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:

Wind Energy Project in Maharashtra by M/s Shah Promoters & Developers

Version: 03

Date: 29/01/2011

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

The proposed project activity by M/s Shah Promoters & Developers is a small-scale project involving installation of 9 ENERCON make wind electric generators (WEGs) of individual capacity 0.8 MW, in Ahmednagar district of Maharashtra. The proposed project activity involves E-53 type WEGs & the generated electricity will be fed to the Maharashtra State Electricity Distribution Company Limited (MSEDCL) grid. Details of each of the WTGs have been given below.

WEG Location No.	Village, District	Installed Capacity
E-53/12	Baradari, Ahmednagar	0.8 MW
E-53/13	Baradari, Ahmednagar	0.8 MW
E-53/14	Baradari, Ahmednagar	0.8 MW
E-53/118	Khandke, Ahmednagar	0.8 MW
E-53/128	Jamb, Ahmednagar	0.8 MW
E-53/129	Jamb, Ahmednagar	0.8 MW
E-53/70	Agadgaon, Ahmednagar	0.8 MW
E-53/97	Agadgaon, Ahmednagar	0.8 MW
E-53/100	Agadgaon, Ahmednagar	0.8 MW

The investment will reduce GHG emissions and help in meeting the growing demand of power in the region.

The net electricity that can be exported by the project activity is of the order of 12,614 MWh/year. Had this amount of electricity been produced in the NEWNE Grid, it would have led to net emissions of 11,416 tons of CO_2 per annum.

Contribution towards sustainable development:

Ministry of Environment and Forests (MoEF), Government of India has stipulated following indicators[1] for sustainable development in the interim approval guidelines for CDM projects:

Social well being

[1] http://envfor.nic.in/cdm/host_approval_criteria.htm

- ✓ The proposed project activity will lead to alleviation of poverty by establishing direct and indirect benefits through employment generation and improved economic activities by strengthening of local business opportunities.
- ✓ The infrastructure in and around the project area will also improve due to project activity. Infrastructure development has been undertaken for the wind farm as whole of which the project activity is a part. It will also reduce the demand-supply gap of electricity; hence will lead to the improvement in availability of electricity.

Economic well-being

- ✓ The project activity will lead to direct and indirect employment opportunities as a result of erection, operation and maintenance of the wind turbine. The permanent job opportunities include security guards for the inspection of wind farm, engineers, supervisors, data entry operators and store keepers etc. Temporary employment includes labour for the development of infrastructure, development of road, civil foundation work, construction of sub-station, erection of poles, etc. Improved infrastructure facilities will also enhance business opportunity in the region.
- ✓ The project activity will also result in diversification of the national energy supply, which is dominated by conventional fuel based generating units.

Environmental well being

- ✓ The project will exploit wind energy for generating electricity which would have otherwise been generated through the grid connected fossil fuel based power plants. Thereby the project activity will contribute towards reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions.
- ✓ As wind power projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power.
- ✓ Being a renewable resource, using wind energy to generate electricity contributes to resource conservation.

Technological well being

The project activity will lead to the promotion of 800 KW E -53 WEGs in the region, demonstrating the success of these small sized wind turbines, which will feed the generated power into the nearest sub-station, thus increasing energy availability and improving quality of power under the service area of the substation. Hence, the project leads to technological well being.

A.3 Project participants:

Name of party involved (*) (host) indicates a host party	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicates if the party involved wishes to be considered as project participants (Yes/No)
India	• Private entity - M/s Shah Promoters & Developers	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:

Ahmednagar District.

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

WEG Location No.	Addresses	Latitude	Longitude
E-53/12	Gut No.195[2], Village – Baradari, Taluka - Ahmednagar, Dist - Ahmednagar	19°06' 20.9"N	74°50' 01.1"E
E-53/13	Gut No.206/A[3], Village – Baradari, Taluka –Ahmednagar, Dist - Ahmednagar	19°06' 28.8"N	74°50' 01.6"E
E-53/14	Gut No. 206/A[4], Village – Baradari, Taluka -Ahmednagar, Dist - Ahmednagar	19°06' 35.3"N	74°50' 00.6"E
E-53/118	Gut No.282[5], Compt. No.- 315 PT, Village – Khandke, Taluka - Ahmednagar, Dist - Ahmednagar	19°07' 36.6"N	74°52' 57.2"E
E-53/128	Gut No.217[6], Village – Jamb, Taluka - Ahmednagar , Dist - Ahmednagar	19°06' 07.3"N	74°53' 34.8"E
E-53/129	Gut No.217[7], Village – Jamb, Taluka - Ahmednagar, Dist - Ahmednagar	19°06' 00.5"N	74°53' 37.2"E
E-53/70	Gut No.208[8], Village – Agadgaon, Taluka - Ahmednagar, Dist - Ahmednagar	19°10' 32.0"N	74°52' 55.2"E
E-53/97	Gut No.365[9], Village – Agadgaon, Taluka - Ahmednagar, Dist - Ahmednagar	19°09' 29.6"N	74°52' 51.4"E
E-53/100	Gut No.365[10], Village – Agadgaon, Taluka -Ahmednagar, Dist - Ahmednagar	19°09' 32.6"N	74°52' 25.4"E

[2] Infrastructure clearance for 3.20MW Ref:PGN-I/IC/Shah P & D/3.20MW/08-09/1515_Issued by MEDA_Dated 25/03/09
[3] Infrastructure clearance for 2.40MW_Ref:PGN-I/IC/Shah P & D/2.40MW/08-09/1529_Issued by MEDA_Dated26/03/09
[4] Infrastructure clearance for 2.40MW_Ref:PGN-I/IC/Shah P & D/2.40MW/08-09/1529_Issued by MEDA_Dated26/03/09
[5] Infrastructure clearance for 3.20MW Ref:PGN-I/IC/Shah P & D/3.20MW/08-09/1515_Issued by MEDA_Dated 25/03/09
[6] Infrastructure clearance for 3.20MW Ref:PGN-I/IC/Shah P & D/3.20MW/08-09/1515_Issued by MEDA_Dated 25/03/09
[7] Infrastructure clearance for 3.20MW Ref:PGN-I/IC/Shah P & D/3.20MW/08-09/1515_Issued by MEDA_Dated 25/03/09
[8] Infrastructure clearance for 2.40MW_Ref:PGN-I/IC/Shah P & D/2.40MW/08-09/1529_Issued by MEDA_Dated26/03/09
[9] Infrastructure clearance for 1.60MW_Ref:PGN-I/IC/Shah P & D/1.60MW/09-10/3874_Issused by MEDA_Dated26/06/09
[10] Infrastructure clearance for 1.60MW_Ref:PGN-I/IC/Shah P & D/1.60MW/09-10/3874_Issused by MEDA_Dated26/06/09

Figure 1: Map depicting States of India

Figure 2: District Map of Maharashtra

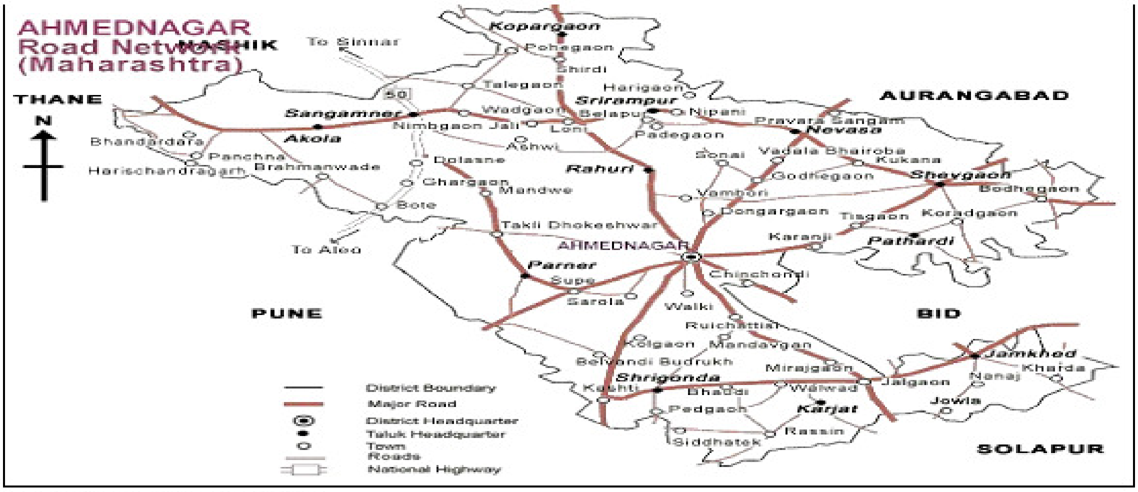


Figure 3: Map of Ahmadnagar

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

The project activity belongs to 'Scope Number 1, Sectoral Scope - Energy industries (renewable / non - renewable sources), as per the CDM sectoral scope.

The proposed project activity uses indigenous technology and no technology transfer will take place with relation to the project activity.

The present project activity is a wind power project; hence it is environmentally safe and sound technology.

Technology

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 WEG, is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity. A wind turbine generator consists of following parts.

Tower – Either steel lattice or tubular pole. The tubular towers are more popular among modern turbines because of their lower airflow interference and downstream turbulence creation. Also, they seem to be more aesthetically acceptable.

Rotor Blades - Current design uses either two- or three-bladed wind turbines, but the latter are becoming more popular and have a number of technical advantages. Two-bladed designs have the advantage that the hub is lighter and so the entire structure can be lighter. This is traded off by the fact that three bladed designs are much better understood aerodynamically and also have a lower noise level than the two-bladed turbines. These blades are made of glass reinforced plastic (GRP).

The Nacelle – This sits atop the tower and holds the rotor blades in place while housing the generator. In large turbines, the nacelle with rotor is electrically yawed into or out of the wind.

Salient features of ENERCON (E-53) 800 KW WEG

1.	Turbine model	ENERCON E-53
2.	Rated power	800 kW
3.	Hub-height	75 m
4.	Rotor (Diameter)	53 m
5.	Turbine type	Direct driven, upwind, horizontal axis wind turbine with variable rotor speed.
6.	Power regulation	Independent pitch system for each blade.
7.	Design life time	20 years
8.	Cut-in wind speed	2.5 m/s
9.	Rated wind speed	12 m/s
10.	Cut-out wind speed	28-34 m/s
11.	Extreme wind speed	59.5 m/s
12.	Rated rotational speed	32 rpm
13.	Operating range rotational speed	12 - 29 rpm
14.	Orientation	Upwind
15.	No. of blades	3
16.	Blade material	Glass Fibre Epoxy Reinforced
17.	Gear box type	Gearless
19.	Braking	Aerodynamic
20.	Output voltage	400 V
21.	Yaw system	Active yawing with 4 electric yaw drives with brake motor.

Description of Generator[11]

Type	Sync. - Wound rotor
Number	1
Max speed	29 rounds/minute
Output voltage	400
Manufacturer	Enercon

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

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2011 (April to December)	8,562
2012	11,416
2013	11,416
2014	11,416
2015	11,416
2016	11,416
2017	11,416
2018	11,416
2019	11,416
2020	11,416
2021(January to March)	2,854
Total estimated reductions (tonnes of CO_2 e)	**114,160**
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (t CO_2 e)	11,416

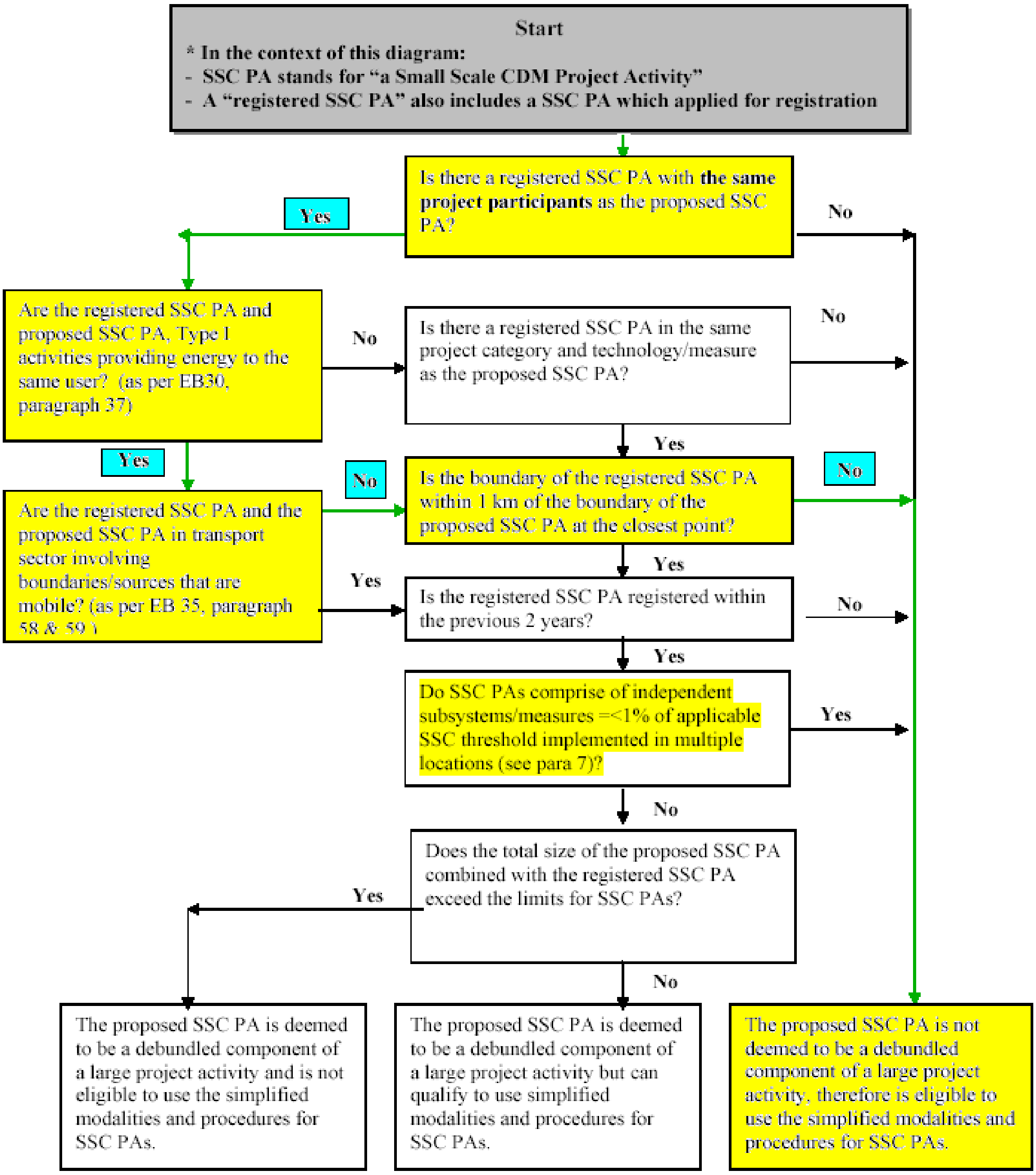
A.4.4 Public funding of the small-scale project activity:

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

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

As per the *"Guidelines on assessment of debundling for SSC project activities", Version 03, EB 54,* in order to determine whether or not a small scale project activity is a debundled component of a large project activity, the following analysis is required.

[11] http://www.thewindpower.net/wind-turbine-datasheet-technical-4-enercon-e53-800.php



As represented above, it can be safely said that the project activity is not a de-bundled component of a larger 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 : **I.D. –** Grid connected renewable electricity generation (Version 16)

Reference : Appendix B of the simplified M&P for small scale CDM project activities

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

Applicability Criteria	
This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to a national or a regional grid. Project activities that displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit shall apply AMS-I.F.	Being a wind power project, the project activity uses renewable energy for generating 12,614 MWh/year of power & evacuates it subsequently to the Integrated NEWNE grid.
This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	This project activity includes installation of new WTGs at the site which are connected to integrated NEWNE grid. The project activity is a Greenfield plant activity so this condition is justified
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	This is not applicable to the project activity, as the project activity is not a hydro power plant.
In the case of biomass power plants, no other biomass types than renewable	This is not applicable to the project activity, as the project activity is not a Biomass based power plant.

biomass are to be used in the project plant.	
If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	There is neither a non-renewable component nor co-firing in this case. Furthermore the aggregated capacity of project activity (7.2 MW) is within the small scale limit of 15 MW.
Combined heat and power (co-generation) systems are not eligible under this category.	Project activity is not a co-generation project as it involves installation of Wind Turbine Generator.
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 as this is a newly installed wind energy generation project and not capacity enhancement project.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable, No retrofits and/or replacement are involved in this project activity.

With above considerations, Type I.D. is most appropriate for the project activity.

B.3 Description of the project boundary:

As mentioned under paragraph 9 of Type I.D. of '*Appendix-B of the simplified modalities and procedures for small-scale CDM project activities'*, project boundary encompasses the physical, geographical site of the renewable generation source. The project boundary includes the WEGs, regional grid & substations of the project. The flow diagram showing boundary of the project is as follows-

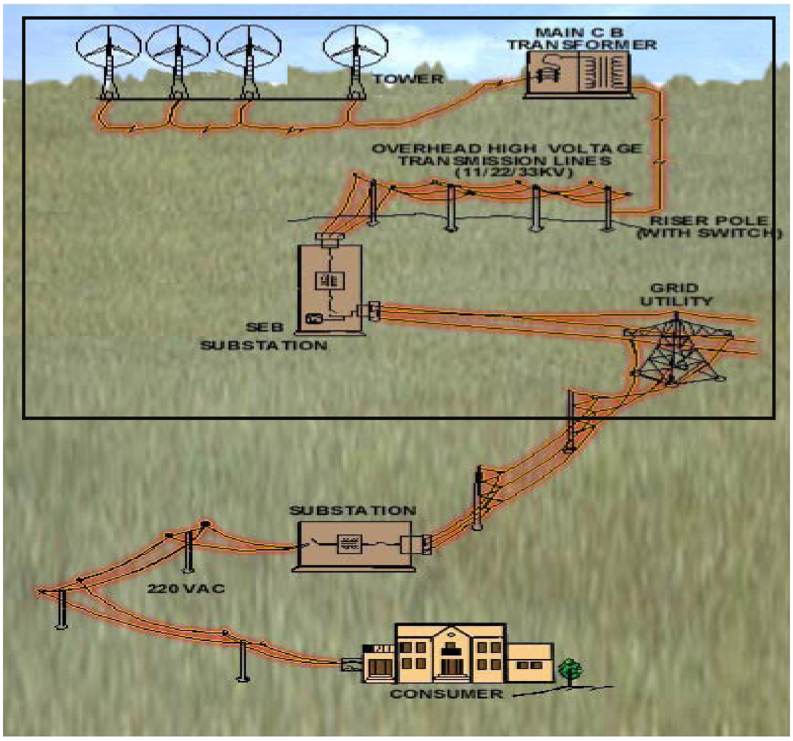


Figure 3: Project Boundary

B.4. Description of baseline and its development:

Baseline scenario identification

Baseline methodology for projects under Type I.D has been detailed in paragraphs 10-12 (Type I.D Version -16) of the above-mentioned document. Paragraph 11 (Type I.D) applies to this project activity, which states that:

For all other systems, The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

BE_y	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year y (t CO_2/MWh)

In this PDD, $EG_{BLy} = EG_y$ and $EF_{CO2,grid,y} = EF_{CM}$

As per para 12 of AMS I.D. Version 16

(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 t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations shall be based on data from an official source (where available) and made publicly available.

Baseline emission reductions have been estimated using ***Combined Margin Emission factor*** *(in t* CO_2*/MWh) for the integrated NEWNE Grid.*

Baseline scenario description

The Indian power system is divided into two grids, namely Integrated Northern, Eastern, Western, and North-Eastern grid (NEWNE Grid). The geographical scope of each regional grid is as follows[12] -

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

For the purpose of calculating emission reductions to be achieved by any CDM project, 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 are most appropriately calculated at the level of the regional grids. As the project activity falls in Maharashtra which is under the western region, therefore the NEWNE grid is the appropriate project electricity system.

[12] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf

Region wise installed capacity[13] (MW) as on 31.03.2008.

(As on 31-03-08)

SL. NO.	REGION	THERMAL				Nuclear	HYDRO	R.E.S.**	TOTAL
		COAL	GAS	DSL	TOTAL		(Renewable)	(MNRE)	
1	Northern	18877.50	3543.19	14.99	22435.68	1180.00	12975.15	1288.27	37879.10
2	Western	24252.50	6600.72	17.48	30870.70	1840.00	7198.50	3130.94	43040.14
3	Southern	16682.50	3586.30	939.32	21208.12	1100.00	10685.18	6350.48	39343.78
4	Eastern	16146.38	190.00	17.20	16353.58	0.00	3933.93	203.61	20491.12
5	N. Eastern	90.00	736.00	142.74	968.74	0.00	1116.00	146.00	2230.74
6	Island	0.00	0.00	70.02	70.02	0.00	0.00	6.11	76.13
7	All India	76048.88	14656.21	1201.75	91906.84	4120.00	35908.76	11125.41	143061.01

Captive Genrating capacity connected to the Grid (MW) = 14636

From the above table, it is evident that the installed capacity is primarily fossil fuel based and therefore leads to higher GHG emissions.

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:

Alternatives

This is a small scale wind energy project using methodology AMS ID. Additionality tool version 05.2 states that a coal fired power station and hydro power may not be an alternative for an independent power producer investing in wind power. Therefore the only two alternatives for the project are
(a.) the proposed project activity not undertaken as CDM project activity
(b) No project activity, in which case an equivalent amount of energy would be generated by the grid either through the expansion of the existing fossil fuel based power plant or by setting up new fossil fuel based power plants.

Both these alternatives are in compliance with the applicable legal and regulatory requirements in as, much as the implementation of the project activity is a voluntary initiative and not mandated by any law. The electricity act 2003 does not restrict fuel choice for power generation and the existing environmental regulation does not restrict the use of wind energy. Moreover there is no legal requirement as to the choice of technology to be employs.

However of the two alternatives, a subsequent paragraph should remain alternative a can not be considered realistic as it faces barriers. Hence alternative b is the only alternative which is credible, realistic and plausible. However, this alternative would result in higher GHG emissions.

Demonstration of CDM Consideration

As per annex 22 of EB 49 project activities with a start date before 2nd August 2008 for which the start date of prior to the date of publication of the PDD for GSC, project developer is required to demonstrate that the CDM was seriously considered in the decision to implement the project activity. Such demonstration require the project developer to indicate the awareness of the CDM prior to project activity start date, that the benefits of CDM were a decisive factor in the decision to proceed

[13] http://www.cea.nic.in/power_sec_reports/Executive_Summary/2008_03/8.pdf

with the project and that the continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.
The Partners of the firm were aware of the CDM benefit in as much as they were already planning to their 14 MW wind energy project registered as CDM activity for which purpose they were already in touch with various CDM consultants.

The Partners met on 1st March 2008 to take a decision on investing in a wind energy project with a total installed capacity of 7.2 MW. In the meeting they discussed the financial viability of the project and observed that the project *per se* was not financially attractive. The partners also noted that only after taking into account the CDM benefits that the project became financially attractive. That the CDM benefit was the decisive factor in decision with proceed with the project is evidences by the Partners resolution, a copy of which submitted to the DOE for verification.

The PP had been taking steps for registering the project as CDM activity in parallel with its implementation. This is evidenced by the following chronology of events.

Events	**Project Implementation**	**Steps towards availing CDM funds**
01/03/2008	--	Partner’s resolution, in which the decision was taken to set up a wind energy project of 7.2 MW as a CDM activity.
20/03/2008	Purchase orders placed for wind power project	--
13/05/2008	--	Appointment of consultant for developing the project as candidate CDM project.
10/02/2009	--	Stakeholder's Consultation Meeting
19/02/2009	--	Appointment of DOE
30/03/2009	Commissioning of three number of WTGs	--
31/03/2009	Commissioning of four number of WTGs	--
01/07/2009	Commissioning of two number of WTGs	--

It could be seen from the above that the project developer had taken action to register the project as CDM activity in parallel with the implementation of the project. As evident from the chronology of events given above that the gap between any two CDM activities is less than one year and therefore the project activity confirms to the stipulation made vide Annex 22 of EB 49

Justification for additionality of the project

UNFCCC simplified modalities seek to establish additionality of the project activity as per Attachment A to Appendix B, (Version 07: 28 November 2005). It states that project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Project participants identified following barriers for the proposed project activity.

Other Barriers:

Investment Barrier

Wind power projects are costlier than the other conventional fossil fuel based power plants. Following table shows the project cost of various fossil fuel based power plants and present project activity.

Table: Cost per MW

Sr. No.	Type of Power Plant	Capital Cost (INR million/MW)
1	Coal Power Plant	40
2	Lignite Power Plant	42
3	Natural Gas Power Plant	27
4	Diesel Power Plant	35
5	Present Project Activity	56

Source: Report of the Expert committee on fuel for power generation-Page XI-CEA.

The financial un-viability of the wind power project is further demonstrated by means of carrying investment analysis of the present case. Bench-mark analysis has been carried out.

Financial Indicator

Suitability of project IRR for the project activity

The project developer had chosen benchmark analysis to demonstrate the financial un-attractiveness of the project. The selection of the bench mark analysis is in confirmatory with guidance 16 of annex 58 of EB 51 which states that the bench mark approach is suited to circumstances where the baseline is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest.

Additionality Tool (Version 05.2) requires the PP to identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g. levelized cost of electricity production in $/kWh

or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context. The project developer had originally chosen Equity IRR to demonstrate the additionality of the project, additionality Tool (Ver. 05.2) permits the use of project IRR, for demonstrating the additionality using benchmark analysis. The tool permits the use of either project IRR or equity IRR. However as the DOE had raised an issue on the appropriates of using equity as the financial indicator, considering the fact that the project is financed by a mix of debt and equity, project developer had chosen to demonstrate the financial unattractiveness of the project through project IRR. This financial indicator is considered appropriate as the project is financed by debt and equity and this indicator is also project IRR has been considered appropriate, as it is often used by the financial institutions and promoters alike to make an investment decision

Benchmark

In the webhosted PDD, required return on equity as computed through CAPM was used as the benchmark as equity IRR was used to demonstrate the additionality. However, consequent upon the CARs and CLs raised by the DOE on the appropriateness of using equity IRR as financial indicator having regard to the fact that the project has been funded by both equity and debt, the financial indicator has been changed to project IRR. Accordingly, the benchmark has also been altered. Annex 45 of EB 41 states that where the project IRR is used to demonstrate the additionality of the project, WACC or the commercial lending rates are suitable benchmarks. The PP has therefore chosen the commercial lending rate – Prime Lending Rate (PLR) – as the benchmark. The investment decision was taken by the PP in March 2008. At that point of time the PLR was ranging from 12.75% to 13.25%[14]. The mid rate of 13% has been selected as the benchmark. This benchmark is in conformity with Annex 58 of EB 51, transparent and available publicly for verification by the DOE.

Calculation and comparison of financial indicators:

The financial indicator – project IRR -was computed for a period of 20 years, corresponding to the lifetime a wind power project. The following assumptions have been used for computing the financial indicator.

Total Installed Capacity[15]	**MW**	**7.2**
No. of turbines	Nos.	9
Capacity of each turbine	MW	0.80
Total capacity	MW	7.2
Total Net Generation	**MWh/year**	
Plant load factor[16]	Percent	20
Net annual generation[17]	MWh/year	12,614
Selling rate considered[18]	Rs./unit	3.50
Escalation till 13th Year[19]	Rs / year	0.15
Selling rate[20] considered from 14th year onwards.	Rs./unit	3.50

[14] http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/82364.pdf
[15] Purchase Order of the wind turbines
[16] Loan sanction letter:Ref:AX1/ADV/Shah Promoters/08-09 on dated 14th March 2009
[17] Annual generation considering 20 % PLF.
[18] As per MERC tariff order (http://www.mercindia.org.in/pdf/Detail_Wind_Energy_Order.pdf) and power purchase agreement.
[19] MERC tariff order

Total CER sale value/annum	**Rs. Lacs**	
CERs per annum	T CO_2/yr	11,416
Rate per CER considered	Euro	13
Exchange rate per Euro	INR	61
CER sale value per Annum	Rs. Lacs	90.53
Insurance & O&M		
Insurance p.a.[21]	Rs. Lacs	0.52
O & M charges [22]	Rs. Lacs	5.337
O & M from which year is applicable[23]	Year	2nd
Escalation in the O & M expenses [24]	Percent	5.00
Deration in energy generation after 10 Years[25]	Percent	5.00
Financing		
Total cost of 9 WEGs (Project Cost)	Rs Lacs	4,032
Debt	Rs Lacs	1500
Equity	Rs Lacs	2,532
Bank loan interest rate considered	Percent	11.25
Moratorium	Months	Six
Repayment term	Year	Three

Justification for the PLF Considered

The Plant Load factor considered for the present case (i.e. 20%) is appropriate as per Annex 11 of EB -48, as it is based on the PLF given to the bank, based on which the loan was sanctioned.

The IRR for the project activity without CDM benefits was found to be 11.14% which is lower than the benchmark rate of 13 %.

Item	Value
Benchmark	13. 00%
IRR without CDM benefit	11.14%

The foregoing data proves that the project is not financially attractive and is additional. However, the robustness of this conclusion was tested by subjecting critical parameters to reasonable variation as required under Annex 45 of EB 41. The results of the sensitivity analysis are given below:

Sensitivity Analysis

[20] The tariff rate applicable for this project activity is 3.50 Rs/unit for the first year. This value will increase subsequently for the next 12 years at the rate of 0.15 Rs/unit every year. As the contract period is only for 13 years, the rate that will be applicable after 13th year is not known and has neither been specified in the power purchase agreement nor in the MERC Order dated 24th November 2003. However the State Electricity Commission has hinted at reduction in this tariff rate after the 13th year. This fact is further substantiated by MERC Order dated November 20, 2007 (Case No. 33 of 2007) on Group II projects where the tariff has been frozen at 90% of lowest HT Industrial Energy Tariff. Similar treatment was anticipated for this project activity as well. http://www.mercindia.org.in/pdf/Ord_20_11_2007_CNo_33_of_2007.pdf

[21] As per Insurance cover note.

[22] O&M Contract with ENERCON

[23] As per O & M Contract

[24] As per quotation/purchase order and O & M Contract

[25] As per MERC tariff order (http://www.mercindia.org.in/pdf/Detail_Wind_Energy_Order.pdf)

Annex 45 of EB 41 requires the PP to conduct a sensitivity analysis by subjecting variables, including the initial investment cost, that constitute more than 20%of either total project cost or total project revenues took reasonable variations and the results of this variation should be presented in the PDD under reproducible in the associated spread sheet. The guidance also states that *all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude.* Moreover, the guidance also sates, though as a general point of departure variations in the sensitivity analysis should at least cover arrange of +10% and -10%, *unless this is not deemed appropriate in the context of the specific project circumstances. And in cases where a scenario will result in the project activity passing the benchmark or becoming the most financially attractive alternative, the DOE shall provide an assessment of the probability of the occurrence of this scenario in comparison to the likelihood of the assumptions in presented investment analysis, taking into consideration correlations between the variable as well as the specific socio-economic and the policy context of the project activity. In-put parameters, which are variable and accounts for 20% of cost/revenue included PLF and project cost. Though O & M cost does not constitute 20%, O & M cost has also been included as it is one of the major cost. These variable have been subjected to a 10% variation except project cost which as s been subjected to a 5 % variation as permitted in paragraph 17b and 18 of annex 58 EB 51. Since the PP has placed orders, received the WEGs and commended generation at the sated cost the question of the project cost going up and coming down is hypothetical. As regards, PLF the WEGs in Maharashtra have not even achieved 20% PLF leave alone achieving any higher PLF. The results of the sensitivity analysis is given below.*

Sensitivity Analysis			
Plant Load Factor			
Variation	*+10%*	*0*	*-10%*
Project IRR	*13.04%*	*11.14%*	*9.11%*

Sensitivity Analysis			
O & M Cost			
Variation	*+10%*	*0*	*-10%*
Project IRR	*10.92%*	*11.14%*	*11.37%*

Sensitivity Analysis			
Project Cost			
Variation	*+5%*	*0*	*-5%*
Project IRR	*10.10%*	*11.14%*	*12.31%*

As could be seen from the foregoing, the project remains additional irrespective of whether the O&M cost goes down by 10% or the project cost goes down by 5%. Only in case when PLF increased by 10% IRR of the project crosses the benchmark. Having said that, it is submitted that none of the situations are realistic. Maharashtra Energy Development Agency's site wise installation data[26] indicates that over a period of 9 years achieved PLF has never cross 20% PLF (except financial year 2004-05, where PLF was 20.82% i.e. increase in PLF by 4% only) considered in policy for tariff determination. In fact the project has achieved a PLF[27] of only 16.57% in last twelve months of its operation. The O&M cost is based on the O&M agreement and it is subject to 5% yearly escalation.

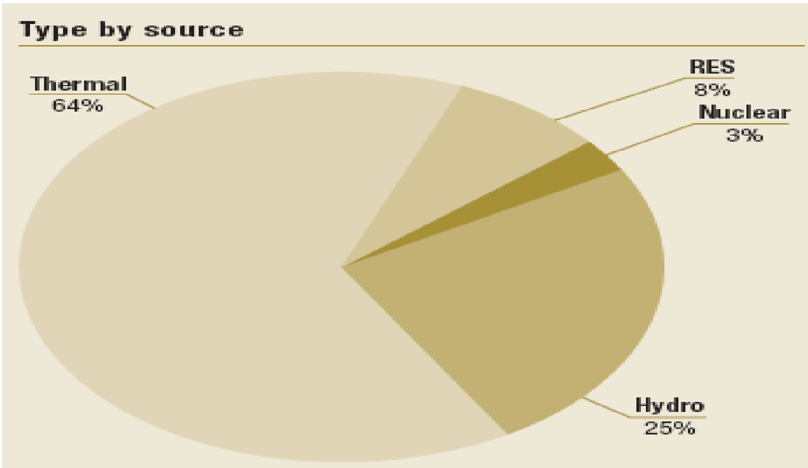
[26] www.mahaurja.com/Download/Sitewise_WindInstallationInfo.xls

[27] The generation details, month wise from April 2009 to March 2010 has been furnished to DOE for verification.

This is unlikely to come down what with the country experiencing inflation of 4.89[28]%. As regards project cost, any reduction is highly hypothetical as the POs have been released on the basis. Thus, it could be seen that the project is not only additional per se, but would continues to remain additional even if the critical parameters are subjected to reasonable variation. It is against this background that the CDM benefits become imperative for the project to render it financially attractive.

Prevailing practice

In spite of new and cleaner technologies having been introduced in India, Coal-fired thermal units account for around 62.2[29] per cent of total power generation in the country. Thus, coal continues to be the mainstay for the power sector. Out of the total installed capacity as on 31.12.2007; the percentage of thermal power plant is 64%.



Table[30] : Break-up of total installed capacity as on 31/12/2007

Ministry of Power, Government of India proposes a total capacity addition of 78,577 MW during the XI the Five Year Plan. The breakup of this capacity addition[31] stands as

Proposed Power Generation Capacity Addition in XI th, 5 year Plan

Sector	Hydro	Thermal	Nuclear	Total (MW)
Central	9685	26800	3380	39865 (50.7%)
State	3605	24347	0	27952 (35.5%)
Private	3263	7497	0	10760 (13.8%)
Total	**16553 (21%)**	**58644 (74.6%)**	**3380 (4.4%)**	**78577 (100%)**

The break-up clearly indicates that renewable sources of energy are yet to find a place in India's energy planning.

[28] http://www.expressindia.com/latest-news/Inflation-still-a-threat-says-Chidambaram/279650/

[29] http://indiabudget.nic.in/es2007-08/chapt2008/chap92.pdf

[30] http://indiabudget.nic.in/es2007-08/chapt2008/chap92.pdf

[31] http://www.powermin.nic.in/indian_electricity_scenario/pdf/Annual_Report_2007-08_English.pdf

One of the major reasons is the initial investment risk in renewable energy since they are neither proven nor in high demand, making coverage of venture risk an important aspect of financial arrangements. It is often argued that many times it is risk coverage rather than capital cost that is a limiting factor in rapid commercialisation of renewable energy technologies[32].
The above paragraphs explain adequately that the proposed project activity was not a business as usual case for the project proponent. It thus satisfies the additionality conditions as required under Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities. The CDM benefits will help the project activity to cover up some of the risks.

The project activity is clearly unattractive in absence of CDM revenues. The promoters were aware of this fact and had considered this investment only in light of carbon credits being available for this project. With the inclusion of CDM benefits in project revenue, the IRR improves from 11.14% to 13.28%.

B.6 Emission reductions:

B.6.1 Explanation of methodological choices:

Baseline emissions

Baseline emissions (BE_y in tCO_2) for proposed project can be calculated by simply multiplying the baseline emissions factor (EF_{cm} in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh).

$$BE_y = EF_{cm} * EG_y$$

The gird emission factor must be calculated in a transparent & conservative 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 t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

For the present project activity option (a) is being adopted and as per methodology its estimation must be done as per the "Tool to calculate the emission factor for an electricity system" Version 02.

Calculation of $EF_{Grid,CM,Y}$ (EF_{cm}) For the present project activity option (a) is being adopted and as per methodology its estimation must be done as per the "Tool to calculate the emission factor for an electricity system" Version 02

The emission factor has been estimated using option (a) above by using the following seven steps of "*Tool to calculate the emission factor for an electricity system*" (Version- 02, EB- 50):

Step 1: Identify the relevant electricity systems

[32] http://www.indiasolar.com/barriers.htm

Central Electricity Authority, 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 per CEA, the Indian power system is divided into two regional grids, viz. NEWNE Grid & Southern Grid.

Each grid covers several States as below:

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

As the project activity is located in the State of Maharashtra NEWNE Grid is the identified relevant electricity system.

The build margin & operating margin emission factors for the project activity are also calculated by the Central Electricity Authority by using the *"Tool to calculate the emission factor for an electricity system"*[33].

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Option I is applicable as the grid system in India is very enough stable and off grid generation is not significant.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Out of the above options, the simple OM method (option a) is used in India. The Dispatch data analysis OM is not used as off-grid generation is not significant in India as per step 2 above. Other methods cannot currently be applied in India due to lack of necessary data.

[33] CO_2 Baseline Database (Version: 4)
(http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm)

As per emission factor tool, the simple OM method (option a) can only be used if low- cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

In India as per available data with CEA, the low-cost/must-run resources constitute (Average of most recent 4 years[34]) less than 50% of total grid generation.

Share of Must-Run [35] (% of Net Generation)					
	2003-04	2004-05	2005-06	2006-07	2007-08
North	28.1%	26.8%	28.1%	27.1%	19.0%
East	10.3%	10.5%	07.2%	09.0%	
West	09.1%	08.8%	12.0%	13.9%	
South	16.2%	21.6%	27.0%	28.3%	
North-East	41.9%	55.5%	52.7%	44.1%	27.1%
India	17.1%	18.0%	20.1%	20.9%	21.0%

The emissions factor has been calculated by using the *ex ante* option. As the *ex ante* option has been chosen, the emission factor has been determined once at the validation stage, thus no monitoring and recalculation of the emissions factor will be required during the crediting period.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. OM values have been taken from CEA Database. The *"Tool to calculate the emission factor for an electricity system"* has been used in the CEA Baseline Database for the calculation of operating margin. The value of operating margin emission factor is 1.009 tCO_2 /MWh.

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

	2005-06	2006-07	2007-08
NEWNE	1.02	1.01	1.00
South	1.01	1.00	0.99
India	1.02	1.01	1.00

OM calculation has been done *ex-ante* and hence OM value will remain fixed and need not be monitored during the crediting period.

Step 5: Identify the group of power units to be included in the build margin

In accordance with the Grid Tool, the build margin is calculated in this database as the average emissions intensity of the 20 % most recent capacity additions in the grid based on net generation. Depending on the region, the build margin covers units commissioned in the last five to ten years.

[34] As per CO_2 Baseline Database (Version: 4) data for recent 4 years is available (http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm).

[35] http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm

20% of Net Generation (GWh)

Year	2005-06	2006-07	2007-08
NEWNE	87,575	93,072	99,224
South	27,666	30,441	31,463
India	115,241	123,513	130,687
Table reference- CO_2 Baseline Database (Version: 4): http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip			

Net Generation in Built Margin (GWh)

Year	2005-06	2006-07	2007-08
NEWNE	87, 764	93, 524	100, 707
South	28,228	30,442	31,613
India	115, 991	123,965	132,320
Table reference- CO_2 Baseline Database (Version: 4): http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip			

In line with the Grid Tool, if a station is registered as a CDM activity, it is excluded from the build margin but not from the operating margin[36].

Step 6: Calculate the build margin emission factor

The build margin reflects the average CO_2 intensity of newly built power stations that will be (partially) replaced by a CDM project. In accordance with the Grid Tool, the build margin is calculated in this database as the average emissions intensity of the 20 % most recent capacity additions in the grid based on net generation. Depending on the region, the build margin covers units commissioned in the last five to ten years.

BM values have been taken from CEA Database. The *"Tool to calculate the emission factor for an electricity system"* has been used in the CEA Baseline Database for the calculation of build margin. The value of build margin emission factor is 0.5977 tCO_2/MWh.

Year	2005-06	2006-07	2007-08
NEWNE	0.67	0.63	0.60
South	0.71	0.70	0.71
India	0.68	0.65	0.63
Table reference- CO_2 Baseline Database (Version: 4): http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip			

BM calculation has been done *ex-ante* and hence BM value will remain fixed and need not be monitored during the crediting period.

Step 7: Calculate the combined margin emissions factor

[36] See EB-35 (Annex 12), pp.5 and 13.

The combined margin is a weighted average of the simple operating margin and the build margin. By default, both margins have equal weights (50%). In particular, for intermittent and non-dispatchable generation types such as wind and solar photovoltaic, the Grid Tool allows to weigh the operating margin and build margin at 75% and 25%, respectively.

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 (%)

Thus the grid emission factor for NEWNE Grid is calculated as below:

Baseline emission factor (EF y)

The baseline emission factor EFy is calculated as the weighted average of the operating margin emission factor ($EF_{OM,\ simple,\ y}$) and the build margin emission factor ($EF_{BM,\ y}$), where the weights[37] w_{OM} and w_{BM}, are 75% for $w_{OM} = 0.75$, and 25 % for $w_{BM} = 0.25$. $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh or MU.

$$\mathbf{EF_{GRID,\ CM,\ Y} = EF_{CM} = 0.75\ EF_{grid,OM,y} + 0.25\ EF_{grid,BM,\ y}}$$

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

(Copy this table for each data and parameter)

Data / Parameter:	**EF_{OM}**
Data unit:	$t\ CO_2/MWh$
Description:	Simple Operating Margin Emission Factor
Source of data used:	Baseline CO_2 Emission Database[38] (Version 4.0)
Value applied:	2005-06 : 1.02 2006-07 : 1.01 2007-08: 1.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is prepared by Central Electricity Authority, GOI.
Any comment:	Average of 3 years data has been considered.

Data / Parameter:	**EF_{BM}**
Data unit:	$t\ CO_2/MWh$
Description:	Build Margin Emission Factor
Source of data used:	Baseline CO_2 Emission Database (Version 4.0)

[37] Weight of OM & BM in case of wind power project.

[38] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Value applied:	2007-08 : 0.60
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is prepared by Central Electricity Authority, GOI.
Any comment:	Value for the year 2007-08

Data / Parameter:	**EF_{CM}**
Data unit:	t CO_2/MWh
Description:	Combined Margin Emission Factor
Source of data used:	Baseline CO_2 Emission Database[39] (Version 4.0)
Value applied:	0.905
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated as per ACM0002 with 3years vintage data and option of ex ante calculation based on "75% of OM and 25% of BM values approach". Computed once during PDD finalization.
Any comment:	Emission factor has been calculated ex-ante for the entire crediting period.

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions or CERs generated by the project are estimated to be:

Baseline emissions $_{(project)}$ = Grid emission factor * Power generated from the project
(tons of CO_2) *(tons of CO_2/MWh)* *(MWh/year)*

The grid emission factor for Maharashtra which falls under Integrated NEWNE grid calculates to 0.905 tCO_2/MWh.

Generation from the WEGs is –

Parameter	Description
No. of turbines	09
Capacity, MW	0.8
Total capacity, MW	7.2
Net annual generation, MWh	12,614
Grid	Integrated NEWNE
Grid e emission factor, tCO_2/ MWh	0.905
Total emission reductions, tCO_2/ yr.	11,416

Therefore total baseline emissions = 11,416 tCO_2/ yr.

[39] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Being a renewable energy project, there are no associated project emissions or emissions resulting from leakage.

Hence Baseline emission = Emission reduction.

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

Year	Project emission (tons of CO_2 e/year)	Baseline emission (tons of CO_2 e/year)	Leakage (tons of CO_2 e/year)	Emission reductions (tons of CO_2 e/year)
2011 (April to December)	0	8,562	0	8,562
2012	0	11,416	0	11,416
2013	0	11,416	0	11,416
2014	0	11,416	0	11,416
2015	0	11,416	0	11,416
2016	0	11,416	0	11,416
2017	0	11,416	0	11,416
2018	0	11,416	0	11,416
2019	0	11,416	0	11,416
2020	0	11,416	0	11,416
2021(January to March)	0	2,854	0	2,854
Total (tonnes CO_2e)	0	**114,160**	0	**114,160**

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:	**EG_y**
Data unit:	MWh
Description:	Net Electricity exported to the grid by the Project Activity.
Source of data to be used:	Joint meter reading issued by MSEDCL for promoter with the help of O & M contractor by applying logic of apportioning described in section B.7.2.
Value of data	
Description of measurement methods and procedures to be applied:	Net Electricity exported to the grid by the Project Activity is calculated based on the monitoring parameter- $\sum_0^n EG_{n,y}$, EG_{MSEDCL} and $\sum_0^m EG_{m,y}$. $$EGy = \left[\frac{\sum_0^n EG_{n,y}}{\sum_0^m EG_{m,y}}\right] \times EG_{MSEDCL}$$
QA/QC procedures to be applied:	The project revenue is based on the net units displaced as calculated by applying apportioning logic on the values that are monitored with the help of metering system involving common bulk meter and inbuilt control

	panel meter of WTGs. The common bulk meters constitute main meter and check meter. The calibration of the common bulk meters (main & check meter) will be done by state utility normally on annual basis or as per the schedule of MSEDCL. Check meter is placed to verify main meter readings. It can be used as a source of reading in case of main meter failure. The calibration of main & check meter will be done as per the guidelines set by CERC.
Any comment:	The data will be archived in paper form up-to two years after the completion the crediting period or the last issuance whichever is later.

Data / Parameter:	$\sum_{0}^{n} EG_{n,y}$
Data unit:	MWh
Description:	Electricity generation by WTG/s owned by SPD (either individual or group)
Source of data to be used:	Monitored through inbuilt control panel meters of the WTGs. The O & M contractor further aggregates (calculates) the monitored readings to arrive at "Total electricity generation by WTGs owned by SPD (either individual or group)".
Value of data	-
Description of measurement methods and procedures to be applied:	The electricity generated by the WTGs of SPD is monitored with the help of inbuilt control panel meters installed on all the WTGs. The data is continuously measured at each WTG by inbuilt control panel meter and recorded at CMS maintained by O & M contractor. The aggregated or individual monthly readings of "Total electricity generation by WTGs owned by SPD (either individual or group)" is provided by O & M contractor to MSEDCL for apportioning and calculating the net electricity exported by the individual/group WTG in Joint Meter Reading Report issued by MSEDCL.
QA/QC procedures to be applied:	Please refer to detailed description under "Description of calibration of WEG Controller" under section B.7.2 .
Any comment:	This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later.

Data / Parameter:	$\sum_{0}^{m} EG_{m,y}$
Data unit:	MWh
Description:	Total electricity generation by all the WTGs connected to the common bulk meters
Source of data to be used:	Monitored through inbuilt control panel meters of the WTGs. The O & M contractor further aggregates (calculates) the monitored readings to arrive at "Total electricity generation by all the WTGs connected to the common bulk meter".
Value of data	-
Description of measurement methods and procedures to be applied:	The electricity generated by all the WTGs (including WTGs of SPD) is monitored with the help of inbuilt control panel meters installed on all WTGs (which are connected to common bulk meters i.e. main meter & check meter). The data is continuously measured at each WTG by inbuilt control panel meter and recorded at CMS. The readings are aggregated by

	the O & M contractor and provided to the MSEDCL for apportioning and calculating the net electricity exported by WTG's. The reading of "Total electricity generation by all the WTGs connected to the common bulk meter" is monitored by O & M contractor at CMS. .
QA/QC procedures to be applied:	Please refer to detailed description under "Description of calibration of WEG controller" in section B.7.2.
Any comment:	This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later.

Data / Parameter:	EG_{MSEDCL}
Data unit:	MWh
Description:	Total net electricity supplied to the grid measured at the substation by common bulk meters (main and check meter).
Source of data to be used:	This parameter is calculated by subtracting imported electricity from the exported electricity to grid and monitored with the help of bulk meters.
Value of data	-
Description of measurement methods and procedures to be applied:	Net export from all the WTGs is calculated by subtracting import from the export. Export and import of electricity is measured at the common bulk meters (i.e. main meter & check meter). The reading at the common bulk meter will be taken on a monthly basis, in presence of the representative of MSEDCL & O & M contractor (PP's representative)
QA/QC procedures to be applied:	The common bulk meters constitute main meter and check meter. The meter are of accuracy class 0.2. The calibration of the common bulk meters (main & check meter) will be done by state utility normally on annual basis or as per the schedule of MSEDCL. Check meter is placed to verify main meter readings. It can be used as a source of reading in case of main meter failure. The calibration of main & check meter will be done as per the guidelines set by CERC.
Any comment:	This data will be archived in paper form up-to two years after the completion of crediting period or last issuance whichever is later.

B.7.2 Description of the monitoring plan:

As emission reductions from the project are determined by the number of units exported to the grid, it is mandatory to have a monitoring system in place and ensure that the project activity produces and exports the rated power at the stipulated norms. The sole objective of a having monitoring system is to have a constant watch on the emission reductions.

The delivered energy will be metered by ENERCON and MSEDCL at the high voltage side of the step up transformers. Metering will be done either for two /three / more wind turbines depending on the location of wind turbines and service connection number. Metering equipments will be electronic trivector meters. The metering equipments will be maintained in accordance with electricity standards[40] and will have the capability of recording daily and monthly readings. Records of joint

[40] http://www.powermin.nic.in/acts_notification/electricity_act2003/pdf/Metering_Regulations.pdf

meter reading will be maintained at site and a copy will be maintained at the head office. All the meters will be tested for accuracy every calendar year with reference to a portable standard meter.. As the instruments will be calibrated and marked at regular intervals, the accuracy of measurement can be assured at all times. Necessary records of calibration will be maintained by both MSEDCL and project proponents.

The project activity essentially involves generation of electricity from wind, the employed WEGs 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 (MSEDCL).
- The electricity generation measurements are required by the utility and the investors to assess electricity sales revenue and / or wheeling charges.
- 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 (MSEDCL). Machines for sale to utility are connected to the feeder.
- 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 will be connected to the Central Monitoring Station (CMS) of the entire wind farm through a wireless Radio Frequency (RF) network (PLC). The generation data of individual machine can be monitored as a real-time entity at CMS.

- 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.
- Metering equipment - Metering is carried out through electronic trivector meters, installed at the substation. The main meter shall be installed and owned by MSEDCL, whereas the project participant owns the check meters. The metering equipments are maintained in accordance with electricity standards.

  Trivector Meter - is a device that measures the amount of electrical energy supplied to the utility. It is called as tri-vector meter because it measures energy consumption of the three phase lines R, Y, B which are 120 phase difference from each other. It measures the consumption in terms of the active energy, reactive energy, apparent energy, power factor

"Description of calibration of WEG controller[41]"

MPU (Main Processing Unit) is used for control of Wind Turbine Generator (WTG), this micro-processor based intelligent controller specially designed for WTG. Monitoring of Electricity is on continuous basis by MPU. WTG can not operate without MPU as it continuously monitors for any fault or deviation in the reading thus provide on line tracking of metering arrangement.

The electrical function is as below:

[41] Calibration of WTG controller provided by Enercon (India) limited.

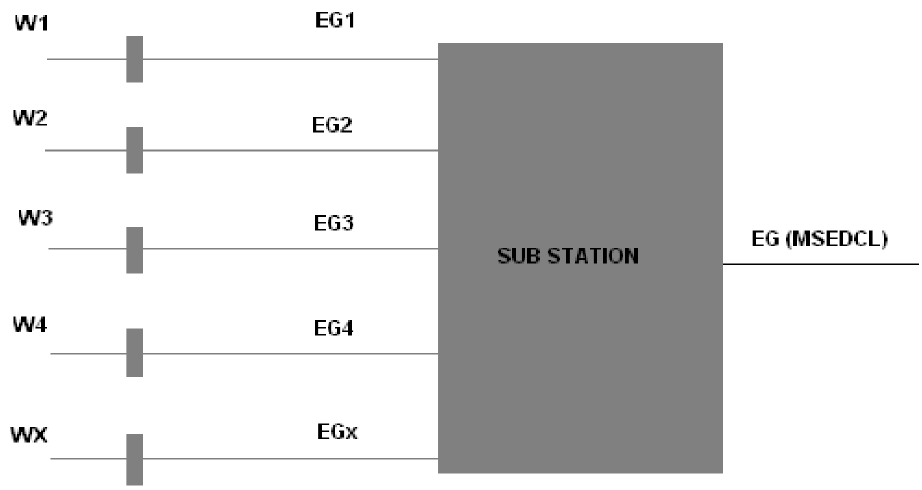
The three-phase current transformer operated electricity meter in the control cabinet measures the kilowatt-hours fed by the converter. The meter supplies 3000 pulses for every kilowatt-hour metered. Since, due to the electricity meters which in the pulse inverter have a ratio of 1000 A/5 A (c=200) per metered kilowatt hour, the converter has therefore fed 200 kilowatt hours, 3000/200= 15 pulses per kilowatt hour fed in obtained.

Since some meters or converters from some operators are used along with other factors, as is the case with the thyristor inverter, the pulse rate of the meter and the conversion factor must be set on the I/O card under "basic settings" (3000 pulses/KWh and 1000 A/5 A for pulse inverters). After every 15^{th} pulse, the I/O card relays a signal to the MPU which meters these kilowatt hours to compare with the measured output and pass on to the display, the customer interface data transfer system

The above arrangement is of auto tracking type and hence calibration is not required separately for WTG electricity meter

Description of billing calculation from net meter to individual meters

Each substation is connected to approximately a number of wind turbines. The generation reading is collectively displayed by the substation meter. The net generation of each of the wind turbines is then calculated in the following manner:



The generated electricity is measured through a two step procedure wherein the first metering is carried out at the controller of the machine with on-board meter. The monitoring of all these wind turbines is done from a common monitoring station as a part of central monitoring system. The system consists of a state- of- the- art controlling and monitoring and well trained staff personnel of O&M contractor, are always present on site to monitor various parameters of power generation and deal with any problems related to generation, transmission or maintenance. EGn,y is the electricity generated from an individual wind turbine measured through its controller meter. The individual Electricity Generated from the wind turbines of the project proponent in MWh is presented as

$$\sum_{0}^{n} EG_{n,y}$$

And the summation of total Electricity Generated from all the wind turbines connected to the particular feeder in MWh as measured at the individual controllers is presented as

$$\sum_{0}^{m} EG_{m,y}$$

A ratio based on these two set of measured values is used for apportioning the net electricity supplied to the NEWNE grid by the project activity. The second metering is carried out at grid interconnection point (sub station) wherein the Joint Meter Reading (JMR) is carried out, usually in the first week of every month, in presence of the representatives of the project proponent & the state electricity utility (MSEDCL). This JMR is used for calculation of the amount of electricity supplied to the grid against which the utility makes the payment to the project proponent. The JMR gives both the "export" ($EG_{JMR,export}$) and "import" ($EG_{JMR,import}$) of the electricity to/ from the NEWNE grid. There is a single meter which gives both the export and import values, this metered reading includes the net value of line losses and auxiliary consumption. Further, as there is a common MSEDCL joint meter for multiple project proponents, the joint meter reading (JMR) taken every month by MSEDCL personnel, reflects the cumulative monthly generation for all wind turbines connected to this MSEDCL meter. The apportioning of electricity generated from the various wind turbines is done by MSEDCL based on the values of generation from the installed WTG's (connected to common bulk meter) provided by the EPC contractor (Enercon in this case). Once the JMR is issued by MSEDCL, project proponent will raise invoice on MSEDCL.

EGy - Net Electricity exported to the grid by the Project Activity is calculated as follows:

$$EGy = \left[\frac{\sum_{0}^{n} EG_{n,y}}{\sum_{0}^{m} EG_{m,y}} \right] X \ EG_{MSEDCL}$$

Where

EG_y	Net Electricity exported to the grid by the Project Activity.
$\sum_{0}^{n} EG_{n,y}$	Electricity generation by WTG/s owned by SPD (either individual or group) included in this project activity (monitored).
EG_{MSEDCL}	Total net electricity supplied to the grid measured at the substation by common bulk meter (main and check meter).
$\sum_{0}^{m} EG_{m,y}$	Total electricity generation by all the WTGs connected to the common bulk meters

MSEDCL is responsible for calibration, periodical testing, sealing and maintenance of meters in the presence of SPD representative. The frequency of meter testing is annual. All meters are tested only at the Metering Point. The meters are tested and maintained as per the Metering Code of Maharashtra. Additionally, each wind turbine is equipped with an integrated electronic meter. The electricity generated is recorded by the O & M staff of the EPC contractor on 24 hour basis.

The Accounts department of SPD receives the data from both the sources and keeps track of electricity generation. The project performance is communicated to the higher management by the accounts department.

Recording of generation at the joint meter is usually from 1st of one month to 1st or 2nd of next month. However, the utility has not fixed any particular date for the activity.

The project participant signed an operation and maintenance agreement with the supplier of the wind turbines i.e ENERCON. The agreement is for a period of 10 years. The performance of the turbines, safety in operation and scheduled /breakdown maintenances is responsibility of ENERCON and is organized and monitored by them.

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 farm 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 Wind Farm 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 WEGs and all parts thereof.
b) Technical assistance including checking of various technical, safety and operational parameters of the equipment, trouble shooting and relevant technical services.

The project activity essentially involves generation of electricity from wind. The employed WEGs can only convert wind energy into electrical energy and cannot use any other input fuel for electricity generation. As the operation of WEGs is emission free and no emissions will be produced during the lifetime of the WEGs.

SPD has appointed a full time project in-charge to manage the overall project activity. The project in-charge supervises the functioning of the wind farm in close coordination with the officials & technical personnel of Enercon.

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

Baseline Completion Date:30/03/2009

Name of person/entity determining the baseline: M/s Shah Promoters & Developers and their consultant, MITCON Consultancy Services Ltd., Maharashtra, India

MITCON is the consultant and not project participant.

Detailed contact address of the concerned person has been included 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:

20/03/2008 based on the release of purchase order.

C.1.2 Expected operational lifetime of the project activity:

20 years 0 months[42]

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.

[42] The life of the WEG has been certified by manufacturers.

C.2.2 Fixed crediting period:

Opted.

C.2.2.1 Starting date:

The starting date of crediting period shall be 01/04/2011 or date of registration which ever is later.

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:

The project activity does not fall under the purview of Environmental Impact Assessment notification dated 14th September, 2006 released by the Ministry of Environment and Forests (MoEF), Government of India (GOI).

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 project activity has no significant impact on the environment. However, certain foreseen impacts due to the project activity are discussed below:

Impact on air
Wind power plants are known to contribute to zero atmospheric pollution as no fuel combustion is involved during any stage of the operation.

Impact on water
There is absolutely no effluent discharge during operation of wind turbine generators.

Socio-economic impacts
There is no inconvenience to the local community due to the transmission lines. The locals have benefited economically through land sales. The project activity helps the up-liftment of skilled and unskilled manpower in the region. The project will provide employment opportunities not only during the construction phase, but will also provide during its operational lifetime. The project activity will improve employment rate and livelihood of local populace in the vicinity of the project. Moreover, the proposed project will generates eco-friendly, GHG free power, which contributes to sustainable development of the region.

SECTION E. Stakeholders' comments

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

A stakeholder meeting was conducted by the project promoter M/s Shah Promoters & Developers, to discern the opinion of stakeholders on the present project activity. The medium used for communicating the date and venue of this meeting was through personal letters sent to each of the identified stakeholders and also public notice was given in the local newspaper[43].

Site	Date	Time	Venue
Ahmednagar	10/02/2009	11.00 AM	Saveli, Ahmednagar

Purpose of this meeting was to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns related to the development and operation of the activity as a CDM project. The number of public groups that exist around the project area was established in order to identify the key stakeholders. Next, these groups were analysed from an institutional and social perspective. Once a comprehensive list of stakeholders was identified, they were invited to attend the public meeting to assert their opinions on the project.

E.2 Summary of the comments received:

Once the project and process was explained, including the local job creation and benefits, the local stakeholders had no objections or negative comments relating to the project. In fact they were excited about the new development in their immediate surroundings. They showed enthusiasm when proponent explained that as a result of the windmills infrastructure facilities such as roads will improve.

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

There were no negative comments received therefore it was not necessary to incorporate the comments into the project design or alter the project in any way.

[43] News paper cutting Dainik Nagar Times on dated 5th February 2009.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	M/s Shah Promoters & Developers
Street/P.O.Box:	Apte Road, Deccan Gymkhana
Building:	AST-1, Success Chambers
City:	Pune
State/Region:	Maharashtra
Postfix/ZIP:	411 004
Country:	India
Telephone:	91-20-25531777
FAX:	91-20-24275998
E-Mail:	vastushree@vsnl.net
URL:	
Represented by:	
Title:	Partner
Salutation:	Mr.
Last Name:	Shah
Middle Name:	Chandrakant
First Name:	Rajesh
Department:	Management
Mobile:	91-9822095858
Direct FAX:	91-20-24275998
Direct tel:	91-20-24275996
Personal E-Mail:	Rajeshshah28@yahoo.co.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

BASELINE INFORMATION

Baseline emissions are calculated by using the following formula.

$$\mathbf{BE_y = EF_{cm} * EG_y}$$

Where EGy is the net quantity of electricity generated by the project in year y, and EF_{cm} Combined margin CO_2 emission factor for grid connected power generation in year *y*.

"Tool to calculate the emission factor for an electricity system" for calculation of combined margin has been used.

The value of combined margin CO_2 emission factor has been calculated ex-ante for the entire crediting period according to the tool to calculate the emission factor for an electricity system, using CEA database version 4. The detailed calculation has been shown in section B.6 of the PDD.

Annex 4

MONITORING INFORMATION

The project is a renewable energy project generating electricity – the monitoring methodology that has been applied is as per the Methodology.

Monitoring methods and procedures	Monitoring of Generation with the help of inbuilt control panel meters: This generation data will be measured with the help of inbuilt control panel meters. The Technicians of the CDM team will record the generation data from CMS.. Monitoring of Net export of electricity to grid from WTG's connected to Common Bulk Meters: The reading from MSEDCL meter will be recorded every month by MSEDCL personnel in the presence of Site Engineer. The MSEDCL will apply the apportioning logic and issues the JMR which provided the "Net export of electricity by each WTG" accordingly the PP raises invoices. The monitoring records will be maintained at the PP's end for the entire crediting period plus two years.
QA/QC procedures	The monthly MSEDCL meter reading will be cross-checked with the generation data from the WTG's connected to common bulk meter will be compared with the readings of common bulk by the Site Engineer. In case the deviation in MSEDCL's recorded data is beyond the allowable limits, the PP will request MSEDCL to calibrate/rectify the meter at the earliest. For the period of error, data would be adjusted as described under "Data uncertainties and adjustments". The Site Engineer will be Responsible to undertake the calibration from the MSEDCL.
Reporting	The Site Engineers (SE) will review generation data measured at inbuilt control panel meters at CMS on a daily basis and record the data in computer. On a daily basis, a compilation of the electricity generation from each WEG will be uploaded in the O&M Contractor's website. This website data will be accessible by the Head - Wind Power Projects (WPP) at the respective project promoter's administration office. The Head – WPP will then take a print of the daily report from the website and file it. He will prepare a monthly consolidated report electricity generation data.
Data archiving	Once the monthly reports are approved, it would be archived in paper at the respective administrative office by the Head-WPP. Electronic copy of monthly reports would be archived by the PP. Generation data from the CMS at the site would be archived by the Site Engineer.
Data uncertainties and adjustments	For this parameter, data uncertainties are likely during the following scenarios: • During error in meter • When meter is dismantled for O&M or calibration • When data is not recorded or records are lost Error in common bulk meter will be usually identified during cross-checking the monthly electricity generation reports. If an error is found in the MSEDCL meter, the generation data measured at inbuilt control panel metersby the PP's meter minus average transformer losses would be used

	to calculate the net export from the WTG and used for emission reduction determination for the error period. When the common bulk meters will be dismantled for O&M or Calibration, pre-calibrated standby meters may be used by the MSEDCL meter for that period which would be noted. When data or records are lost, the emission reductions would be calculated based on MSEDCL's monthly generation report.

Procedures for internal audit and management review:

An internal audit of the project activity would be done on a half yearly basis by a special audit team. The audit team would comprise competitive persons. The team would audit the project for the following aspects among other things:

- Are the monitoring of CDM parameters done in line with the CDM PDD and CDM Manual?
- Is the documentation of monitored CDM parameters done properly?
- Are equipments calibrated and maintained as scheduled?
- Is the quantity of CERs generated inline with that projected in the CDM PDD, if not, what are the reasons for deviation?
- Are necessary corrective actions being taken to address deviations?
- Check the authenticity of data monitored and recorded by random cross-checking with other sources.

The audit team will submit their observations to the Head- Wind Power Projects for his review and necessary action.

Procedures for maintenance of monitoring equipments:

- The Site Engineer will conduct a physical inspection of all the energy meters once a month
- Any maintenance requirements would be immediately attended
- The energy meters will undergo a preventive maintenance one a year
- The responsibility of maintenance will be with the Site Engineer
- Maintenance history card would be maintained for all energy meters

Internal audit and GHG compliance at the suppliers end:

Since the promoters have signed an O&M contract with the suppliers of the wind turbines i.e. ENERCON, internal audits regarding GHG compliance is carried out by the suppliers.