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:

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15 MW bundled grid connected renewable energy project in Maharashtra, India
Version: 01
Date: 10/10/2007

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

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The objective is development, design, engineering, procurement, finance, construction, operation and maintenance of 15 MW wind power project ("Project") in the Indian state of Maharashtra to provide reliable, renewable power to the Maharashtra state electricity grid which is part of the Western regional electricity grid. The Project will lead to reduced greenhouse gas emissions because it displaces electricity from fossil fuel based electricity generation plants. The project installs 12 of the megawatt capacity wind energy generators (WEG) of 1.25 MW totaling to 15 MW, across two districts of Maharashtra, namely; Dhule and Sangli.

Nature of Project

The Project harnesses renewable resources in the region, and thereby displacing non-renewable natural resources thereby ultimately leading to sustainable economic and environmental development. Suzlon Energy Limited ("Suzlon") will be the equipment supplier and the operations and maintenance contractor for the Project. The generated electricity will be supplied to Maharashtra State Electricity Distribution Company Limited (MSEDCL) under a long-term power purchase agreement (PPA) for 13 years. The Project is owned by C. Mahendra Exports Limited and Suzlon Energy Limited has the responsibility of operation and maintenance of the Wind farm. .

Contribution to sustainable development

The Project meets several sustainable development objectives including:

- contribution towards the policy objectives of Government of India and Government of Maharashtra of incremental capacity from renewable sources;
- contribution towards meeting the electricity deficit in Maharashtra;
- CO_2 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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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)	C. Mahendra Exports Limited	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.:

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Maharashtra

A.4.1.3. City/Town/Community etc:

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Taluka: Kavthe Mahakal and Tasgaon in Sangli district, Sakri in Dhule district

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 spreads across two districts in Maharashtra, both of which are well connected by railways and national highways. The villages are well interconnected by metalled and un-metalled roads. The WEGs can be well identified with the respective WEG numbers. A location map is attached in Annexure 5.

District: Dhule (Latitude: 20° 58’ N, Longitude: 74° 47’ E)
District: Sangli (Latitude: 16° 52’ N, Longitude: 74° 36’ E)

Locational details of the WEGs:

WEG Number	Installed Capacity (MW)	Name of Owner	Village	Taluka	Commissioning Date	Land Survey Number
G – 320	1.25	C. Mahendra Exports Ltd.	Tisangi	Kawathe Mahakal	31.03.2006	474
G – 52	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	25.03.2006	388
G – 53	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	25.03.2006	435
G – 54	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	25.03.2006	453
G – 55	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	20.02.2006	479

G – 56	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	20.02.2006	478
G – 57	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	25.03.2006	456
G – 38	1.25	C. Mahendra Exports Ltd.	Ghatnandre	Kawathe Mahakal	14.02.2006	851
G – 311	1.25	Ratnakala Exports	Jarandi	Tasgaon	20.02.2006	843
G – 319	1.25	Ratnakala Exports	Tisangi	Kawathe Mahakal	31.03.2006	491
K – 139	1.25	Ambika Diamonds	Titane	Sakri	11.07.2005	198
K – 123	1.25	Rindiam Export	Titane	Sakri	01.09.2005	142
TOTAL CAPACITY	**15 MW**					

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

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

Sectoral Scope I Energy Industries (renewable/non-renewable sources).
Project Type: I, Renewable energy projects
Project Category: D, Grid connected renewable electricity generation

Technical Description of the Project Activity

The technology is a clean technology since there are no GHG emissions associated with the electricity generation. The project installs the model S-70 Suzlon-make WEGs of individual capacity 1.25 MW. Technical specifications of the S-70 WEG are furnished in Annexure 4.

The salient features of the 1.25 MW WEG are as follows:

1. Higher Efficiency - Designed to achieve increased efficiency and co-efficient of power (Cp)
2. Minimum Stress and Load - Well-balanced weight distribution ensures lower static & dynamic loads
3. Shock Load-free Operation - Advanced hydrodynamic fluid coupling absorbs peak loads and vibrations
4. Intelligent Control – Sophisticated and advanced technologies applied by extensive operational experience maximizes yield
5. Maximum Power Factor - High-speed asynchronous generator with a multi-stage intelligent switching compensation system delivers power factor up to 0.99
6. Climatic Shield - Hermetically sheltered, advanced over-voltage and lightning protection system
7. Unique Micro-Pitching Control - Unmatched fine pitching with 0.1° resolution to extract every possible unit of power
8. Grid-friendly - Grid friendly design generates harmonics-free pure sinusoidal power

9. ISO-certified vendors confirm high quality components
10. ISO 9001:2000 for Design, Development, Manufacture and Supply of WEGs
11. ISO 9001:2000 certification for Installation, Commissioning, Operation and Maintenance
12. Type certification by Germanischer Lloyd, Germany
13. Approved by the Ministry of Non-Conventional Energy Sources (MNES)

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

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 CO2e
01/08/2008 – 31/07/2009	23680
01/08/2009 – 31/07/2010	23680
01/08/2010 – 31/07/2011	23680
01/08/2011 – 31/07/2012	23680
01/08/2012 – 31/07/2013	23680
01/08/2013 – 31/07/2014	23680
01/08/2014 – 31/07/2015	23680
01/08/2015 – 31/07/2016	23680
01/08/2016 – 31/07/2017	23680
01/08/2017 – 31/07/2018	23680
Total estimated reductions (tonnes of CO2e)	**236800**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	**23680**

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:

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According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants
- In the same project category and technology

- Registered within the previous two years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

The project promoters hereby confirm that there is no registered small scale project activity registered within the previous two years with them in the same project category and technology whose project boundary is within 1km of the project boundary of the proposed small scale activity.
Thus the project is not a debundled component of any other large-scale 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:

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Project Type: I - Renewable energy project
Project Category: I D - Grid connected renewable electricity generation
Version: 13
Reference: Appendix B of the simplified M&P for small scale CDM project activities (UNFCCC, 2003b)

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

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The Project is wind based renewable energy source, zero emission power project connected to the Maharashtra state grid, which forms part of the Western regional electricity grid. The Project will displace fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in Western regional electricity grid.

The approved small scale methodology AMS 1D Version 13 is the choice of the baseline and monitoring methodology and is applicable because:

- the Project is grid connected renewable power generation project activity
- the Project represents electricity capacity additions from wind sources
- the Project does not involve switching from fossil fuel to renewable energy at the site of project activity since the Project is green-field electricity generation capacities from wind sources at sites where there was no electricity generation source prior to the Project, and
- the geographical and system boundaries of the Western electricity grid can be clearly identified and information on the characteristics of the grid is available.

B.3. Description of the project boundary:

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The project boundary is defined as the notional margin around a project within which the project's impact (in terms of GHG reduction) will be assessed. The spatial extent of this project activity includes the project site and all the power plants connected physically to the electricity system that the CDM power project is connected to. As per the Appendix B of simplified modalities & procedures for small-scale CDM-project activities, the project boundary is "The project boundary encompasses the physical, geographical site of the renewable generation source."

The project boundary is thus composed of the Wind Energy Generators, the metering equipment for each generator and substation, and the grid which is used to transmit the generated electricity.
The project is supplying the generated electricity to the Western Region Grid, thus the western grid has been chosen as the grid system for the baseline calculation.

B.4. Description of baseline and its development:

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The project category is renewable electricity generation for a grid system, which is also fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind). Hence, the applicable baseline, as per AMS 1D is the kWh produced by the renewable generating unit multiplied by an emission factor (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner.

Approach
The baseline methodology approach called "existing actual or historical emissions, as applicable" has been applied in the context of the project activity. As the Project does not modify or retrofit an existing generation facility, the baseline scenario is the emissions generated by the operation of grid-connected power plants and by the addition of new generation sources. This is estimated using calculation of Combined Margin multiplied by electricity delivered to the grid by the Project.

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

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Investment in wind energy projects in the state of Maharashtra is not mandatory. There are no national or local laws or regulations that mandate this investment i.e. setting up of wind power projects, to be undertaken. Setting up of wind energy projects is a voluntary activity.

The additionality of this project stands principally on the investment analysis carried out in order to evaluate the stability in the projected financial returns of the project. This has been described below.

Barrier due to Investment

The post tax return on equity and 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 power projects. Incentives, foreign exchange variations and efficiency in operations are in addition to this benchmark of 14%.

For determining the tariffs for wind power projects, the electricity regulatory commissions of the state of Rajasthan and Gujarat have considered the return on equity at 14% while the electricity regulatory commissions of the state of Madhya Pradesh, Maharashtra and Karnataka have considered the return on equity at 16%[1].

[1]Source: RERC Order dated 29 September 2006

There are some essential differences between the Project (whether implemented with or without CDM revenues) and utility scale fossil fuel and hydro projects. These should be taken into account while setting the appropriate level of equity IRR.

- The project activity tariff structure is a single-part tariff structure as compared to fossil fuel and hydro projects, which have two-part tariff structure. This implies that project activity carries a higher investment risk than 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 project activity, 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 activity investors would require higher rate of return to compensate them for these additional risks.

- In case of fossil fuel and hydro projects, these are by reference to 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 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. If the Project has a post-tax equity IRR of less than 16%, then it can be considered to be additional.

The financial analysis for calculating the benchmark (post-tax equity IRR) is carried out and Key assumptions used for calculating the benchmark (post-tax equity IRR) are set out below. The values taken for the assumptions under each investor has been included in Annexure 6 to the PDD.

Operations	
Plant Load Factor	20.0%
Insurance charges	As % of capital cost
Operation & Maintenance Cost base year	As % of capital cost
% of escalation per annum on O & M Charges	5.0%

Tariff	
Base year Tariff (Rs./kWh)	3.5
Annual Escalation (Rs./kWh per Year)	0.15
Tariff applicable after 10 years (Rs/kWh)	Cost plus 16% of return on equity

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%
Cess	2%

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

Length of Crediting period	10

Baseline Emission Factor for Western Region (tCO_2/MWh)	0.901

The equity IRR for the Project without CDM revenues for all the investors included in the bundle is detailed in the table below, which is less than the benchmark IRR in all cases.

Sr. No.	Name of Customer	Equity IRR
1	C. Mahendra Exports Limited	9.01%
2	Rindiam Exports	9.37%
3	Ratnakala Exports	10.28%
4	Ambika Diamonds	9.86%

Thus it can be seen that the proposed project is not financially the most attractive and requires the additional flow of revenue in the form of CDM incentives in order to stabilize the finances.

Sensitivity analysis

To further demonstrate additionality, a sensitivity analysis of the sub project (Ratnakala Exports) with the highest Equity IRR amongst the others has been carried out, to assess the sensitivity of the IRR to variations in the most critical parameter of the project; the Plant Load Factor (PLF). Since the revenue to be earned from sale of electricity generated depends entirely on the Plant Load Factor of the WEGs, it is of paramount importance to evaluate the impact of PLF on the equity IRR of the project. PLF is the key variable encompassing variation in wind profile and variation in off-take (including grid availability) including machine downtime.

Sensitivity analysis has been carried out considering a PLF of 18% and 22% (10% variation from the CUF considered by MERC for tariff determination in its Order dated 24 November 2003). The post tax Equity IRRs of Ratnakala Exports at the stated PLFs are as follows:

Sensivity analysis	18% PLF	22% PLF
IRR without CDM benefits	7.85%	12.7%

(The sensitivity analysis of the Equity IRR to the PLF, of all the Sub projects, is mentioned in Annexure 6).

Barriers due to Common Practice

We analyze the extent to which wind energy projects have diffused in the electricity sector in Maharashtra. At the time the decision to invest in the proposed wind project was taken, the total installed capacity for electricity generation in 2004-2005 was 13368.59 MW. Of this, only 411.2 MW[2] comprised of wind installations. The total energy available in the state for the same year was 82075.33[3] GWh of which 495.36 GWh[4] was contributed by wind energy.

State	Grid Penetration[5]
Rajasthan	1.1%
Gujarat	0.7%
Madhya Pradesh	0.1%
Maharashtra	0.6%
Andhra Pradesh	0.3%
Karnataka	1.5%
Tamil Nadu	4.7%

Available information on grid penetration (as mentioned above) for wind power projects in Indian states indicates that Tamil Nadu is by far the leader having achieved close to 5% penetration, whereas the penetration level of wind farms in Maharashtra is merely 0.6% which clearly demonstrates that wind power generation is not a common practice.

Clearly, wind power project development in Maharashtra is insignificant when compared to the power sector of Maharashtra. Further, wind power project development is substantially dependent on CDM, as demonstrated below, and is not a financially viable project in itself.

A comparison of installed capacities of wind generation sources between year 2002 and 2007 indicates that during this period about 1275.5 MW of wind generating capacity was added in Maharashtra (Source: Wind Power India Statistics). These installations came during the time when the the Indian Government ratified the Kyoto Protocol and investors across the country became aware of the additional revenue benefits that could be accrued to them for investment in cleaner technology. Thus, investment in wind energy accelerated in India beginning from year 2002, and project promoters relied on the potential carbon revenue to strengthen the finances and uncertain returns from projects of this nature. To exemplify this statement, we can see that currently, there is approximately 780 MW of wind energy projects from

[2] Source: Table No. 2.6, CEA General Review 2006

[3] Source: Table No. 5.3, CEA General Review 2006

[4] Source: Table No. 3.4, CEA General Review 2006

[5] 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

Maharashtra that are in various stages of CDM development (Source: UNEP CDM pipeline) and more are expected to follow. Therefore wind power project development is substantially dependent on CDM and thus is not a common practice.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The approach adopted for selecting the baseline scenario for the project is based on the existing actual emissions. The investors are currently drawing power from the grid. In the absence of the CDM project, the investors would have continued to draw electricity for meeting their power demands from the western grid. Investment in other technology for power generation would not be feasible as the baseline for the simple reason that the project activity itself is financially not the best course of action for the promoters. Investment in wind energy demands a huge share of the financial and human resources. Therefore, the most plausible baseline scenario remains that of power purchase from the regional grid.

Emission reductions are calculated as:

$$ER_y = BE_y – PE_y – L_y$$

Where: BE_y is the baseline emissions
PE_y is project activity emissions and;
L_y 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

$$BE_y = EG_y * EF_y$$

Where: EG_y is the electricity supplied to the grid,
EF_y is CO_2 emission factor of the grid

Calculation of Baseline Emission Factor

According to AMS I.D, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner as:
(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'
(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The project proponents have chosen the combined margin approach to calculate the emission coefficient for the grid. According to the tool the baseline emission coefficient will be determined using the following steps:

STEP 1. Identifying the relevant electric power system

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.

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".

STEP 2. Select an operating margin (OM) method

According to the tool the calculation of the operating margin emission factor 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.

Any of the four methods can be used, however, 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.

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the different grids in India in the last five years is as follows:

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Source: CO_2 Baseline Database for the Indian Power Sector – Central Electricity Authority

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the western regional grid is less than 50 % of the total generation. Hence the Simple OM method can be used to calculate the Operating Margin Emission factor.

The project proponents choose an ex ante option for calculation of the OM with a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

STEP 3. Calculate the operating margin emission factor according to the selected method
The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C)

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 Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the "Tool to calculate the emission factor for an electricity system". We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

The CEA database uses the option B i.e. data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit, to calculate the OM of the different regional grids.
The simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathbf{EF_{grid,OMsimple,y} = \Sigma\,(EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}}$$

Where:
$EF_{grid,OMsimple,y}$ Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m All power units serving the grid in year y except low-cost / must-run power units
y Either the three most recent years for which data is available at the time of submission of the CDM PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The emission factor of each power unit m has been determined using Option B1

$$\mathbf{EF_{EL,m,y} = (\Sigma\, FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,I,y}) / EG_{m,y}}$$

Where:
$EF_{EL,m,y}$ CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$FC_{i,m,y}$ Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)

$NCV_{i,y}$ Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,I,y}$ CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
m All power units serving the grid in year y except low-cost / must-run power units
i All fossil fuel types combusted in power unit m in year y
y Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

STEP 4. Identify the cohort of power units to be included in the build margin
The sample group of power units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use the set of power units that comprises the larger annual generation. Accordingly, the CEA database calculates the build margin as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation.
The build margin emission factor has been calculated ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period.

STEP 5. Calculate the build margin emission factor
The build margin emissions factor is the generation-weighted average emission factor of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$\mathbf{EF_{grid,BM,y} = (\Sigma\ EG_{m,y} \times EF_{EL,m,}) / \Sigma\ EG_{m,y}}$$

Where:
$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m Power units included in the build margin
y Most recent historical year for which power generation data is available

The CO2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 3 (a) for the simple OM, using options B1 using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

STEP 6. Calculate the combined margin emissions factor
The emission factor *EFy* of the grid is represented as a combination of the Operating Margin (OM) and the Build Margin (BM). Considering the emission factors for these two margins as $EF_{OM,y}$ and $EF_{BM,y}$, then the *EFy* is given by:

$$\mathbf{EF_y = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}}$$

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 (%) (where $w_{OM} + w_{BM} = 1$).

Using the values for operating and build margin emission factor provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is 901.055 tCO2e/GWh or 0.901 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.
PEy = 0

Leakage:

Since no equipment is transferred from another project activity or that any existing equipment is transferred to another activity, leakage as per AMS ID is taken as zero.
Ly = 0

Details of Baseline data:

Data of Operating and Build Margin for the three financial years from 2003-04 to 2005-06 has been obtained from -

The CO2 Baseline Database for the Indian Power Sector
Ministry of Power: Central Electricity Authority (CEA)
Version 3
Dated: 15th December 2007
Key baseline information is reproduced in annexure 3.
The detailed excel sheet is available at:
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

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

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO2e/MWh
Description:	Operating Margin Emission Factor of Western Regional Electricity Grid
Source of data used:	"CO2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	2004 – 05: 1.01294 2005 – 06: 1.00385 2006 – 07: 0.99362
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:	$EF_{BM,y}$
Data unit:	tCO2e/MWh
Description:	Build Margin Emission Factor of Western Regional Electricity Grid
Source of data used:	"CO2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	0.5938
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:

>>

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)
= 0.901 tCO2e/MWh

Annual electricity supplied to the grid by the Project
= 15 MW (Capacity) x 20% (PLF) x 8760 (hours)
= 26280 MWh

Annual baseline emissions
= 0.901 tCO2e/MWh x 26280 MWh
= 23680 tCO2e

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

>>

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
01/08/2008 – 31/07/2009	0	23680	0	23680
01/08/2009 – 31/07/2010	0	23680	0	23680
01/08/2010 – 31/07/2011	0	23680	0	23680

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
01/08/2011 – 31/07/2012	0	23680	0	23680
01/08/2012 – 31/07/2013	0	23680	0	23680
01/08/2013 – 31/07/2014	0	23680	0	23680
01/08/2014 – 31/07/2015	0	23680	0	23680
01/08/2015 – 31/07/2016	0	23680	0	23680
01/08/2016 – 31/07/2017	0	23680	0	23680
01/08/2017 – 31/07/2018	0	23680	0	23680
Total (tonnes of CO2e)	**0**	**236800**	**0**	**236800**

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

>>

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	kWh
Description:	Electricity wheeled to the grid by the project
Source of data to be used:	JMR Sheets/measurement records of the EPC contractor.
Value of data	Details of the data values are given in the baseline calculations done above.
Description of measurement methods and procedures to be applied:	- The electricity is measured with the help of two-way electronic meters (measuring import & export) connected to each WEG - The data is measured hourly and recorded monthly - 100% of the data is monitored - The data will be archived electronically
QA/QC procedures to be applied:	Electricity is generated through the project activity and sold to the grid. This is double checked by receipt of sales.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

Since the project activity is generation of electricity from renewable energy source i.e. wind there are no leakage effects generated by the project activity.

The operation and maintenance structure that will be implemented in order to monitor emission reductions generated by the project activity is as under:

1. Routine Maintenance Services

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

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

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

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

4. Technical Services
a) Visual inspection of the WEG 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.

Monitoring – Salient features
The proposed project activity requires evacuation facilities for sale to grid and the evacuation facility is essentially maintained by the state power utility (MSEDCL).

- **Metering:** Electricity supplied to the grid is metered by MSEDCL at the high voltage side of the step up transformer installed at the Project Site.
- **Metering Equipment:** Metering equipment is electronic tri-vector meters of accuracy class 0.5% required for the Project (both main and check meters). Both meters (main meter and check meter) are owned and installed by the Project owner. The metering equipment is duly approved, tested and sealed by the MSEDCL.
- **Metering Arrangement:** The metering arrangement for the project activity is highly systematic and operates at two levels;
  a) The primary recording of the electricity fed to the state utility grid is carried out jointly at the incoming feeder of the state power utility. WEGs for sale to utility will be connected to the feeder. It is achieved by way of the tri-vector meters described above. Each WEG is connected to two tri-vector meters, one; the main meter and the other; check meter.

  b) The secondary monitoring provides a backup (fail-safe measure) in case the primary monitoring is not carried out, and is done at the individual WEGs. Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm through a wireless Radio Frequency (RF) network. The generation data of individual WEG can be monitored as a real-time entity at CMS. The snapshot of generation on the last day of every calendar month is kept as a record in electronic form.

- **Data Archiving -** The JMRs obtained from the primary monitoring system for each month is maintained as a hard copy at the project site.
- **Meter Readings:** Meter readings of both main and check meters are undertaken jointly by representatives of MSEDCL and the project participant (in this case Suzlon officials are the representatives) on the first day of every month for the preceding month. At the conclusion of each meter reading, the meter readings are jointly certified by the representatives.
- **Inspection of Energy Meters:** Each meter is jointly inspected and sealed in the presence of representatives from MSEDCL and project participant 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 main and check meters are tested for accuracy with reference to a portable standard meter. The portable standard meter is owned by MSEDCL. The main and check meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.5% accuracy class. The frequency of meter testing is annually. MSEDCL provides a copy of each test report to the project participant.

The Authority and Responsibility for registration and monitoring over the crediting period is – Mr. Kirtikumar N. Shah – Head, Administration

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

>>
Date of completion: 01/02/2008

Name of responsible person/entity: C. Mahendra Exports Limited and their appointed CDM experts.

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:

>>
25/03/2005 – Date of Board meeting considering CDM at Ambika Diamonds

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

>>
20 years and 0 months

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

C.2.1. Renewable crediting period

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

>>
N/A

C.2.1.2. Length of the first crediting period:

>>
N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/08/2008 (or date of project registration, whichever is later)

C.2.2.2. Length:

>>
10 years and 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:

>>
As per the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 27, 1994, - 30 activities are required to undertake environmental impact assessment studies. The details of these activities are available at:

http://envfor.nic.in/legis/eia/so1533.pdf (14th September, 2006)

The proposed project doesn't fall under the list of activities requiring EIA as it will not involve any negative environmental impacts, as the WEGs installed for generation of power use wind (cleanest possible source of renewable energy), thus no EIA study was conducted.

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

>>
The wind park is located in a sparsely populated area with no vulnerable flora or fauna. The wind park results only in positive environmental impacts (lower emissions) and no negative impacts.

SECTION E. Stakeholders' comments

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

>>
The players included in the stakeholders for the proposed project are as follows:

1. Maharashtra Energy Development Agency
2. Maharashtra State Electricity Distribution Corporation Limited
3. Gram Panchayat (representative body for Local Government in the Village)
4. Local Villagers

The land area falling under the wind farm is primarily barren or fallow. The owners of the land were contacted and transfer of land was transacted under the proper legal system. The villagers were well aware about the project activity and the land was procured at mutually agreeable terms. The villagers were not deprived of their rights and they were assigned full freedom to use their land. In addition to receiving revenue for the land, local stakeholders have received the benefits of improved infrastructure and employment opportunities at the wind farm location.

The stakeholders of each village of the project were contacted before the starting of the project and were briefed about the activity, its associated positive impacts to the environment and the direct benefits to their livelihood. Discussions were held on the many aspects of the lives of the villagers that may have been negatively or positively impacted by the project. They were interviewed and encouraged to provide comments and suggestions regarding the activity.

E.2. Summary of the comments received:

>>

No Objection Certificates (NOC) have been obtained from all the villages certifying that the villagers along with the Gram Panchayat have no objection to the windmill installation in their village, and that the project activity has led to no significant negative impacts.

The MEDA gave statutory clearance to the project for its establishment and operation. This is a reflection of the environmentally benign activity that adheres to the prescribed standards of compliance.

Being the buyer of the electricity generated, MSEDCL is a significant player and contributor to the success of the project. It has cleared the project and the proponent has already signed a Power Purchase Agreement with MSEDCL.

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

>>

It was conveyed to the villagers that they could continue with their agricultural practices in the wind farm area, keeping the minimum necessary distance from the WEGs. Further, eligible candidates from the villages would be hired by Suzlon as security guards or trained for operations and maintenance related jobs.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	C. Mahendra Exports Limited
Street/P.O.Box:	1204 Panchratna
Building:	12th Floor, Opera House
City:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 004
Country:	India
Telephone:	+91 22-2382 6998
FAX:	+91 22-2380 2847
E-Mail:	infonagindas@cmahendra.com
URL:	www.cmahendra.com
Represented by:	Mr. Kirtikumar N. Shah
Title:	Head
Salutation:	Mr.
Last Name:	Shah
Middle Name:	Nagindas
First Name:	Kirtikumar
Department:	Administration
Mobile:	9377780999
Direct FAX:	+91 0261-307 2444
Direct tel:	+91 0261-307 2222
Personal E-Mail:	kirti.shah@cmahendra.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the project.

Annex 3

BASELINE INFORMATION

Baseline Emission Factor:

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

	tCO2e/MWh
Simple Operating Margin - 2004-05	1.01294
Simple Operating Margin - 2005-06	1.00385
Simple Operating Margin - 2006-07	0.99362
Average Operating Margin of last three years	1.00347

Build Margin

	tCO2e/MWh
Build Margin	0.5938

Combined Margin calculations

	Weights	tCO2e/MWh
Operating Margin	0.75	1.00347
Build Margin	0.25	0.5938
Combined Margin		**0.901**

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

Operating Data:

1. Rotor Height: 70 m
2. Hub Height: 67 m
3. Cut in Speed: 3 m/s
4. Rated Speed: 12 m/s
5. Cut out speed: 25 m/s
6. Survival Speed: 67 m/s

Rotor:

1. Blade: 3 Blade Horizontal Axis
2. Swept Area: 3217 m^2
3. Rotational Speed: 13.9 to 20.8 rpm
4. Regulation: Pitch Regulated

Generator:

1. Type: Asynchronous 4 / 6 Poles
2. Rated Output: 250 / 1250 kW
3. Rotational Speed: 1006 / 1506 rpm
4. Frequency: 50 Hz

Gear Box:

1. Type: Integrated (1 Planetary & 2 Helical)
2. Ratio: 74.971:1

Yaw System:

1. Drive: 4 electrically driven planetary gearbox
2. Bearings: Polyamide slide bearings

Braking System:

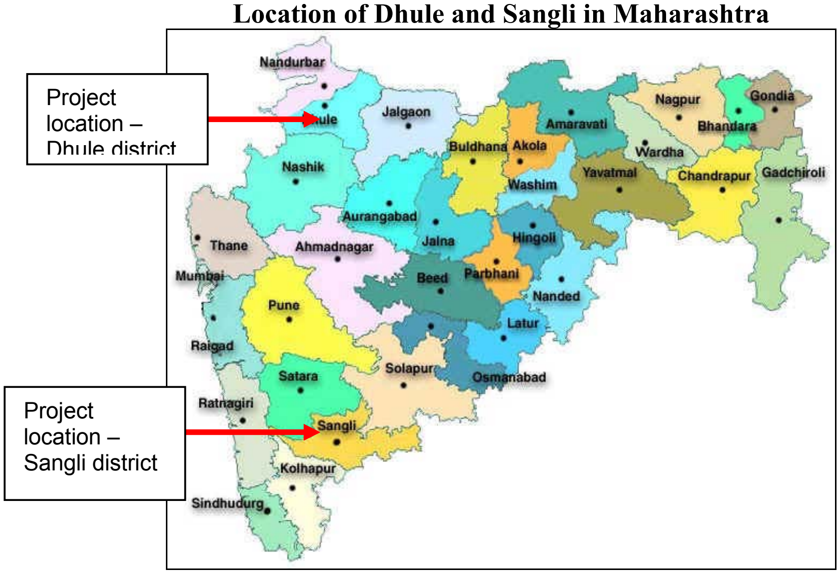
1. Aerodynamic Brake: 3 independent systems with blade pitching
2. Mechanical Brake: Hydraulic fail safe disc braking system

Control Unit:

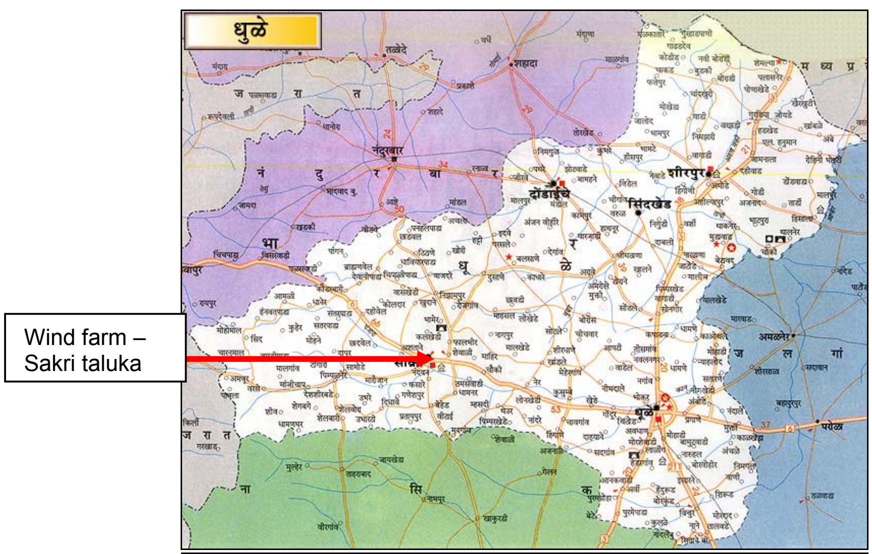
1. Type: Programmable microprocessor based; high speed data communication, active multilevel security, sophisticated operating software, advance data collection remote monitoring & control option, UPS backup, Real time operating indication.

ANNEX 5

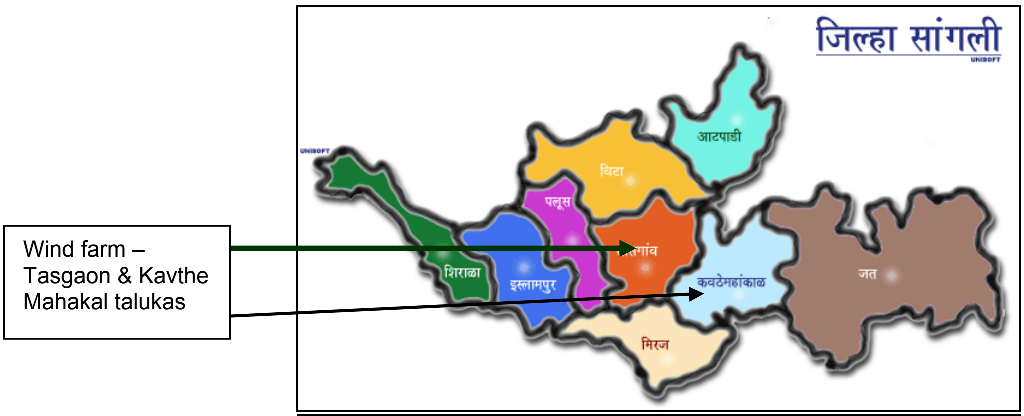
Location of Dhule and Sangli in Maharashtra



Wind farm location in Dhule



Wind farm location in Sangli


Wind farm –
Tasgaon & Kavthe
Mahakal talukas
जिल्हा सांगली
UNISOFT
आटपाडी
विटा
पलूस
शिराळा
इस्लामपुर
कवठेमहांकाळ
जत
मिरज

ANNEX 6
Assumptions for Equity IRR

Reference No.	Name of Customers	Capacity of WEG (MW)	No. of WEG	Total MW	Date of Comissioning	Projet Cost (Million)	per MW Cost (Million)	Debt %	Equity %	Interest rate %	loan tenure (Yrs)	Insurance charges(% of capital cost)	O&M charges(% of capital cost)	Equity IRR (Without CDM)	Equity IRR (With CDM)	IRR at 18% PLF	IRR at 22% PLF
1	C. Mahendra Exports Ltd	1.25	8	10.00	Mar-06	502.70	50.27	75.0%	25.0%	9.0%	6.00	0.118%	1.75%	9.01%	11.12%	6.42%	**11.66%**
2	Rindiam Export	1.25	1	1.25	Sep-05	59.68	48	78.0%	22.0%	8.8%	7.00	0.125%	2.30%	9.37%	11.72%	6.32%	12.52%
3	Ratnakala Exports	1.25	2	2.50	Mar-06	118.18	47	65.0%	35.0%	8.5%	5.00	0.166%	1.86%	10.28%	12.22%	7.85%	12.70%
4	Ambika Diamonds	1.25	1	1.25	Jul-05	59.68	48	67.0%	33.0%	9.0%	5.00	0.125%	1.84%	9.86%	11.67%	7.38%	12.32%
	Total			**15.00**													