS ON 31/03/2007	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2006-07 NET GENERATI GWh
INDIRA SAGAR	7	27-Oct-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
S.SAROVAR CHPH	1	4-Oct-04	50	WR	GUJARAT	STATE	SSVNL	HYDRO			
S.SAROVAR CHPH	2	4-Sep-04	50	WR	GUJARAT	STATE	SSVNL	HYDRO			
S.SAROVAR CHPH	3	1-Sep-04	50	WR	GUJARAT	STATE	SSVNL	HYDRO			
S.SAROVAR CHPH	4	1-Sep-04	50	WR	GUJARAT	STATE	SSVNL	HYDRO			
INDIRA SAGAR	5	23-Jul-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
INDIRA SAGAR	4	28-Mar-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
INDIRA SAGAR	3	27-Feb-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
INDIRA SAGAR	2	18-Jan-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
INDIRA SAGAR	1	1-Jan-04	125	WR	MADHYA PRADESH	CENTER	NHDC	HYDRO			
DHUVARAN CCPP	2	22-Sep-03	38	WR	GUJARAT	STATE	GSECL	THERMAL	GAS	n/a	

NAME	UNIT_NO	DT_Comm	CAPACITY MW AS ON 31/03/2007	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2006-0 NET GENE GWh
DHUVARAN CCPP	1	4-Jun-03	67.9	WR	GUJARAT	STATE	GSECL	THERMAL	GAS	n/a	
KHOPOLI	2	25-Mar-03	24	WR	MAHARASHTRA	PVT	TATA MAH.	HYDRO			
BANSAGAR (III)	3	2-Sep-02	20	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
BANSAGAR (II)	2	1-Sep-02	15	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
HAZIRA CCCP	3	31-Mar-02	52.1	WR	GUJARAT	STATE	GSECL	THERMAL	GAS	n/a	
TAWA	1	31-Mar-02	6.75	WR	MADHYA PRADESH	PVT	HEGL	HYDRO			
TAWA	2	31-Mar-02	6.75	WR	MADHYA PRADESH	PVT	HEGL	HYDRO			
BANSAGAR (II)	1	18-Feb-02	15	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
KHOPOLI	1	13-Feb-02	24	WR	MAHARASHTRA	PVT	TATA MAH.	HYDRO			
HAZIRA CCCP	2	16-Oct-01	52	WR	GUJARAT	STATE	GSECL	THERMAL	GAS	n/a	
HAZIRA CCCP	1	30-Sep-01	52	WR	GUJARAT	STATE	GSECL	THERMAL	GAS	n/a	
BANSAGAR (III)	2	25-Aug-01	20	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
KHOPOLI	3	2-Mar-01	24	WR	MAHARASHTRA	PVT	TATA MAH.	HYDRO			
K_KHEDA II	4	7-Jan-01	210	WR	MAHARASHTRA	STATE	MAHAGENCO	THERMAL	COAL	OIL	
BANSAGAR (III)	1	26-Nov-00	20	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
K_KHEDA II	3	31-May-00	210	WR	MAHARASHTRA	STATE	MAHAGENCO	THERMAL	COAL	OIL	
DUDH GANGA	2	31-Mar-00	12	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
KOYNA-IV	15	28-Mar-00	250	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
KOYNA-IV	16	3-Mar-00	250	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
DUDH GANGA	1	27-Feb-00	12	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			

NAME	UNIT_NO	DT_Comm	CAPACITY MW AS ON 31/03/2007	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2006 NET GEN GWh
VINDH_CHAL STPS	8	26-Feb-00	500	WR	MADHYA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	
SURAT LIG.	1	16-Jan-00	125	WR	GUJARAT	PVT	GIPCL	THERMAL	LIGN	OIL	
KOYNA-IV	17	25-Nov-99	250	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
SANJAY GANDHI	4	23-Nov-99	210	WR	MADHYA PRADESH	STATE	MPGPCL	THERMAL	COAL	OIL	
SURAT LIG.	2	6-Nov-99	125	WR	GUJARAT	PVT	GIPCL	THERMAL	LIGN	OIL	
RAJGHAT (MP)	3	3-Nov-99	15	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
RAJGHAT (MP)	1	15-Oct-99	15	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
KOYNA-IV	18	7-Oct-99	250	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
RAJGHAT (MP)	2	29-Sep-99	15	WR	MADHYA PRADESH	STATE	MPGPCL	HYDRO			
BHIVPURI	3	24-Sep-99	24	WR	MAHARASHTRA	PVT	TATA MAH.	HYDRO			
WARNA	2	1-Sep-99	8	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
RELIANCE ENERGY	1	14-Aug-99	48	WR	GOA	PVT	REL	THERMAL	NAPT	n/a	
VINDH_CHAL STPS	7	3-Mar-99	500	WR	MADHYA PRADESH	CENTER	NTPC	THERMAL	COAL	OIL	
SANJAY GANDHI	3	28-Feb-99	210	WR	MADHYA PRADESH	STATE	MPGPCL	THERMAL	COAL	OIL	
WANAKBORI	7	31-Dec-98	210	WR	GUJARAT	STATE	GSECL	THERMAL	COAL	OIL	
SURYA	1	31-Dec-98	6	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
PAGUTHAN	4	11-Dec-98	241	WR	GUJARAT	PVT	GTE CORP	THERMAL	GAS	NAPT	
RATNAGIRI GAS	1	11-Dec-98	235	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	
RATNAGIRI GAS	2	11-Dec-98	235	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	
RATNAGIRI GAS	3	11-Dec-98	235	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	

NAME	UNIT_NO	DT_Comm	CAPACITY MW AS ON 31/03/2007	REGION	STATE	SECTOR	SYSTEM	TYPE	FUEL 1	FUEL 2	2006-07 NET GENEI GWh
RATNAGIRI GAS	4	11-Dec-98	35	WR	MAHARASHTRA	PVT	RATNAGIRI	THERMAL	NAPT	DISL	
BHIVPURI	2	29-Sep-98	24	WR	MAHARASHTRA	PVT	TATA MAH.	HYDRO			
WARNA	1	16-Sep-98	8	WR	MAHARASHTRA	STATE	MAHAGENCO	HYDRO			
PAGUTHAN	3	3-Jun-98	138	WR	GUJARAT	PVT	GTE CORP	THERMAL	GAS	NAPT	
PAGUTHAN	2	2-Jun-98	138	WR	GUJARAT	PVT	GTE CORP	THERMAL	GAS	NAPT	
TOTAL											

Annex 4

MONITORING INFORMATION

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

- The proposed project activity requires evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state power utility.
- The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue.
- The project activity has therefore envisaged two independent measurements of generated electricity from the wind turbines.
- The primary recording of the electricity fed to the state utility grid will be carried out jointly at the incoming feeder of the state power utility. Machines for sale to utility will be connected to the feeder.
- 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.
- 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 WTGs. Each WTG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm through a wireless Radio Frequency (RF) network (SCADA). The generation data of individual machine can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month will be kept as a record both in electronic as well as printed (paper) form.

The project proponents have signed an "Operation and Maintenance" agreement with the supplier of the wind turbines for the operation of the wind turbines. The O & M management structure is as follows:

Routine Maintenance Services:

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

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

Security Services: This service includes watch and ward and security of the wind turbines and the equipment.

Management Services:

d) Data logging in for power generation, grid availability, machine availability.
e) Preparation and submission of monthly performance report in agreed format.
f) Taking monthly meter reading jointly with utility of power generated at promoter's wind turbines and supplied to grid from the meter/s maintained by utility for the purpose and co-ordinate to obtain necessary power credit report/ certificate.

Technical Services:

a) Visual inspection of the WTGs 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.
