

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

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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.

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

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4.8 MW Manganese Ore (India) Limited Wind farm in Madhya Pradesh managed by Enercon
Version 1.0.
09/05/2007

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

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Purpose of the project activity

The project activity is set up to produce clean power from the wind electric converters. The objective is development, design, engineering, procurement, construction, operation and maintenance of Manganese Ore India Limited (MOIL) Wind Farm of 4.8 MW wind power project (“Project”) in the Indian state of Madhya Pradesh. The generated electricity will be wheeled using the state transmission system for captive consumption. The Project will lead to reduced greenhouse gas emissions because it displaces electricity from fossil fuel based electricity generation plants. The project activity puts to use barren land at Rajoda village in Dewas district in the state of Madhya Pradesh.

The project will help in bridging the demand supply gap by using wind as a source of generating electrical energy.

Nature of Project

The project activity consists of 6 nos. machines of Enercon make 800 KW wind turbines, totaling to a capacity of 4.8 MW. The Project harnesses renewable resources in the region, thereby displacing non-renewable natural resources thereby ultimately leading to sustainable economic and environmental development. Enercon (India) Ltd (“Enercon” or “EIL”) is the equipment supplier and the operations and maintenance contractor for the Project. The generated electricity will be supplied to MOIL for captive consumption.

Contribution to Greenhouse gas emissions reduction

The project activity harnesses wind energy to generate electricity that displaces fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in the Western region electricity grid, thereby leading to reduction in emission of greenhouse gases associated with fossil fuel based electricity generation.

Contribution to sustainable development

The project activity contributes towards sustainable development of the country and the state of Madhya Pradesh by reducing the dependency on fossil fuel based electricity generation, which ultimately leads to reduction in greenhouse gas emissions. The project also fulfills several other sustainable development objectives as set out below:

- Contribution towards the policy objectives of Government of India and Government of Madhya Pradesh of incremental capacity from renewable sources;

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- Contribution towards meeting the electricity deficit in Madhya Pradesh;
- CO₂ abatement and reduction of greenhouse gas emissions through development of renewable technology;
- Reducing the average emission intensity (SO_x, NO_x, PM, etc.), average effluent intensity and average solid waste intensity of power generation in the system;
- Conserving natural resources including land, forests, minerals, water and ecosystems; and
- Developing the local economy and create jobs and employment, particularly in rural areas, which is a priority concern for the Government of India;

A.3. Project participants:

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Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

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

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

Note: When the PDD is filled in support of a proposed new methodology at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

MOIL has authorized Enercon India Limited to take the project through the CDM process.

A.4. Technical description of the small-scale project activity:**A.4.1. Location of the small-scale project activity:**

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A.4.1.1. Host Party(ies):

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The host party to the project activity is the Government of India.

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

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The project is located in the state of Madhya Pradesh that forms the part of Western regional electricity grid of India.

A.4.1.3. City/Town/Community etc:

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Rajoda Village, Dewas district, Madhya Pradesh

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

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The project is located near Rajoda village in Dewas district in the state of Madhya Pradesh. The project extends between 22° 54' to 22° 55.5' latitude and 76° 4.5' to 76° 5.5' longitude. The location of the units is on the micro-siting data to get optimum performance.

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

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Project Type and Category:

The type and category of project activity as per Appendix B to the simplified modalities and procedures for small-scale CDM project activities is as under:

Project Type: I, Renewable energy project

Project Category: D, Electricity generation for system

Technology of the small scale project activity:

The Project involves 6 wind energy converters (WECs) of Enercon make (800 kW E-48) with internal electrical lines connecting the Project with local evacuation facility. The WECs generate 3-phase power at 400V, which is stepped up to 33 KV. The Project can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V \pm 12.5%. The other salient features of the state-of-art-technology are:

- Gearless Construction - Rotor & Generator Mounted on same shaft eliminating the Gearbox.
- Variable speed function – has the speed range of 18 to 33 RPM thereby ensuring optimum efficiency at all times.
- Variable Pitch functions ensuring maximum energy capture.
- Near Unity Power Factor at all times.
- Minimum drawl (less than 1% of kWh generated) of Reactive Power from the grid.
- No voltage peaks at any time.
- Operating range of the WEC with voltage fluctuation of -20 to +20%.
- Less Wear & Tear since the system eliminates mechanical brake, which are not needed due to low speed generator which runs at maximum speed of 33 rpm and uses Air Brakes.
- Three Independent Braking System.
- Generator achieving rated output at only 33 rpm.
- Incorporates lightning protection system, which includes blades.
- Starts Generation of power at wind speed of 3 m/s.

Enercon (India) Ltd has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.

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

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Years	Annual estimation of emission reductions in tonnes of CO ₂ e

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2007-08	8,895
2008-09	8,895
2009-10	8,895
2010-11	8,895
2011-12	8,895
2012-13	8,895
2013-14	8,895
2014-15	8,895
2015-16	8,895
2016-17	8,895
Total estimated reductions (tonnes of CO ₂ e)	88,950
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ e)	8,895

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

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There is no ODA financing involved in the Project.

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

In addition to the project activity, there is another 4.8 MW wind farm at the same location (Kala Pahad Hill Top on Nagda Hills in Rajoda village, Dewas district, Madhya Pradesh) being taken through the CDM process by the project proponent whose project boundary is within 1 km of the project boundary of the proposed small scale activity. However, the combined capacity of both the projects is 9.6 MW which is less than 15 MW, i.e. the threshold capacity for small scale projects as set in paragraph 6 (c) of the decision 17/CP.7. Further all the sites available on this hilltop for wind turbine installation have already been exhausted and no further installations are possible at the project location. The next available site for wind farm development is approx 10 kms away from the project location.

Therefore in accordance with the annex-7, appendix-C of the simplified modalities and procedures for the small-scale activity, the project activity qualifies to use simplified modalities and procedures for small-scale CDM project activities

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

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Grid connected renewable electricity generation, AMS-ID, version 11 EB 31

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

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The project activity utilizes wind power for electricity generation, which falls into the category of renewable energy. Since the installed capacity of the project is 4.8 MW, less than the threshold capacity of 15MW, the project activity can be regarded as a small-scale CDM project activity as per paragraph 6(c) of decision 17/CP.7.UNFCCC.

Electricity generated by the project is used for captive consumption by MOIL's Mining Facility and Ferro Manganese Processing plant located at Balaghat District in Madhya Pradesh, which is also connected to the distribution system of Madhya Pradesh Paschim Kshetra Vidyut Vitran Company Limited. In the absence of the project activity the power requirements of the MOIL plant will have to be met by the distribution system of Madhya Pradesh Paschim Kshetra Vidyut Vitran Company Limited, which is part of the western regional electricity grid of India. The western grid comprises of a large number of power generating units, this satisfies the necessary criteria i.e. "displaces electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit" as per Appendix B of Simplified modalities and procedures for small-scale clean development mechanism project activities to be classified into category I.D.

The project activity is located on Kala Pahad hilltop near Rajoda village in Dewas district of Madhya Pradesh. All sites available on this hilltop for wind turbine installation have already been exhausted and no additional installations on this hilltop are possible. Therefore the capacity of the project activity can not exceed the 15 MW limit in future.

B.3. Description of the project boundary:

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The project boundary, as stated in Appendix B of the simplified modalities and procedures for small-scale CDM project activities, encompasses the physical, geographical site of the renewable generation source.

The Indian electricity system is divided into five regional grids, viz. Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. As the regional grids are interconnected, there is inter-state and inter-regional exchange. A small power exchange also takes place with neighbouring countries like Bhutan and Nepal.

The project boundary encompasses the physical extent of the western regional electricity grid which includes the project site and all power plants connected physically to the electricity system.

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 its demand with its 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. The regional grid thus represents the largest electricity grid where power plants can be dispatched without significant constraints and thus, represents the "project electricity system" for the Project. As the Project is connected to the Western regional electricity grid, the Western grid is the "project electricity system".

B.4. Description of baseline and its development:

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As per the Indicative Simplified Baseline and Monitoring Methodologies for selected small scale CDM Project activity categories (I.D Version 11 Scope 1, EB 31), the baseline for wind energy generating systems is the electricity (measured in KWh) produced by the generating unit multiplied by an emission coefficient (measured in tCO₂e/MWh) calculated in a transparent and conservative manner as either of the following.

- (a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered
OR
- (b) The weighted average emissions (in tCO₂e/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

We have used option (a) i.e. combined margin as per approved methodology ACM0002 as the emission co-efficient for calculating the baseline emissions.

Accordingly the baseline emissions are given as:

$$BE_y = EGY * EF_y \dots\dots\dots(1)$$

Where:

- BE_y Baseline emissions (tCO₂e/year)
- EG_y Electricity generation by the project activity (MWh/year)
- EF_y Baseline emission coefficient determined in accordance with option (a) specified above

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:

Project Additionality:

The investment Barrier analysis set out below demonstrates in a conservative and transparent manner that the project activity is financially unattractive.

Investment Barrier:

For carrying out the investment analysis, we have used data and assumptions available from various MPERC orders and other publicly available information sources. The discussions relating to key parameters i.e. appropriate financial indicators and tariff is set out below. A detailed list of assumptions is also provided after these discussions.

Financial Indicator

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The financial indicator identified for carrying out the investment barrier analysis is the post-tax return on equity or the equity IRR. The post tax return on equity and the equity IRR is used as the appropriate financial indicator because in the Indian power sector, a 14% post tax return on equity is an established benchmark for projects in public or private sector based on cost-plus regulations (Source: Central Electricity Regulatory Commission, Terms and Conditions of Tariff, Regulations 2004 dated 26 March 2004) for utility scale power plants. Incentives (based on generation above the norm), foreign exchange variations and efficiency in operations are in addition to this benchmark of 14%.

For determining tariffs for wind power projects, the electricity regulatory commissions of the state of Madhya Pradesh, Maharashtra and Karnataka have considered the return on equity at 16%¹.

In addition, there are some essential differences between wind electricity projects (whether implemented with or without CDM revenues) and utility scale fossil fuel and hydro projects where the tariff is determined considering a post tax return on equity of 14%. These differences should be taken into account while setting the appropriate level of equity IRR for wind projects.

- The tariff structure for wind projects is a single-part tariff structure as compared to utility scale fossil fuel and hydro projects, which have two-part tariff structure. This implies that wind project activities carry a higher investment risk than the utility scale fossil fuel and hydro projects where the investment recovery is decoupled from the level of actual generation achieved by the project due to variations in off-take.

Thus, in case of the wind power projects, issues such as transmission unavailability, back-down of generation or part-load operations, which are beyond the control of the investors are likely to affect the project activity more severely and therefore the project investors would require higher rate of return to compensate them for these additional risks.

- In case of utility scale fossil fuel and hydro projects, the tariff is determined by reference to a cost-plus approach whereby the projects recover their full investment cost each year if they are able to reach specified level of plant availability. In case of the Project, it does not recover its full investment cost in the initial years as the tariffs are back-loaded. This increases the investment risks in the project activity compared to conventional power generation activities like fossil fuel fired and hydro power projects.

Based on the above considerations, 16% post-tax equity IRR is considered to be the appropriate post-tax equity return for wind power projects. Accordingly, if the Project activity has a post-tax equity IRR of less than 16%, then it can be considered to be additional.

Tariff

HT consumers in Madhya Pradesh are required to pay a demand charge (fixed) which is based on their connected load and an energy charge (variable) linked to the amount of electricity consumed. In case of captive supply from wind power projects i.e. the project activity; the electricity generated is infirm and seasonal in nature and can not be adjusted to the requirements of captive demand, therefore MOIL has to continue to rely on grid supply. The electricity supplied by the project activity provides relief only from the energy charge payable by MOIL; MOIL would continue to bear the demand charge as it was doing prior to the project activity. Evidence that there is no reduction in contract demand/demand charge prior to and after implementation of the project activity is available for the validator for verification.

Accordingly we have used the energy charge component of the applicable HT tariff for MOIL as the revenue line item for our investment analysis.

¹ ROE for Madhya Pradesh, Maharashtra and Karnataka - Source: RERC Order dated 29 September 2006

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Key assumptions for financial analysis

Capacity of Machines in kW	800
Number of Machines	6
Project Capacity in MW	4.80
Project Commissioning Date	30-Jun-06
Project Cost per MW (Rs. In Millions)	46.25

Operations	
Plant Load Factor	22.50%
Insurance Charges @ % of capital cost	0.18%
Operation & Maintenance Cost base year @ % of capital cost	1.25%
% of escalation per annum on O & M Charges	5.0%

Tariff	
HT Tariff for 33KV load in HV-3 category	4.15

Project Cost	Rs Million
Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc.	
Total Project Cost	222

Means of Finance		Rs Million
Own Source	100%	222
Term Loan	0%	0
Total Source		222
Income Tax Depreciation Rate (Written Down Value basis)		
on Wind Energy Generators	80%	
On other Assets	10%	
Book Depreciation Rate (Straight Line Method basis)		
On all assets	7.86%	
Book Depreciation up to (% of asset value)	90%	

Income Tax	
Income Tax rate	30%
Minimum Alternate Tax	10%
Surcharge	10%

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Cess	2%
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Working capital	
Receivables (no of days)	45
O & m expenses (no of days)	30
Working capital interest rate	12%

CER Revenues	
CER Price in US\$	-
Exchange rate Rs./US\$*	43.59

* RBI reference rate as of 30 March 2007

Crediting period starts	1-Aug-07
Length of Crediting period	10

Baseline Emission Factor for Western Region (tCO ₂ /GWh)	940.22
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The equity IRR for the project activity is 13.03% which improves to 14.34% after CER revenues are considered.

As can be seen from the above, the equity IRR generated by the project, without CDM revenues, is 13.03% which is lower than the benchmark rate of 16%. The equity IRR improves to 14.34% after CDM revenues are considered, therefore the CDM revenues can improve the commercial attractiveness of the project activity.

Barriers due to prevailing practice

We analyze the extent to which wind energy projects have diffused in the electricity sector in Madhya Pradesh. In 2004 – 05, the total electricity available at bus bar in the state of Madhya Pradesh was 29,320.8 GWh² where as electricity generation in Madhya Pradesh from wind sources in 2004-05 was 38.76 GWh³. This works out to about 0.13% of electricity available in the state of Madhya Pradesh. As can be seen, electricity generation from wind is not a common practice in Madhya Pradesh.

State	Grid Penetration ⁴
Rajasthan	1.1%
Gujarat	0.7%
Madhya Pradesh	0.1%
Maharashtra	0.6%
Andhra Pradesh	0.3%

² CEA General Review 2005-06 containing data for 2004-05

³ CEA General Review 2005-06 containing data for 2004-05

⁴ Grid penetration = Electricity generation from wind projects as a percentage of the ex-bus energy available to the state. Source of data is CEA General Review 2005-06 containing data for 2004-05

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Karnataka	1.5%
Tamil Nadu	4.7%

Available information on grid penetration (as mentioned above) for wind power projects in Indian states indicate that Tamil Nadu is by far the leader having achieved close to 5% penetration, whereas the penetration level of wind farms in Madhya Pradesh is merely 0.1% which clearly demonstrates that wind power generation is not a common practice.

Clearly, the project activity faces significant Barriers as per Attachment A - Appendix B, Simplified modalities and procedures for small scale CDM project activities

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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According to the approved small scale methodology AMS I.D. version 11 EB31, the emission reductions *ER_y* by the project activity during a given year “y¹” is

$$ER_y = BE_y - PE_y - Ly \dots\dots\dots(1)$$

where *BE_y* is the baseline emissions
PE_y is project activity emissions and;
Ly is the amount of emissions leakage resulting from the project activity.

Baseline Emissions for the amount of electricity supplied by project activity, *BE_y* is calculated as

$$BE_y = EG_y * EF_y \dots\dots\dots(2)$$

Where, *EG_y* is the amount of electricity displaced from the grid i.e. electricity supplied by the project to the grid, *EF_y* is the CO₂ emission factor of the grid as calculated below.

As per AMS I.D. the baseline emission coefficient for wind power projects could be either of the following:

- (a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered.
- (b) The weighted average emissions (in kg CO₂equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

¹ Throughout the document, the suffix *y* denotes that such parameter is a function of the year *y*, thus to be monitored at least annually.

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We have used option (a) Combined Margin consisting of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002, as the applicable emission coefficient for determining baseline emissions.

As per approved baseline methodology ACM0002, the combined margin emission factor (denoted as “EF_y”) is represented as a combination of the Operating Margin (OM) and the Build Margin (BM) of the project electricity system i.e. the Western region electricity grid. Considering the emission factors for these two margins as EF_{OM,y} and EF_{BM,y}, the EF_y is given by:

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y} \dots \dots \dots (3)$$

with respective weight factors w_{OM} and w_{BM} (where w_{OM} + w_{BM} = 1).

Operating Margin Emission Factor

As per ACM0002, dispatch data analysis should be the first methodological choice. However, this option is not selected because the information required to calculate OM based on dispatch data is not available in the public domain for the Western region electricity grid.

The Simple Operating Margin approach is appropriate for calculating the Operating Margin emission factor applicable in this case. As per ACM 0002 the Simple OM method can only be used where low cost must run resources constitute less than 50% of grid generation based on average of the five most recent years. The generation profile of the Western grid in the last five years is as follows:

Generation in GWh	2004-05	2003-04	2002-03	2001-02	2000-01
Low cost/must run sources					
Hydro	10,610	9,282	8,172	7,928	7,174
Wind & Renewables	884	1,522	879	610	314
Nuclear	5,100	5,700	6,200	6,073	5,903
Other sources					
Coal	141,964	136,063	137,392	133,628	128,561
Diesel	-	-	-	-	-
Gas	25,526	21,508	18,713	16,072	21,280
Total Generation	184,084	174,075	171,356	164,311	163,232
Low cost/must run sources	16,594	16,504	15,251	14,611	13,391
Low cost/must run sources	9%	9%	9%	9%	8%

Source: Table 3.4 of CEA General Review 2004-05, 2003-04, 2002-03, 2001-02, 2000-01

From the available information it is clear that low cost/must run sources account for less than 50% of the total generation in the Western grid in the last five years. Hence the Simple OM method is appropriate to calculate the Operating Margin Emission factor applicable.

Build Margin Emission Factor

The Build Margin emission factor EF_{BM,y} (tCO₂/GWh) is given as the generation-weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most recent 20% of the generating units built (summation is over such plants specified by k):

$$EF_{BM,y} = [\sum_i F_{i,m,y} * COEF_i] / [\sum_k GEN_{k,m,y}] \dots \dots \dots (4)$$

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The summation over i and k is for the fuels and electricity generation of the plants in sample m mentioned above.

The choice of method for the sample plant is the most recent 20% of the generating units built as this represents a significantly larger set of plants for a large regional electricity grid having a large number of power plants connected to it and is therefore appropriate.

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO₂ Baseline Database provides information about the Operating Margin and Build Margin Emission Factors of all the regional electricity grids in India. The Operating Margin in the CEA database is calculated ex ante using the Simple OM approach and the Build Margin is calculated ex ante based on 20% most recent capacity additions in the grid based on net generation as described in ACM0002. We have, therefore, used the Operating Margin and Build Margin data published in the CEA database, for calculating the Baseline Emission Factor.

Combined Margin Emission Factor

As already mentioned, baseline emission factor (EF_y) of the grid is calculated as a combined margin (CM), calculated as the weighted average of the operating margin (OM) and build margin (BM) factor. In case of wind power projects default weights of 0.75 for EF_{OM} and 0.25 for EF_{BM} are applicable as per ACM0002. No alternate weights are proposed.

Using the values for operating margin and build margin emission factors for western regional electricity grid provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is 940.22 tCO₂e/GWh or 0.94022 tCO₂e/MWh.

Project Emissions:

The project activity uses wind power to generate electricity and hence the emissions from the project activity are taken as nil.

$$PE_y = 0$$

Leakage:

As per the applicable approved methodology AMS I.D. (version 11 EB31), leakage is to be considered if the energy generating equipment is transferred from another activity. The project activity is a green field power wind power generation facility and the energy generating equipment used in the project activity has not been transferred from any other activity. Hence, leakage is not considered.

$$Ly = 0$$

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

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Data / Parameter:	<i>EF_{OM,v}</i>						
Data unit:	tCO ₂ e/MWh						
Description:	Operating Margin Emission Factor of Western Regional Electricity Grid						
Source of data used:	“CO ₂ Baseline Database for Indian Power Sector” published by the Central Electricity Authority, Ministry of Power, Government of India. The “CO ₂ Baseline Database for Indian Power Sector” is available at www.cea.nic.in						
Value applied:	<table border="1"> <tr> <td>2002 – 03</td> <td>0.9814</td> </tr> <tr> <td>2003 – 04</td> <td>0.9903</td> </tr> <tr> <td>2004 – 05</td> <td>1.0119</td> </tr> </table>	2002 – 03	0.9814	2003 – 04	0.9903	2004 – 05	1.0119
2002 – 03	0.9814						
2003 – 04	0.9903						
2004 – 05	1.0119						
Justification of the choice of data or description of measurement methods and procedures actually applied :	Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with ACM0002.						

Data / Parameter:	<i>EF_{BM,v}</i>
Data unit:	tCO ₂ e/MWh
Description:	Build Margin Emission Factor of Western Regional Electricity Grid
Source of data used:	“CO ₂ Baseline Database for Indian Power Sector” published by the Central Electricity Authority, Ministry of Power, Government of India. The “CO ₂ Baseline Database for Indian Power Sector” is available at www.cea.nic.in
Value applied:	0.7772
Justification of the choice of data or description of measurement methods and procedures actually applied :	Build Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with ACM0002.

B.6.3 Ex-ante calculation of emission reductions:

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Ex-ante calculation of emission reductions is equal to ex-ante calculation of baseline emissions as project emissions and leakage are nil.

Baseline emission factor (combined margin)
= 940.22 tCO₂e/GWh

Annual electricity supplied to the grid by the Project
= 4.80 MW (Capacity) x 22.5% (PLF) x 8760 (hours) / 1000 GWh
= 9.461 GWh

Annual baseline emissions
= 940.22 tCO₂e/GWh x 9.461 GWh
= 8,895 tCO₂e

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

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Years	Estimation of project activity emissions (tCO ₂ e)	Estimation of baseline Emissions (tCO ₂ e)	Estimation of Leakage (tCO ₂ e)	Estimation of overall emission reductions (tCO ₂ e)
2007-08	0	8,895	0	8,895
2008-09	0	8,895	0	8,895
2009-10	0	8,895	0	8,895
2010-11	0	8,895	0	8,895
2011-12	0	8,895	0	8,895
2012-13	0	8,895	0	8,895
2013-14	0	8,895	0	8,895
2014-15	0	8,895	0	8,895
2015-16	0	8,895	0	8,895
2016-17	0	8,895	0	8,895
Total (tonnes of CO₂e)	0	88,950	0	88,950

B.7 Application of a monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

Data / Parameter:	EGy
Data unit:	MWh (Mega-watt hour)
Description:	Net electricity generated by the Project
Source of data to be used:	Electricity supplied to the grid as per tariff invoices raised on MOIL by Madhya Pradesh Paschim Kshetra Vidyut Vitran Company Limited
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Annual electricity supplied by the Project = 4.8 MW (Capacity) x 22.5% (PLF) x 8760 (hours) MWh = 9,461 MWh
Description of measurement methods and procedures to be applied:	Net electricity supplied to the grid will be measured by billing meter (export and import). The procedures for metering and meter reading will be as per the provisions of the wheeling and banking arrangement between Madhya Pradesh Paschim KVV Company Ltd. Indore and Manganese Ore India Ltd for wind electric generation for captive use. Refer Annex – 4 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	QA/QC procedures will be implemented pursuant to wheeling and banking arrangement.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The project activity falls in the technology measure as described in the paragraph 1 of the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. The applicable simplified baseline and monitoring methodology for selected small scale CDM project activities AMS I.D. version 11 requires monitoring of the following.

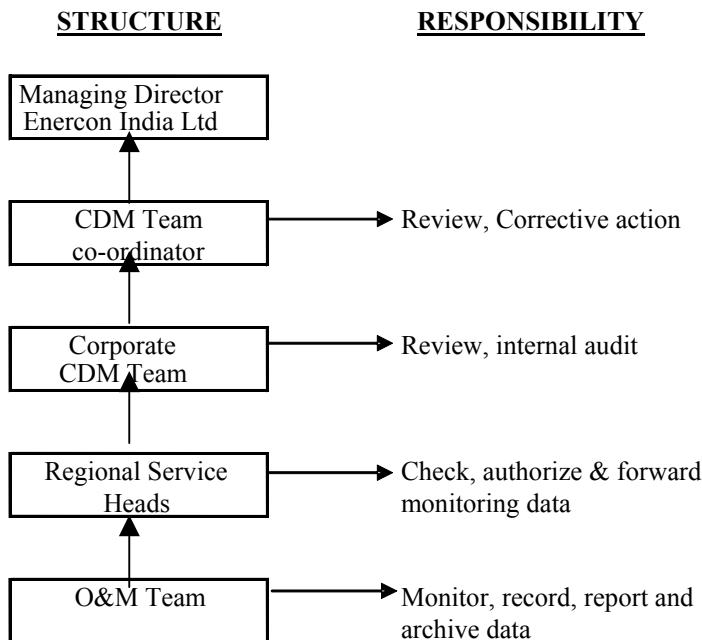
- Metering the electricity generated by the renewable technology
- In the case of co-fired plants, the amount of biomass and fossil fuel input consumed.

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Further, wind based electricity generation is not associated with any kind of leakages. Hence, the sole parameter for monitoring is the electricity generated by the project and supplied to the grid. The Project is operated and managed by Enercon (India) Ltd. Enercon India limited is an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon India limited follows the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project.

The accuracy of monitoring parameter is ensured by adhering to the calibration and testing procedure. The project will adhere to all the mandatory regulatory and statutory requirements at the state as well as national level.

The operational and management structure implemented by Enercon is as follows:



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

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Date of completion: 09/05/2007

Name of responsible person/entity: PricewaterhouseCoopers Private Limited (not a Project Participant)

SECTION C. Duration of the <u>project activity</u> / <u>crediting period</u>

C.1 Duration of the <u>project activity</u>:

C.1.1. <u>Starting date of the project activity</u>:

>>

27/02/2006, being the date of Purchase order for the project activity.

C.1.2. <u>Expected operational lifetime of the project activity</u>:

>>

20 years

C.2 Choice of the <u>crediting period</u> and related information:

The project activity will use fixed crediting period.

C.2.1. <u>Renewable crediting period</u>

C.2.1.1. Starting date of the first <u>crediting period</u>:

>>

Not Applicable

C.2.1.2. Length of the first <u>crediting period</u>:

>>

Not Applicable

C.2.2. <u>Fixed crediting period</u>:

C.2.2.1. Starting date:

>>

01/08/2007, being the expected date of registration of the project activity.

C.2.2.2. Length:

>>

10 years

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SECTION D. Environmental impacts

>>

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

>>

Enercon appointed Care Sustainability, Navi Mumbai to conduct Rapid Environmental Impact Assessment Study in the part of Dewas district where the project activity of Enercon is located, to assess the impact of the project on the local environment

Environmental Impact Assessment (EIA) of this project is not an essential regulatory requirement, as it is not covered under the categories as described in EIA Notification of 1994 or the Amended Notification of 2006. However, Enercon conducted the EIA to study impacts on the environment resulting from the project activity.

The EIA study included identification, prediction and evaluation of potential impacts of the CDM activities on air, water, noise, land, biological and socioeconomic environment within the study area. The ambient air concentrations of Suspended Particulate Matter, Respirable Particulate Matter, Oxides of Nitrogen, Sulphur dioxide and Carbon Monoxide were monitored and were found under limits as specified by CPCB. The noise levels were observed through out the study period and were found to be in the permissible range. Water quality monitoring studies were carried out for determination of physico-chemical characteristics of bore wells. The ph level of water was found to be under the specified limits.

The study area represents part of Dewas district in Madhya Pradesh. The terrain comprises hilly areas which are sparingly populated, the hills are generally covered with shrubs and grass and trees are not found on the hilltops. Moreover the project area doesn't fall under any protected land for wildlife and it has no adverse ecological impacts on the surroundings, flora and fauna found in the vicinity of the project area. The wind-farms do not affect the path of migratory birds.

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:

>>

EIA demonstrated that there is no major impact on the environment due to the installation and operation of the windmills. The local ecology is not likely to get impacted by this type of project activity. The local population confirmed that there is no noise or dust nuisance due to windmills. The EIA also ruled out any adverse impacts due to the project activity.

SECTION E. Stakeholders' comments

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

>>

For inviting the comments of all the stakeholder concerned with the project, an advertisement was published in the local daily newspaper "Raj-Express" on "4th-Oct-2006".

As per the schedule given in the local newspaper about the timing and location, a meeting was conducted on "19th-Oct-2006" at the site to know the views and concerns of the local stakeholders about the project.

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Villagers from villages in the vicinity of the wind farm gathered to give their comments and express their concerns.

The meeting commenced on scheduled time. Local stakeholders from nearby villages were present to attend the meeting. The villagers freely expressed their views about the development of wind farm in the area. No negative comment was received during the course of the meeting by any of the local stakeholder. The meeting ended on a positive note.

E.2. Summary of the comments received:

>>

The meeting was presided over by Shri Yashwant Thakur, Sarpanch Gram panchayat, Village Rajoda) who started of by saying that the wind turbines do not harm us in any way.

- The villagers felt that due to the construction of this wind farm, the local contractors can not use these mountains for excavations and thus there will be no problem of blasting and destroying the natural surroundings by them.
- Villagers themselves said that they know that wind generators do not have any adverse effect on the amount of rainfall in the area and this year it has rained more than their expectations
- Villagers were happy that the company does not stop them from grazing their animals even after the erection of Wind turbines in the area.
- Villagers expressed their gratitude towards company for building roads which the villagers now use to reach to their holy sites located on the mountains.
- People were happy to say that Enercon has employed people from nearby villages.

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

>>

No adverse comment about the project was received during the public stakeholder consultation meeting conducted at the site by Enercon India Ltd. The villagers were happy to know that the power produced from the wind energy project is clean and does not cause any environmental degradation.

The only question, which was discussed in detail during the meeting, was the effect of windmills on the rainfall pattern in the area. The villagers were conscious about this during the construction and operation of the project. The project personnel Mr. Ashish Shukla explained the villagers in detail about the working of the windmills. He said that the windmills extract the energy from the freely flowing wind and thus have no adverse impact on the environment or the rainfall. He said that this year the rainfall in the region was more than the average rainfall last year and if the windmills did affect the rainfall this would not have been the case. The chief guest of the meeting who by citing examples of the rainfall patterns in past few years said that there is no interconnection between the amount of rainfall and the windmills being installed in the area agreed upon this fact. The windmills do not affect the rainfall in this region or any other region. This is a scientifically proven fact that the windmills do not disturb the rainfall. The villagers were encouraged to put forward any further doubts they may have about this issue.

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Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Enercon (India) Limited
Street/P.O.Box:	A-9, Veera Industrial Estate, Veera Desai Road, Andheri West
Building:	Enercon Tower
City:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 053
Country:	India
Telephone:	+91-22-66924848
FAX:	+91-22-67040473
E-Mail:	a.raghavan@enerconindia.net
URL:	
Represented by:	
Title:	Associate Vice President
Salutation:	Mr.
Last Name:	A V Raghavan
Middle Name:	
First Name:	
Department:	Corporate
Mobile:	+91-98200 45724
Direct FAX:	+91-22-5692 1175
Direct tel:	+91-22-6692 4848 extn. 7169
Personal E-Mail:	a.raghavan@enerconindia.net

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no ODA financing involved in the project.

Annex 3**BASELINE INFORMATION**

The Operating Margin data for the most recent three years and the Build Margin data for the Western Region Electricity Grid as published in the CEA database are as follows:

Simple Operating Margin

	Western Grid (tCO₂e/GWh)
Simple Operating Margin - 2002-03	981.41
Simple Operating Margin - 2003-04	990.31
Simple Operating Margin - 2004-05	1,011.94
Average Operating Margin of last three years	994.55

Build Margin

	Western Grid (tCO₂e/GWh)
Build Margin	777.22

Combined Margin Calculations

	Weights	Western Grid (tCO₂e/GWh)
Operating Margin	0.75	994.55
Build Margin	0.25	777.22
Combined Margin		940.22

Detailed information on calculation of Operating Margin Emission Factor and Build Margin Emission Factor is available at www.cea.nic.in.

Annex 4

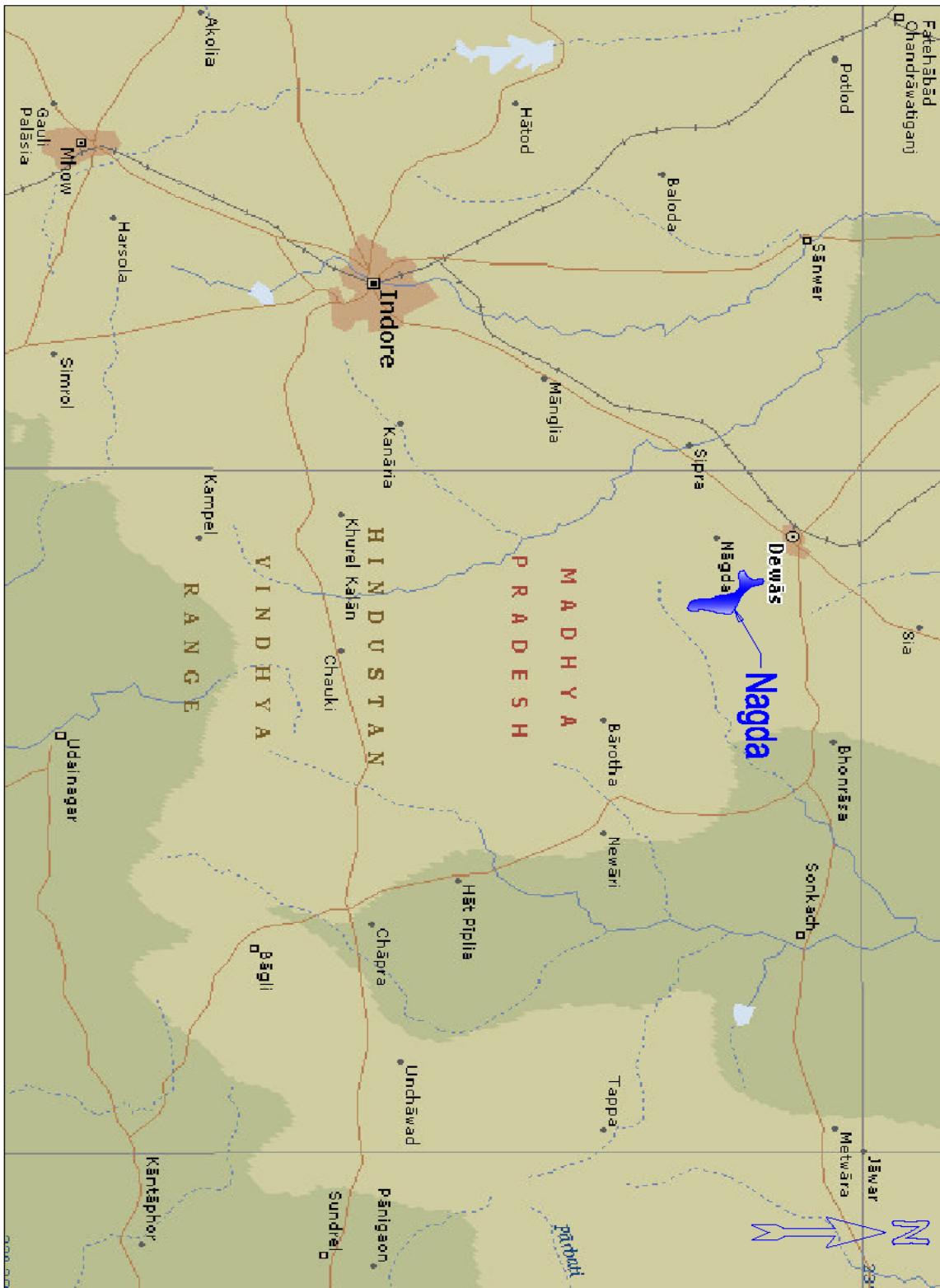
MONITORING INFORMATION

- **Metering:** Electricity supplied to the grid is metered by through the two way export meter installed by Madhya Pradesh Paschim Kshetra Vidyut Vitran Company Limited (“MPPKVVCL”) at the high voltage side of the step up transformer installed at the Project Site. Another export/import meter is proposed to be installed and maintained by the distribution utility for recording the net energy fed into the distribution system. This meter will serve as Standby meter.
- **Metering Equipment:** Metering equipment is an electronic trivector meter of accuracy class 0.5 required for the Project. The meter is installed and owned by MPPKVVCL. The metering equipment is maintained in accordance with electricity standards prevalent in Madhya Pradesh.
- **Meter Readings:** The monthly meter reading is taken jointly by the parties on the last day of each calendar month. At the conclusion of each meter reading an appointed representative of MPPKVVCL and Enercon sign a document indicating the number of Kilowatt-hours from the meter readings.
- **Inspection of Energy Meters:** The two-way export meter and all associated instruments, transformers installed at the Project are of 0.5 accuracy class. The meter is jointly inspected and sealed on behalf of the Parties and is not to be interfered with by either Party except in the presence of the other Party or its accredited representatives.
- **Meter Test Checking:** The meter is tested, checked for accuracy once in a year and also calibrated and adjusted once in a year in the presence of both the parties. The meter shall be deemed to be working satisfactorily if the errors are within the permissible limit as allowed in the relevant IS specification applicable to high precision energy meters. The consumption registered by the billing meter alone will hold good for the purpose of metering electricity supplied to the grid as long as errors in the billing meter or standby meter (proposed to be installed by MPPKVVCL) does not exceed permissible limits. In case in any month the errors in the billing meter and standby meter exceeds permissible limits, the meters will be tested and calibrated and billing will be done on the basis of recording of that meter (billing or standby) whose errors are found within limits.

If during half yearly test check or annual calibration,

- the billing meter is found to have error beyond permissible limits of errors, but the standby meter is found to have error within the permissible limit of errors, billing for previous three months shall be revised on the basis of consumption recorded by the standby meter. However billing meter shall be calibrated immediately and billing thereafter shall be as per consumption recorded by recalibrated billing meter.
- Both billing and standby meters are found to have errors beyond permissible limits, the bill will be revised for the previous three months by applying correction factor to the consumption registered by the billing meter. The correction factor shall mean the percentage of error between the standard meter and billing meter.
- If both billing and standby meter fail to record energy due to any reason whatsoever, the energy imported by MPPKVVCL during the period of outage will be computed as per meter readings of individual meters, period of run of each generating set, losses, consumption on auxiliaries, power factor etc.

Appendix 1 – Location Map



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Appendix 2 – Minutes of stakeholder consultation meeting

Public Consultation Meeting for Wind Farm Projects as Clean Development Mechanism Projects as Site-Nagda Hills, Dewas District, Madhya Pradesh

Venue: Enercon India Ltd, Nagda Hills, Dewas District.

Date: 19th October , 2006

Members from the Villages

1. Sh Yashwant Singh Thakur
 2. Sh Murari Lal
- And 15 participants from the village

Members from Enercon India Ltd., Dewas

1. Mr. Ashish Shukla (Proj. Coord)
2. Mr. Manish Vyas
3. Mr. Sunil Pandey
4. Mr. Aditya Awasthi
5. Mr. Ashish Shukla (Admin)

Members from Enercon India Ltd., Mumbai

1. Mr. Vivek Sen

Agenda of the Meeting:

1. Welcome Address and Introduction
2. Project Profile, CDM Environmental and Social Issues
3. Description about Wind Energy Conversion.
4. Suggestions and Opinions
5. Queries and Responses from the Stakeholders and Co. Authorities respectively.
6. Vote of Thanks

1. **Welcome Address:**

In the Welcome Address the Mr. Ashish Shukla (Admin) ha briefed about the purpose of this Public Meeting, How Wind mills and wind energy are occupied major role in generating power there by rural population is benefited. Further he pointed out, how the benefits of employment opportunities, economical growth taken place in the areas. And also he has quoted examples of various social and religious activities taken up in the villages for ex. Construction of temple etc.

Then Mr. Ashish Shukla (Admin) invited Mr. Yashwant Singh Thakur, Rajoda Village Panchayat leader to preside over the meeting and conduct the further proceedings.

2. Project Profile:

Mr. Ashish Shukla (Proj.. Coord) : Mr. Ashish Shukla has described about the Wind Mills and how the wind Power is generated, Why it is called green energy and our project is emission free, pollution free when compared to thermal power. He reiterated that in thermal power, carbon would be emitted into the air, which causes air pollution. He said that the public would not have any bad impacts from the windmills. When asked by the villagers about the clouds running away causing due to the running of windmills and thereby causing deficiency in rainfall, Mr. Shukla has cleared the doubts of the stakeholder by convincing them about the height of the clouds and the height of the Wind Mill Erector. He also informed that the co-operation by the villagers required for the successful completion and service of Wind Mills.

3. President's Address:

- A) Sh Yashwant Singh Thakur who has presided over the meeting has informed the villagers about how Wind Mills has helped our villagers and Farmers. He said whatever the electricity generated has to be distributed to the nearby locality as electricity cannot be stored. The wind mills are helpful in changing our economic and social life in and around Dewas Villages. He said that near village Rajoda government allot one hill to the contractor of stone crusher, it causes air & noise pollution due to bomb blast and it also destroys our natural gift of God so it is beneficial to install windmill rather than giving it to the contractor. He also pointed out on the news in one newspaper that windmill effect the rainfall and before the installation of windmill, villagers also thought the same but this year heavy rainfall removed all such doubts and there is no relation between these two from any angle. He also pledged that the cooperation from our villagers is there in future also and sought the same from Enercon. He also gave thanks to Enercon for building small temple of God Bhairav as local villagers worship from ancient times.
- B) Sh Murari Lal has accepted that the temple work has been completed by Enercon only and praised about the social and religious activities by Enercon. He said that local villagers are getting employment during and after the project. The Windmill project also built a road up to their villages and fields. He told that there was no shortage of rainfall due to the windmills.

Questionnaire:

a) BY THE STAKEHOLDERS:

- i) In the near time whether you restrict us and our cattle coming for grazing?
 Ans. No, cattle are grazing in the hill area as usual
- ii) Whether windmills affect our farming and ground water level?
 Ans. No, there is no relation of farming with windmill nor it requires any water to rotate. The production of crops will increase if electricity is supplied at full voltage to the pump sets.
- iii) What is the generation capacity of the Machine?
 Ans. 800 kW per hour.

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iii) Electricity generated from the windmill directly supplied to the villages?

Ans. No, it first goes to the MPSEB substation, Dewas and then it is further distributed.

b) BY THE COMPANY:

i) is there any noise pollution by the running of Wind Mills

Ans. No, not heard but since it is in hilltops and away from the villages such nuisance is not there.

ii) is there any problem of animals grazing in the hills?

Ans. No, cattle are grazing in the hill area as usual.

iii) How windmills helped in improvement of crops?

Ans. By the increase of voltage capacity and less load shedding it results an increase in the crop production.

iv) During construction or erection any damages or accidents occurred?

Ans. Absolutely not. The project work is taken up very smoothly and run with high safety standards.

Vote of Thanks: Mr. Ashish Shukla (Admin) thanked the village leaders and the villagers who have set aside their work and shown interest and eagerness to know about the Wind Mills. He also sought cooperation from all the corners for successful operation of windmills thereby achieving the national target of self sufficiency in power sector.
