



CDM – Executive Board

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

CONTENTS

- A. General description of project activity
- B. Application of a baseline and monitoring methodology
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan

Appendices

- Appendix 1: WTG Locations
- Appendix 2: Implementation Plan for Sustainable Development Initiatives



CDM – Executive Board

SECTION A. General description of project activity.**A.1. Title of the project activity:**

Title: 25.5 MW Wind Energy Farm at Nandurbar Maharashtra by HZL

Version: 04

Date: 12/09/2012

A.2. Description of the project activity:

Hindustan Zinc Ltd. (HZL), a vertically integrated natural resources enterprise, headquartered at Udaipur, Rajasthan having broad operations ranging from exploration, mining, ore processing to smelting of non-ferrous metals is the owner and project proponent of the proposed project activity.

Purpose of the Project Activity

The project activity primarily aims at reducing Green House Gas (GHG) emissions through utilization of renewable energy technology for generation of electrical energy. The electricity generated from the project activity (approximately 45033 MWh annually) will displace equivalent electricity generation in grid connected power plants. The project activity will reduce the anthropogenic GHG emissions (approximately 42,912 tCO₂ annually and 300,384 tCO₂ through the crediting period) associated with the equivalent amount of electricity generation from NEWNE grid connected power plants predominantly fossil fuel based

Measures Implemented within the Proposed Project Activity

The project activity involves installation and operation of Seventeen Suzlon makes 1.5 MW Wind Turbine Generators (WTGs) by Hindustan Zinc Limited (HZL) in the state of Maharashtra. The cumulative capacity of the project activity is 25.5 MW. The electricity generated from the project activity will be exported to regional Grid.

Baseline Scenario

The project activity is a Greenfield wind power project, supplying electricity to the fossil fuel dominated NEWNE grid system. In the absence of the project activity equivalent amount of electricity would have been generated in the NEWNE grid. Since the wind power project is a Greenfield project, there is no difference between the pre-project scenario and the baseline scenario.

Project's contribution to Sustainable Development

The Designated National Authority (DNA) for the Government of India (GoI) in the Ministry of Environment and Forests (MoEF), called the National CDM Authority (NCDMA), has stipulated four



CDM – Executive Board

indicators for sustainable development in the interim approval guidelines for CDM projects¹:

- **Social well being**

The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.

- The project activity would generate employment in the region during construction as well as operation of the project activity.
- It would lead to generation of employment and development of the region.
- It would augment power generation in the region that would aid the local population.

- **Economic well-being**

The CDM project activity should bring in additional investment consistent with the needs of the people.

- The project activity would lead to additional business for equipment suppliers, O&M contractors, civil work contractors etc.
- It would also lead to additional investment for the development of infrastructure in the region like roads, communication facilities etc and the same could be utilized by the local population.

- **Environmental well being**

This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.

- The proposed project activity will reduce the GHG emissions associated with the combustion of fossil fuels in grid connected power plants.
- The project activity utilizes wind power as the source of kinetic energy used to generate renewable power. Wind power generation does not consume any fuels or water for power generation.
- Wind is a clean form of energy and electrical power generation using wind does not produce any solid waste products (such as ash from combustion), emissions of carbon dioxide, SO_x, or NO_x.

- **Technological well being**

The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewable sector or energy efficiency projects that are comparable to best practices in order to assist in up-gradation of technological base.

The proposed project activity will demonstrate the use of wind based electricity generation, which would serve as an example for other industries to replicate.

¹ <http://www.envfor.nic.in/cc/cdm/criteria.htm>

**CDM – Executive Board****A.3. Project participants:**

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

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:****A.4.1.1. Host Party(ies):**

India

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

Maharashtra

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

District: Nandurbar

State: Maharashtra

Site: Chakla

Village: Akhatwade, Gangapur, Vasdara, Mandal, Thanepada

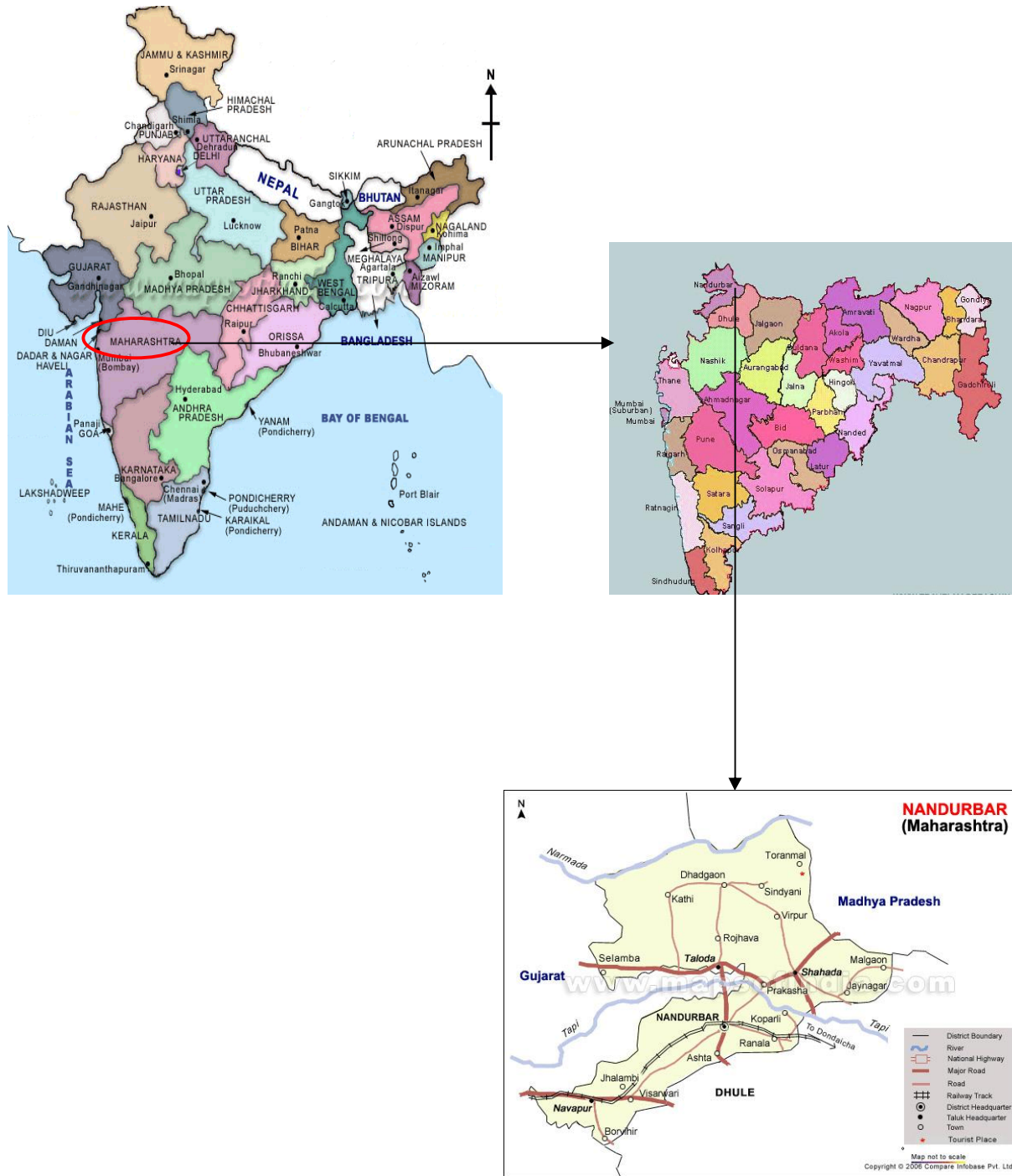
A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity consists of seventeen 1.5 MW wind turbines in the district of Nandurbar in the state of Maharashtra, India. The nearest railway station to Nandurbar is Nandurbar railway station and nearest airport is situated at Nasik which is 188 Kms from Nandurbar.

The specific geographical coordinates of the individual WEGs are provided as Appendix 1.



CDM – Executive Board





CDM – Executive Board**A.4.2. Category(ies) of project activity:**

The project activity is considered under “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, having a capacity of more than 15 MW. Therefore as per the scope of the project activity enlisted in the ‘list of sectoral scopes and related approved baseline and monitoring methodologies’, the project activity may principally be categorized in:

Scope Number – 1

Sectoral Scope – Energy Industries (renewable/non-renewable sources).

Methodology – ACM0002 Version 12.3.0 (EB 66) “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”

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

The technology employed by the project activity converts kinetic energy in wind to mechanical energy and mechanical energy to electrical energy using wind turbine generators (WTGs). In this process, there are no greenhouse gas emissions or burning of any fossil fuels. The electricity is generated through sustainable means without causing any negative effect to the environment and therefore the technology is environmentally safe and sound.

The technical specifications of the WTGs are as below:

WTG (S82 , 1.5 MW, 50 Hz) TECHNICAL DATA

Rated capacity : 1500 kW
Rotor diameter : 82 m
Hub height : 78.5 m

Rotor with Pitch Control

Type : Upwind rotor with active pitch control
Number of blades : 3
Swept area: 5281 m²
Blade material : The rotor blades are made epoxy bonded fibre glass
Rotor speed : 16.30 rpm
Tip speed : 70 m/s

Generator :

Type: Single fed Induction Generator with slip-rings, variable rotor resistance with SUZLON-FLEXI-SLIP control system.

Hub : Cast spherical hub
Bearings : Spherical roller bearing
Tower : Steel Tubular, 76 m height

Technology Transfer

**CDM – Executive Board**

No technology transfer from other countries is involved in the project.

Plant Load Factor

The expected plant load factor for the project activity as determined by independent third party assessment (Power & Energy Consultants) is 20.16 %. The plant load factor is applied in accordance with paragraph 3(b) of the “Guidelines for the reporting and validation of plant load factors” for ex-ante estimation of emission reductions. However, for the investment analysis, the PLF available the time of investment decision (based on offer Letter from Suzlon dated 04/12/2010) is applied as explained in section B.5.

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

Years	Estimation of annual emission reductions in tonnes of CO₂ e
2012*	42,912
2013	42,912
2014	42,912
2015	42,912
2016	42,912
2017	42,912
2018	42,912
Total estimated reductions (tonnes of CO₂ e)	300,384
Total number of crediting years	7
Annual average of the estimated reductions over the crediting period (tonnes of CO₂ e)	42,912

*1 December 2012 to 30 November 2013

A.4.5. Public funding of the project activity:

No public funding from parties included in Annex – I is involved in the project activity. The project proponent hereby confirms that there is no divergence of Official Development Assistance (ODA) to the project activity.



CDM – Executive Board

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

Title of the approved baseline and monitoring methodology: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”.

Reference: ACM0002, Version 12.3.0 (EB 66), Sectoral Scope: 01

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

The following tools and guidance's have been followed (References):

1. Tool to calculate the emission factor for an electricity system (Version 02.2.1)
2. Tool for the demonstration and assessment of additionality (Version 06.00)

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

The project activity is Grid connected renewable power generation and meets the applicability conditions of the chosen methodology as follows:

S. No.	Applicability Conditions in the ACM0002 Version 12.3.0	Position of the project activity vis-à-vis applicability conditions
1.	<i>The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit</i>	The project activity is the installation of a wind power project for renewable electricity generation. Thus, it meets the applicability condition.
2.	<i>In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum</i>	This condition is not applicable to the project activity as it is a wind power project and does not involve capacity addition, retrofit or replacement of an existing power plant.

**CDM – Executive Board**

	<i>historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;</i>	
3.	<i>In case of hydro power plants:</i> • <i>At least one of the following conditions must apply:</i> ○ <i>The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</i> ○ <i>The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m² after the implementation of the project activity; or</i> ○ <i>The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m² after the implementation of the project activity.</i>	The project is not a hydro power project. Hence, this applicability criterion is not applicable.
4.	<i>The methodology is not applicable to the following:</i> • <i>Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</i>	This is a greenfield project activity and does not involve switching from fossil fuels to renewable energy at the project site. Further, the project activity is a neither a biomass fired project and nor a hydro power project. Hence, this applicability condition is also satisfied.

**CDM – Executive Board**

	• <i>Biomass fired power plants;</i> • <i>A hydro power plant² that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m².</i> •	
5.	<i>In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance..</i>	This condition is not applicable to the project activity as it is a wind power project and does not involve capacity addition, retrofit or replacement of an existing power plant.

The project activity meets the applicability conditions of tools referred in the methodology as follows:

S. No.	Relevant Applicability Criteria of “Tool for the demonstration and assessment of additionality”	Position of the project activity vis-à-vis applicability conditions
1.	Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory.	The tool is referenced in ACM0002. Application of the additionality tool is mandatory.
2.	Project activities with a start date before the date of validation shall specifically take into account the guidance provided in Chapter B “Specific guidelines for completing the Project Design Document (CDM-PDD)” section B, sub-section B-5. The start date of a project activity is as defined in paragraph 76 of thirty-third	The project start date is prior to the date of validation. The guidelines are taken into account in section B.5.

² Project participants wishing to undertake a hydroelectric project activity that result in a new reservoir or an increase in the existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

**CDM – Executive Board**

	report of the Board.	
3.	Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.	Only one alternative more attractive than the proposed project activity (no investment) has been identified.

S. No.	Relevant Applicability Criteria of “Tool to calculate the emission factor for an electricity system”	Position of the project activity vis-à-vis applicability conditions
1.	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	The project activity supplies electricity to the grid. Therefore the tool may be applied.
2.	In case of CDM projects the tool is not applicable if the project electricity system is located partially or Totally in an Annex I country.	Project Activity is located in India, which is not an Annex I Country. Therefore, the tool may be applied.

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

ACM0002 version 12.3.0 (EB 66) specifies that the project boundary will be:

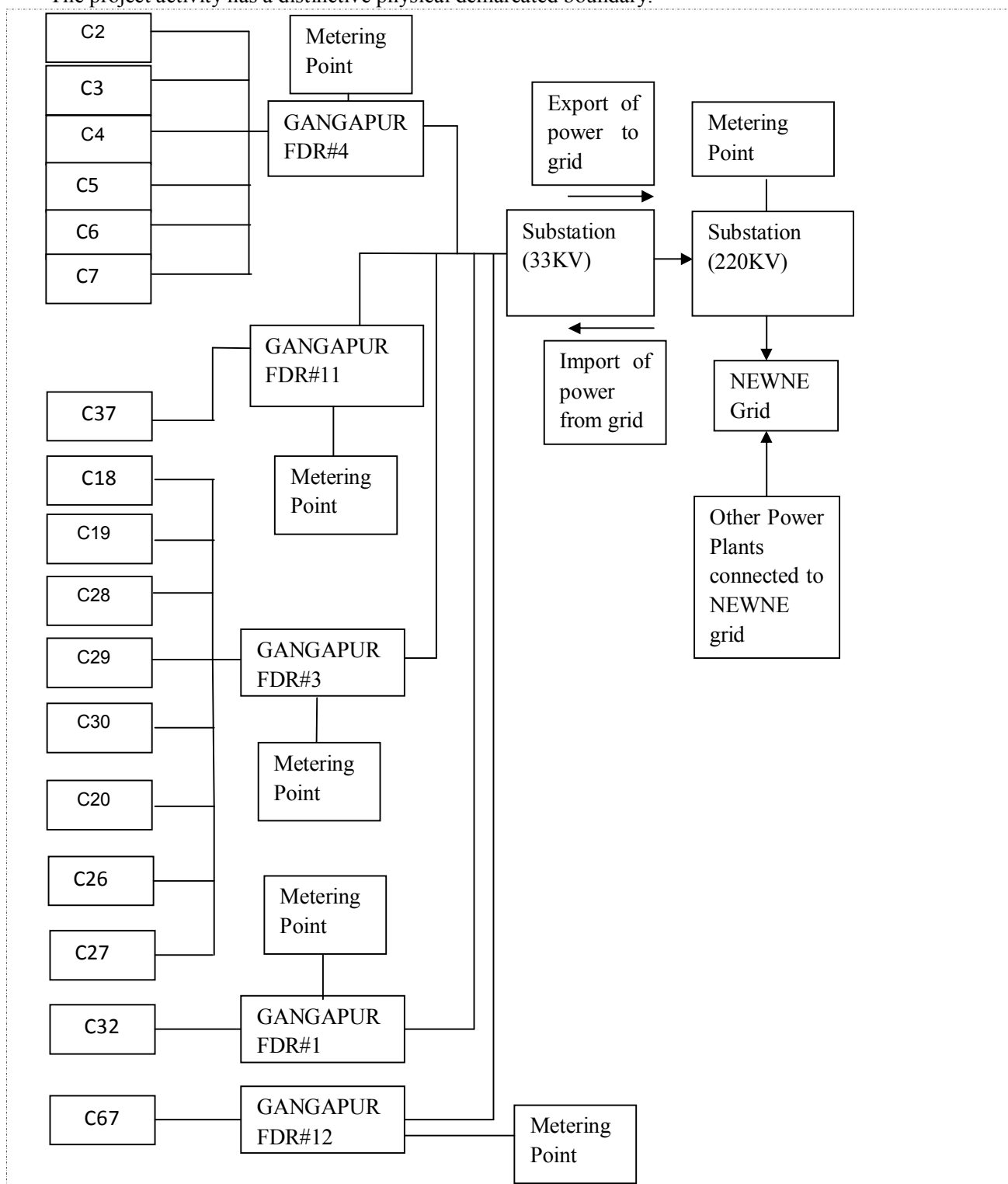
*The **spatial extent** of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.*

The proposed project would be feeding the electricity in the NEWNE regional grid which constitutes several states and Union territories including Maharashtra. The proposed project would have marginal

**CDM – Executive Board**

impact on all the generation facilities in the NEWNE grid. Thus all the power generation facilities connected to this grid form the project boundary for the purpose of baseline estimation. For conservative and accurate estimation, the imports of electricity from other regional grids have been included in the baseline calculation.

The project activity has a distinctive physical demarcated boundary.





CDM – Executive Board

There are separate check and main meters for each of the feeders at the substation.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table below:

Overview on emission sources included in or excluded from the project boundary				
	Source	Gas	Included ?	Justification / Explanation
Baseline	CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO ₂	Yes	This is the main emission source because the combustion of fossil fuels for electricity generation leads to emission of CO ₂ .
		CH ₄	No	This is a minor emission source because the emission of CH ₄ from the combustion of fossil fuels is low.
		N ₂ O	No	This is a minor emission source because the emission of N ₂ O from the combustion of fossil fuels is low.
Project Activity	For geothermal power plants, fugitive emissions of CH ₄ and CO ₂ from non-condensable gases contained in geothermal steam.	CO ₂	No	The project activity is a wind power project and not a geothermal project. Thus these emission sources are not applicable to the proposed project.
		CH ₄	No	
		N ₂ O	No	
	For geothermal power plants, CO ₂ emissions from combustion of fossil fuels required to operate the geothermal power plant.	CO ₂	No	The project activity is a wind power project and not a geothermal project. Thus these emission sources are not applicable to the proposed project.
		CH ₄	No	
		N ₂ O	No	
	For hydro power plants, emissions of CH ₄ from the reservoir.	CO ₂	No	The project activity is a wind power project and not a hydro project. Thus these emission sources are not applicable to the proposed project.
		CH ₄	No	
		N ₂ O	No	

**CDM – Executive Board****B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

As the project activity is the installation of a new grid-connected wind power plant/unit, according to ACM0002 Version 12.3.0, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system” described step wise under section B.6.

Step 1: Identify the relevant electricity systems

For determining electricity emission factors, identify the relevant **project electricity system**.

The Indian power system is divided into two regional grids, namely NEWNE and Southern grid. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid.

Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan). Recently, the Indian regional grids have started to work in synchronous mode, i.e. at same frequency.

States connected to different regional grids

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

**CDM – Executive Board**

			Nagar Haveli		
--	--	--	--------------	--	--

The NEWNE grid constitutes several states and union territories including Maharashtra³. These states under the regional grid have their own power generating stations as well as centrally shared power-generating stations. While the power generated by own generating stations is fully owned and consumed through the respective state's grid systems, the power generated by central generating stations is shared by more than one state depending on their allocated share. Presently the share from central generating stations is a small portion of their own generation.

For the purpose of this tool, the reference system is the project electricity system. On this basis the Central Electricity Authority, *CO₂ Baseline Database for the Indian Power Sector - Version 7.0*⁴ defines the project electricity systems within India in two regional grids. This is justified "*as electricity continues to be produced and consumed largely within the same region, as is evidenced by the relatively small volume of net transfers between the regions, and consequently it is appropriate to assume that the impacts of CDM project will be confined to the regional grid in which it is located*". The project is located in Maharashtra and is therefore as per the CEA's grid definitions it is within NEWNE regional grid. Also, it is preferable to take the regional grid as project boundary than the state boundary as it minimizes effect of interstate power transactions, which are dynamic and vary widely. Considering free flow of electricity among member states and the union territory the entire NEWNE grid is considered as a single entity for estimation of baseline.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

The project participant has chosen Option I for the calculation of the operating and build margin emission factor i.e. off-grid power plants are not being included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4::

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

³ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf

⁴ http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver7.pdf

**CDM – Executive Board**

For the proposed project activity, simple OM method (option a) has been chosen to calculate the operating margin emission factor ($EF_{grid, OM, y}$). However, the simple OM method 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 low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

Share of Low Cost / Must-Run (% of Net Generation)

Grid	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	18.5%	19.0%	17.4%	15.9%	17.6%
South	28.3%	27.1%	22.8%	20.6%	21.0%
India	20.9%	21.0%	18.7%	17.1%	18.4%

Ref: CO₂ Baseline Database for the Indian Power Sector – CEA, Version 07.

Percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) = 17.7 %

The calculation above shows that the generation from low-cost/must-run resources constitutes less than 50% of total grid generation, hence usage of the **Simple OM method** in the project case is justified.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y :

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use 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. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation.

or

- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y , alternatively the emission factor of the previous year ($y-1$) may be used. If the data is usually only available 18 months after the end of year y , the emission factor of the year proceeding the previous year ($y-2$) may be used. The same data vintage (y , $y-1$ or $y-2$) should be used throughout all crediting periods.

The project proponent chooses the *Ex ante* option for estimating the simple OM emission factor wherein as described above 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 will be undertaken.

**CDM – Executive Board*****Step 4: Calculate the operating margin emission factor according to the selected method***

The simple OM method has been selected as justified above. The simple OM emission factor is calculated based on the net electricity generation of each power unit and a CO₂ emission factor for each power unit, as follows:

$$EF_{grid,OM,simple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

- $EF_{grid,OM,simple,y}$ = Simple operating margin CO₂ emission factor of in year y (tCO₂/MWh)
- $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
- m = All power units serving the grid in year y except low-cost / must-run power units
- y = The relevant year as per the data vintage chosen in step 3 i.e. 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)

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m has been determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/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)
- $EF_{CO2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂/GJ)



CDM – Executive Board

$EG_{m,y}$	=	Net 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 plant / unit m in year y
y	=	The relevant year as per the data vintage chosen in step 3 i.e. 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)

Determination of $EG_{m,y}$

Since, the calculations consider only grid power plants, $EG_{m,y}$ should have been determined as per the data provided by the Central Electricity Authority (CEA) CO₂ Baseline Database for the Indian Power Sector.

In India, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. This data has also been endorsed by the DNA and is the most authentic information available in the public domain. The details of same can be found on CEA website at <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>.

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, project proponents can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor 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. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project proponent wishes to choose option 1.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units m used to calculate the build margin should be determined as per the

**CDM – Executive Board**

following procedure, consistent with the data vintage selected above:

- Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh);
- Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total} , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET \geq 20\%$) and determine their annual electricity generation ($AEG_{SET \geq 20\%}$, in MWh);
- From $SET_{5-units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

In India, the installed capacity and corresponding annual generation from power plants is quite high. The Central Electricity Authority (CEA) has estimated the annual electricity generation from $SET_{\geq 20\%}$ to be larger than the generation from $SET_{5-units}$. The details of same can be found on CEA website at <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>. Further, none of the power units in $SET_{\geq 20\%}$ started to supply electricity to the grid more than 10 years ago. Therefore, SET_{sample} is selected as $SET_{\geq 20\%}$ for the estimation of build margin.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid, BM, sample, y} = \frac{\sum_m EG_{m, y} \cdot EF_{EL, m, y}}{\sum_m EG_{m, y}}$$

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

Calculations for the Build Margin emission factor $EF_{grid, BM, y}$ is based on the most recent information



CDM – Executive Board

available on the plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20 % of the system generation and that have been built most recently.

Step 6: Calculate the combined margin emission factor

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

- (a) Weighted average CM; or
- (b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option. Therefore, The combined margin emissions factor is calculated as follows:

$$EF_{CO_2} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

The following default values should be used for w_{OM} and w_{BM} :

- Wind and solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.
- All other projects: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

As mentioned before, the CEA has calculated the baseline emission factors for various regional grids in India according to the formulas specified above. As this is the most authentic information available in the public domain. The baseline emission factor used in the calculation of baseline emissions for the proposed project activity is being referred from the same for transparency and conservativeness⁵.

⁵ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



CDM – Executive Board

The approach proposed in the “Option (a)” i.e. “Combined Margin” has been used for ascertaining baseline emissions and corresponding emission reductions. The OM and BM emission factor have been considered from the information (CO₂ Baseline Database for the Indian Power Sector -Version 7.0) published by the Central Electricity Authority (CEA), Ministry of Power, Govt. of India. Considering the individual weightings assigned to the OM and the BM emission factors respectively, as prescribed in the ‘Tool to calculate the emission factor for an electricity system (Version 02.2.1)’, the combined margin emission factor for the NEWNE Grid has been estimated at 0.9529 tCO₂/MWh.

Year	Net generation in OM (GWh)	Operating Margin (OM) (tCO ₂ /MWh)
2008-09	421802.63	1.006553
2009-10	458043.08	0.977736
2010-11	476986.72	0.970663

Generation Weighted Average Operating Margin (OM): 0.9842 tCO₂/MWh

Build Margin (BM) ; 0.8588 tCO₂/MWh

Combined Margin; $0.75 \times \text{OM} + 0.25 \times \text{BM}$

$$= 0.75 \times 0.9842 + 0.25 \times 0.8588$$

$$= 0.9529 \text{ tCO}_2/\text{MWh}$$

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

In accordance with “*Guidance on the demonstration and assessment of prior consideration of the CDM*” Version 3, since the start date of the project activity falls after 02 August 2008, the project participant is required to inform the host party DNA and UNFCCC Secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. This notification was made by Hindustan Zinc Limited to the UNFCCC Secretariat and Ministry of Environment and Forests on 16/05/2011 which is within six months of the project activity start date and contains the precise geographical location and a brief description of the proposed project activity.

HZL took continuing and real actions to secure CDM status for the project in parallel with its implementation. The chronology of events for project implementation and CDM consideration are as follows:

**CDM – Executive Board**

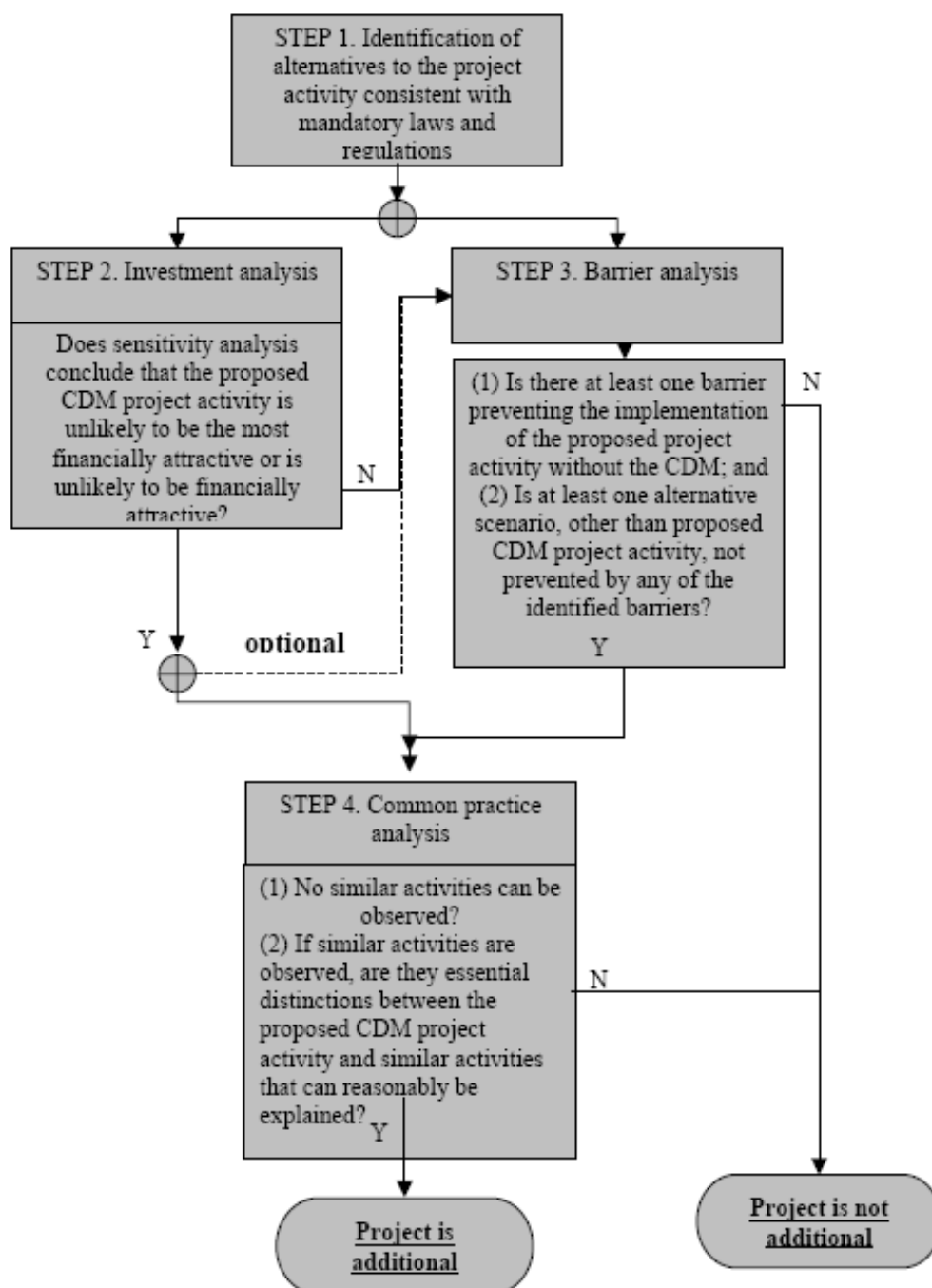
Date	Project Activity	CDM activity
4-Dec-10	Offer Letter from Suzlon	Offer Letter from Suzlon
10-Dec-10	Note for approval for the project activity	Investment Decision Date
28-Mar-11	Purchase order raised for Civil works, electrical works, O&M	Project activity Start date
15-June-2011	-	Acknowledgment from UNFCCC for Receipt of Prior CDM Consideration
18-May-2011	-	Acknowledgment from DNA for Receipt of Prior CDM Consideration
26-Aug-11	-	Appointment of DOE
13-Sep-11	Commissioning of 9 WTGs	
16-Sep-11	Commissioning of 4 WTGs	
22-Sep-11	Commissioning of 2 WTGs	
30-Sep-2011	Commissioning of 2 WTGs	
10-Feb-2012	-	Validation Start day (PDD webhosting date)

Demonstration of Additionality for the project activity

As required in ACM0002 Version 12.3.0, additionality has been demonstrated and assessed using the latest version of the “*Tool for the demonstration and assessment of additionality*”, Version 06.00



CDM – Executive Board





CDM – Executive Board

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

Sub-step (1a): Define alternatives to project activity

Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity. These alternatives are to include:

- (a) The proposed project activity undertaken without being registered as a CDM project activity;*
- (b) Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g., cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;*
- (c) If applicable, continuation of the current situation (no project activity or other alternatives undertaken).*

The proposed project activity is a wind power project involving supply of electricity to NEWNE grid. Hence, according to baseline methodology ACM0002 Version 12.3.0, since the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

Paragraph 105 of the “Clean Development Mechanism Validation and Verification Manual” Version 01.2 states that “*The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.*”

Since, the methodology has prescribed the baseline scenario as given above, there is no further analysis required of alternative scenarios that deliver output services with comparable quality, properties and application areas.

Therefore the following baseline alternatives are considered for further analysis:

**CDM – Executive Board**

SI No.	Alternative
1	<i>The proposed project activity undertaken without being registered as a CDM project activity;</i>
2	<i>Continuation of the current situation (no project activity or other alternatives undertaken)</i>

Sub-step (1b): Consistency with mandatory laws and regulations

The baseline alternative identified above is in compliance with the applicable legal and regulatory requirements as follows:

- The implementation of project activity is a voluntary initiative and it is not mandatory or legal requirement. For power generation, the Indian Electricity Act of 2003 does not restrict or empower any authority to limit the fuel choice⁶.
- The applicable environmental regulations do not restrict the use of wind energy
- There is no legal requirement on the choice of a particular technology.

Thus, the baseline alternative is in line with the applicable legal and regulatory requirements.

The “Tool for the demonstration and assessment of additionality” (Version 06.00) states that project participants may choose to apply Step 2 (Investment analysis) OR Step 3 (Barrier analysis) to demonstrate the additionality of the project. In the present case, Step 2 is used to demonstrate the additionality of the project.

Step 2: Investment Analysis***Sub-step 2a. Determine appropriate analysis method***

As the electricity generated from the project activity will be sold to the state utility, it will generate financial benefits in terms of revenues from the sale of electricity units. Thus simple cost analysis (option I) cannot be applied to the proposed CDM project activity.

Amongst the other two options – investment comparison analysis (option II) and benchmark analysis (option III), the benchmark analysis has been adopted in accordance with the guidance on the assessment of investment analysis wherein the Internal Rate of Return (IRR) of the project activity serves as a

⁶ http://www.powermin.nic.in/acts_notification/electricity_act2003/pdf/The%20Electricity%20Act_2003.pdf



CDM – Executive Board

financial indicator to assess the financial attractiveness of the project activity. The financial indicator therefore chosen is Post tax equity IRR.

The Guidelines on the Assessment of Investment Analysis', EB 62, Annex 5, Paragraph 19, states that *“If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.”*

Since the project activity supplies electricity to the grid and since the baseline scenario does not involve any investment, a benchmark analysis has been applied to the project activity.

Option III assesses if the project's returns are sufficient for investors to make the initial investment and further bear the associated costs of successfully operating the project activity over the crediting period of the project.

Sub-step 2b (Option III) - Apply benchmark analysis

f

As per paragraph 14 in the Guidelines on the Assessment of Investment Analysis, EB 62 Annex 5:

“In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market.”

In accordance with the guideline, the benchmark has been determined using parameters standard in the market, and is based on the expected return on equity calculated using the Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model (CAPM) is a well accepted methodology for estimating the expected rate of return on equity. The reliability of CAPM as a tool for evaluating the minimum rate or return for an investor, is well documented.

It may be noted that there market indices (BSE Sensex, BSE 100, and BSE 200) were analyzed for calculating the market returns and the most conservative value of the market return has been used while calculating the Benchmark for the project activity. BSE 500 is not considered in the analysis since the index was launched in the year 1999 and BSE 500 data is available for only 10 years which is not comparable to the project life time of 20 years. Similarly, other market indices listed are not considered as the available data is not comparable to the project lifetime and/or because they are sectoral indices and not representative of the market. The benchmark calculation applying the three market indices is provided in the consolidated excel sheet.

As per CAPM, the required return on investment is computed as follows:

$$K_e = R_f + \beta \times (R_m - R_f)$$



CDM – Executive Board

where:

K_e = Rate of return on equity capital;

R_f = Risk-free rate of return;

β (Beta) = The stock's risk relative to that of the whole market;

$R_m - R_f$ = Market risk premium;

Risk free rate:

The risk free rate is considered the rate of return on an asset that is theoretically free of any risks. Therefore the yield of Government of India Securities applicable at the time of investment decision is considered as risk free rate. This data is published by Reserve Bank of India and the latest risk free rate available (published on 09th December 2010 by RBI) has been applied. The risk free rate corresponding to 20 years maturity period was considered appropriate, as the lifetime of the project activity is also 20 years.

The applicable risk free rate is 8.43%.

(reference: http://www.rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=11808)

Risk Premium:

The market risk premium is the premium above the risk-free rate of return that investors expect to earn on a well-diversified portfolio of equities. The most common approach for estimating the risk premium is to base it on historical data. The premium is estimated by looking at the difference between average return on stocks (market rate of return) and return on government securities over a period of time.

The market rate of return for BSE 100, BSE 200, and BSE Sensex has been evaluated from January 1991 onwards, thus providing the market returns for 19.92 years which is comparable with the operational lifetime of the project activity (20 years). Further, the use of data from 1991 is appropriate as the economic liberalization of the Indian economy started in 1991.⁷ The economic growth path of India changed from 1991 and the use of data from this year provides a realistic representation of the market returns used to estimate the benchmark.

The market rate of return was evaluated as the compounded annual growth rate of the respective market index from January 1991 to November 2011 (prior to investment decision). The historical market index was taken from the BSE web-site (http://www.bseindia.com/index_op.htm), and the market rate or return for the three indices was determined to be:

BSE 100: 16.37%

BSE 200: 15.87%

⁷ Reference: http://www.indiainbusiness.nic.in/economy/economic_reforms.htm



CDM – Executive Board

BSE Sensex: 16.19%

On a conservative basis, the market returns are applied in accordance with BSE 200.

Market rate of return, $R_m = 15.87\%$

The risk premium has been calculated as the difference in market rate of return and the risk free rate available at the time of decision making. The detailed calculations are presented in the benchmark calculation spreadsheet submitted to the DOE.

The applicable risk premium is determined as: $15.87\% - 8.43\% = 7.44\%$.

Beta:

Beta (β) indicates the sensitivity of the company to market risk factors. For companies that are not publicly listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is wind power generation; the approach therefore should be to base the beta for the project on the beta values of listed wind power generation companies in India. However, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e. wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

Therefore, we have considered beta values of electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. Investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks from significantly varying and unpredictable resource availability and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non conventional energy.

The beta value taken for the analysis is based on the beta values of the listed power producing companies estimated by regressing monthly returns on stock against local index, using 5 years⁸ of data. The beta value for PTC has not been considered in the analysis as it is a power trading company. Further, companies with less than 5 years of data (date of listing after December 2005) have not been considered in the analysis.

Data on stock value of companies and indices has been sourced from the BSE web-iste. Data on debt, equity, and effective tax rates has been sourced from audited financial statements of respective companies available on www.moneycontrol.com, and links for each company have been provided in the benchmark analysis spreadsheet. The beta values for the five years period prior to the time of investment decision

⁸ Five years of Beta value has been chosen in line the Crisil Report on Cost of Capital for Central Sector Utilities which states that ‘for such economies, and for companies whose capital structure and operating environment has been changing, the time period over which beta is calculated should be small’.

**CDM – Executive Board**

(December 2005 to November 2010) has been evaluated. The beta values determined applying **BSE 200** are as follows:

Name	Effective Tax	Debt/Equity	Levered Equity beta	Unlevered Equity Beta
CESC Ltd.	17%	0.621	1.1187	0.7401
Gujarat Industries Power Co Ltd	17%	0.725	1.2568	0.8134
TATA Power	25%	0.525	1.0568	0.7560
Reliance Infrastructure Limited	11%	0.425	1.8683	1.3828
Neyveli Lignite Corporation	22%	0.379	1.4784	1.1689
BF Utilities	29%	1.101	2.2979	1.6537
NTPC	20%	0.563	0.6781	0.4885
Jaiprakash Power Venture Limited	17%	1.586	1.7475	0.7587
Average				0.9211

The average asset beta of companies engaged in power sector is thus **0.9211**

The required return on equity computing using CAPM, is **15.29%** based on the average beta value and market risk premium for BSE 200, and risk free rate as given above.

The required rate on equity based on BSE 200 is the most conservative among the three indices as tabulated below:

Market Index	Average Beta	Return on Equity
BSE 100	0.9304	15.82%
BSE 200	0.9211	15.29%
BSE Sensex	0.9703	15.96%

The detailed benchmark calculation spreadsheets for all three market indices have been submitted to the DOE.

Therefore, the benchmark for the project activity is applied as **15.29%** on a conservative basis.

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

The project proponent has opted to demonstrate the additionality of the project activity by performing an investment analysis using post tax equity IRR. Post tax equity IRR is one of the well-known financial indicators used by banks, financial institutions and project developers for making investment decisions. The chosen indicator, post tax equity IRR, represents the overall returns from an investment, and therefore, is duly considered as the financial indicator for the project activity.

The assumptions used to calculate the post tax equity IRR are listed below:

Capacity			
Project Size	25.5	MW	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
Total Project Cost	155.87	INR (x 10 Million)	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
Means of Finance			
Debt (0%)	0	INR (x 10 Million)	Investment decision
Equity (100%)	155.87	INR (x 10 Million)	Investment decision
Total Project Cost	155.87	INR (x 10 Million)	Investment decision
Operating Parameters			
PLF *	24.67	%	Estimated Electricity Generation specified in Offer Letter from Suzlon dated 04/12/2010
Net Energy Generation (EG _{BL,y})	55,107.85	MWh	Calculated based on the PLF stated above
Life of the WTG assumed	20	Years	WTG technical specifications from Suzlon Energy Limited
Operation & Maintenance Cost			
O & M Cost Exemption	2.00	Years	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
O & M Cost	0.1425	(x 10 Million)/WTG	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
O & M escalation	5.0	%	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
Tax on OMS	10.30	%	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited

**CDM – Executive Board**

Insurance cost			
Insurance Cost	0.01	(x 10 Million)/WTG	Insurance costs incurred in previously commissioned wind power projects (Policy schedule from the Oriental Insurance Company for the period 17/08/2010 to 16/08/2011)
Depreciation Rate			
Yearly book depreciation	5.28%	%	As per Companies Act ⁹
Yearly tax depreciation	7.69%	%	As per IT Act ¹⁰
Tax			
Income Tax Rate	33.22%	%	As per IT Act ¹¹
Minimum Alternate Tax	19.93%	%	As per IT Act ¹⁰
Tariff			
Tariff	4.41	INR	MERC Tariff Regulations, dated 4 July 2010 for wind zone 2
GBI	0.5	INR / kWH	http://mnre.gov.in/file-manager/UserFiles/faq_wind.pdf
Maximum benefit under GBI	6.2	INR Million/MW	http://mnre.gov.in/file-manager/UserFiles/faq_wind.pdf

* The PLF considered for the investment analysis is based on the estimated generation indicated by the equipment supplier in the offer letter dated 04/12/2010, which corresponds to a PLF of 24.67%. This PLF is applicable at the time of investment decision and is in compliance with with EB 62 Annex 5, Paragraph 6 . However, in line with the requirements of EB 48, Annex 11, PLF has also been evaluated based on an independent third party assessment by Power and Energy Consultants dated 26/12/2011 (after the investment decision for the project activity). However, as the PLF based on the offer letter (24.67%) is more conservative than the PLF based on the third party assessment (20.16%), the offer letter has been taken as the basis of the PLF applied for computation of the post tax equity IRR.

⁹ <http://asa-india.com/asa/Depreciation%20Rates%20Companies%20Act.pdf>

¹⁰ http://law.incometaxindia.gov.in/DIT/File_opener.aspx?page=ITRU&schT=rul&csId=2f13c0bd-dec4-4df6-a273-431e3b91a01b&rNo=&sch=&title=Taxmann%20-%20Direct%20Tax%20Laws

¹¹

http://www.incometaxindiapr.gov.in/incometaxindiapr/contents/forms2010/pamphets/COMPANIES_2012_13.htm

**CDM – Executive Board**

Using the assumptions in the table above, the post-tax equity IRR for the project activity works out to be **11.75%**, calculated in accordance with the “Guidance on the Assessment of Investment Analysis” Version 05. The project activity is not financially attractive as the equity IRR is much below the selected benchmark.

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

A sensitivity analysis has been carried out, by varying the critical parameters of the project activity. As per paragraph 20 of the “Guidance on Assessment of Investment Analysis”, EB 62 Annex 5: “only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation.”

Sensitivity analysis has been carried out considering variations in PLF, tariff rate, O&M cost, and project cost. In accordance with Paragraph 21 of the guidance, a range of +10% to -10% has been considered as the range of variation.

Upon introducing the variation of 10% in crucial parameters the IRR figures do not surpass the benchmark. The results of sensitivity analysis for the project activity are as given below:

S. No.	Parameters	Variation	IRR without CDM
1.	PLF	+ 10 %	13.61%
		- 10 %	9.85%
2.	Tariff rate	+10 %	13.57%
		-10 %	9.88%
3.	O&M Cost	+10%	11.54%
		-10 %	11.95%
4.	Project Cost	+10%	10.00%
		-10 %	13.86%

It is evident from the above that the IRR without CDM benefits is consistently below the benchmark of 15.29%, even after introducing variation of 10% in the critical parameters.

An assessment was also carried out of the variation in parameters required for the equity IRR to reach the benchmark and the results are tabulated below.

S. No.	Parameters	Variation for IRR with out CDM revenue to attain benchmark
1.	PLF	+20%
2.	Tariff rate	+20%
3.	O&M Cost	-190%
4.	Project Cost	-16%



CDM – Executive Board

It is unlikely that the above variations would be achieved as:

- The PLF considered for investment analysis (based on offer letter from equipment supplier) is conservative. The PLF based on third party assessment is around 18% lower than the PLF applied for investment analysis..Therefore, an increase of 20% is highly unlikely.
- The project proponent has entered into a power purchase agreement at a price of 4.67 which is within the range of +10%. Varying the tariff by +10 % from takes the IRR to 13.57% , which is much below the benchmark. The tariff would not be varying further as the PPA has been signed. At the end of the PPA term (thirteen years), even if there is an increase of tariff by 20%, the IRR would remain below the benchmark as the change would apply only to the last 7 years of the project life time.
- The equity IRR remains below the benchmark at no O&M costs (-100% of O&M costs) and it is not possible for O&M costs to be reduced below -100%.
- The purchase orders for the project have been signed based on the offer letter considered at the time of investment decision. The actual PO values (actual implemented project cost) is same as the cost considered for financial analysis. Therefore any decrease in the investment cost is not possible.

Conclusion

The project activity was not financially viable to the project proponent considering the low financial returns as described above. The investment decision was approved after considering the CDM revenues, which would be accrued upon registration of the project activity with UNFCCC .

Step 4: Common Practice Analysis

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

Provide an analysis of any other activities that are operational and that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

Paragraph 47 of the Additionality Tool Version 06.0.0 has been applied for the analysis of other activities similar to the proposed project activity. The following step-wise procedure is applied.

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity



CDM – Executive Board

As the proposed project activity is of 25.5 MW capacity, the applicable output range for the identification of projects is 12.75 MW to 38.25 MW.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all} . Registered CDM project activities shall not be included in this step.

For this analysis the applicable geographical area is applied in accordance with the definitions given in the Additionality Tool Version 06.0.0. As per the tool, “the applicable geographical area” covers the host country by default; however project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions. Further, “different technologies” are defined as technologies that deliver the same output but differ by any of various factors including investment climate, energy source / fuel, feed stock, size of installation, etc. In India the regulatory regime and tariff structure is unique for each state¹², and therefore the investment climate varies considerably from state to state. Therefore, the applicable geographical area for the analysis is considered as the state of Maharashtra.

Further, all types of power plants have been considered for the common practice analysis. Similar project activity is being considered as any wind project with an installed capacity between 12.75 MW to 38.25 MW and set up by a single private investor within a particular time frame in the state of Maharashtra for the sale of power to the grid. Projects commissioned before the start date of the project activity have been considered in the analysis.

The Following is the result of this analysis¹³:

Technology Area	Projects in applicable capacity range	Projects excluding CDM projects in applicable capacity range, N(all)	N(diff)
Thermal	3	3	3
Hydro	17	17	17
Wind	22	4	4
Nuclear	0	0	0
Solar	0	0	0

¹² Reference: <http://www.cercind.gov.in/08022007/Act-with-amendment.pdf>

¹³ Detailed spreadsheet with data collated for common practice analysis has been provided to DOE for validation.

**CDM – Executive Board**

Biomass	25	13	13
Tidal-Mechanical & Thermal	0	0	0
Geothermal	0	0	0
Total	67	37	37

The list of wind power projects in the applicable capacity range in the geographical boundary is tabulated below:

Name of owner	Location (District)	Capacity (MW)	Reasons for exclusion
Aryan Coal beneficiation Private limited	Sangli	15	CDM project under validation ¹⁴
Bharat Forge Limited	Satara	15.93	Bharat forge has commissioned 4 projects in Satara district. All the projects were commissioned prior to Electricity Act. Commissioning dates: 2.07: September 1998 6.9: March 2000 4.2: March 2002 2.76: March 2001
Bharati Shipyard Limited	Dhule	15	CDM project under validation ¹⁵
DJ Malpani	Dhule and	15	CDM registered project ¹⁶

¹⁴ <http://cdm.unfccc.int/Projects/Validation/DB/SB3OIAHMLZK0Z0KZ1J4ZLHHC8O8541/view.html>

¹⁵ <http://cdm.unfccc.int/Projects/Validation/DB/KPIKXNELV2Y0NE3YMAD0P58HPDVF43/view.html>

**CDM – Executive Board**

	Nandurbar		
Ellora Times Limited	Satara	21.65	CDM registered project ¹⁷
Enercon wind farms sai limited	Ahemadnagar	20	CDM registered project ¹⁸
Gangadhar Narsingdas Agrawal	Dhule, Satara and Beed	16.5	CDM registered project ¹⁹
GI windfarms Limited	Satara	21	Project consists of two projects with a combined capacity of 21 MW. Both the projects were commissioned in March 2002, prior to introduction of the Electricity Act
Gujarat Fluorochemical limited	Sangli	23.1	CDM registered project ²⁰
Jindal steel and power limited	Satara	18	CDM project under validation ²¹
MSPL Limited	Satara and Dhule	21	MSPL has commissioned two project of capacities of 1 and 20 MW respectively. 1 MW was commissioned in March 2002 prior to introduction of electricity act. 20 MW was submitted to UNFCCC as a CDM project. ²²
Nishkalp investment and trading	Satara, Ahemadnagar	20.95	Nishkalp has installed 4 projects with a combined capacity of 20.95 MW. All four projects were commissioned prior to 2003.

¹⁶ <http://cdm.unfccc.int/Projects/DB/BVQI1207584460.66/view>

¹⁷ <http://cdm.unfccc.int/Projects/DB/BVQI1159875467.29/view>

¹⁸ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1279516994.31/view>

¹⁹ <http://cdm.unfccc.int/Projects/DB/RWTUV1173341097.6/view>

²⁰ <http://cdm.unfccc.int/Projects/DB/RWTUV1202913883.06/view>

²¹ <http://cdm.unfccc.int/Projects/Validation/DB/IUYE8HZCM27FA0V3YWZTQCS97MBZNI/view.html>

²² <http://cdm.unfccc.int/Projects/DB/BVQI1204612226.17/view>

**CDM – Executive Board**

Patnaik minerals private limited	Dhule	15	CDM project under validation ²³																		
REI agro limited	Dhule	22.4	REI agro has commissioned 3 projects with a combined capacity of 22.4 MW. All three projects are developed as CDM projects. Two projects (12.5+3.3) ²⁴ are combined as a single CDM project and third project (6.6) ²⁵ is developed as a separate CDM project.																		
Roaring 40s wind farm private limited	Ahmadnagar	37.6	Roaring has commissioned three projects. All three projects are registered as CDM projects. 2 projects (1.6+8) ²⁶ were developed as a single CDM project and third project (28 MW) ²⁷ was developed separately.																		
Savita Chemicals limited	Ahmadnagar, Satara and Manehere	17.2	Savita Chemicals has commissioned the following WTGs ²⁸ : <table><tr><td>Project Number</td><td>Capacity</td><td>Commissioning Date</td></tr><tr><td>1</td><td>0.8</td><td>Sep-08</td></tr><tr><td>2</td><td>1.6</td><td>Mar-08</td></tr><tr><td>3</td><td>1.05</td><td>Mar-09</td></tr><tr><td>4</td><td>2.25</td><td>Mar-00</td></tr><tr><td>5</td><td>0.75</td><td>Sep-01</td></tr></table>	Project Number	Capacity	Commissioning Date	1	0.8	Sep-08	2	1.6	Mar-08	3	1.05	Mar-09	4	2.25	Mar-00	5	0.75	Sep-01
Project Number	Capacity	Commissioning Date																			
1	0.8	Sep-08																			
2	1.6	Mar-08																			
3	1.05	Mar-09																			
4	2.25	Mar-00																			
5	0.75	Sep-01																			

²³ <http://cdm.unfccc.int/Projects/Validation/DB/6BLYO2WUMBJR43922LAW79OC5AWQUQ/view.html>

²⁴ <http://cdm.unfccc.int/Projects/Validation/DB/CF0MSEL2TA1QOO3X6D9691XW7UO3KX/view.html>

²⁵ <http://cdm.unfccc.int/Projects/Validation/DB/LFTIDSON660NHIT5389DOU44QT1ZI2/view.html>

²⁶ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1270220130.38/view>

²⁷ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1263981578.63/view>

²⁸ Indian Wind power directory

**CDM – Executive Board**

			6	2.5	Sep-05
			7	2.5	Sep-06
			8	3.3	Mar-07
			9	1.65	Sep-07
			10	0.8	Sep-09
			Project number 4 and 5 were commissioned prior to Electricity Act and hence are excluded from the analysis. Project number 6, 7, 8 and 9 are developed as a single CDM project and are under validation stage²⁹. Total combined capacity of remaining projects (1, 2, 3 and 10) is only 4.25 MW and hence is not of similar scale of project activity. Thus, they are excluded from the analysis.		
Shah promoters and Developers	Dhule, Sangli and Ahmadnagar	15.6	CDM registered project ³⁰		
Shraddha Construction and Power generation private limited	Dhule and Satara	24.4	CDM project under validation ³¹		
Shree Naman Developers Limited	Sangli, Nasik and Satara	29.25	CDM registered project ³²		
Suma Shilp Limited	Dhule	15	CDM project under validation ³³		

²⁹ <http://cdm.unfccc.int/Projects/Validation/DB/KPIKXNELV2Y0NE3YMAD0P58HPDVF43/view.html>

³⁰ <http://cdm.unfccc.int/Projects/DB/RWTUV1229007791.61/view>

³¹ <http://cdm.unfccc.int/Projects/DB/RWTUV1229007791.61/view>

³² <http://cdm.unfccc.int/Projects/DB/RWTUV1229007791.61/view>

**CDM – Executive Board**

Sun and sand Hotel private limited	Sangli, Ahmadnagar and Satara	17.6	CDM registered project ³⁴
Tata finance limited	Satara and Ahmadnagar	21.95	Tata finance have commissioned 5 projects in Maharashtra and all five were commissioned prior to 2002. ³⁵ Hence, the project was commissioned prior to the Electricity Act 2003 under a different investment climate.

$$\begin{aligned}
 \text{Therefore, } N_{all} &= \text{Thermal projects}^{36} + \text{Hydro Projects}^{37} + \text{Wind Projects}^{38} + \text{Biomass} \\
 &\quad \text{projects}^{39} + \text{Nuclear projects}^{40} + \text{Solar projects} + \text{Geothermal \& Tidal projects}^{41} \\
 &= 3 + 17 + 4 + 13 + 0 + 0 + 0 + 0 \\
 &= 37
 \end{aligned}$$

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff} .

From the projects identified above, those projects which employ “different technologies”, have been excluded and the number of such projects has been identified as N_{diff} .

³³ <http://cdm.unfccc.int/UserManagement/FileStorage/IUJ83S21V4W0GORLPHMFN95XT7ADQE>

³⁴ <http://cdm.unfccc.int/Projects/DB/RWTUV1200565962.09/view>

³⁵ Indian Windpower directory

³⁶ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

³⁷ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

³⁸ Source, Directory Indian Wind Power, dated August, 2010 & MEDA Website – Investor list for Wind Projects http://www.mahaurja.com/PG_WE_Overview.html

³⁹ <http://mnre.gov.in/schemes/grid-connected/biomass-powercogen/>

⁴⁰ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

⁴¹ <http://www.eai.in/ref/ae/oce/oce.html>

**CDM – Executive Board**

Thermal power projects, biomass projects, and hydropower projects are different from the project activity (a wind based project) as they use different *Energy source/fuel* (paragraph 9a of the Additionality Tool). Further, four wind power projects exist in the applicable capacity range which has not considered CDM Benefits. However, these projects are different from the project activity as they were commissioned prior to the Electricity Act, 2003 under a different investment climate. Accordingly, all four wind projects are considered as projects applying different technologies (in accordance with paragraph 9d of Additionality Tool) Therefore, all 37 projects identified in the determination of N_{all} , apply technologies different from the proposed project activity.

Therefore, $N_{diff} = 37$

Step 4: Calculate factor $F = 1 - N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity

$$F = 1 - 37/37 = 0$$

As per the Additionality Tool, the proposed project activity is a “common practice” within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all} - N_{diff}$ is greater than 3.

As the factor F has been calculated to be 0 (less than 0.2), and $N_{all} - N_{diff} = 0$, the proposed project activity is not in common practice.

B.6. Emission reductions:**B.6.1. Explanation of methodological choices:****Emission Reductions**

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (LE_y), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

**CDM – Executive Board**

where

- ER_y = Emission reductions in year y (t CO₂/y)
 BE_y = Baseline Emissions in year y (t CO₂/y)
 PE_y = Project emissions in year y (t CO₂/y)
 LE_y = Leakage emissions in year y (t CO₂/y)

Baseline Emissions:

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

Where:

- BE_y = Baseline Emissions in year y (tCO₂)
 $EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
 $EF_{CO_2,grid,y}$ = CO₂ Emission Factor in year y (tCO₂/MWh)

In accordance with the “Tool to calculate the emission factor for an electricity system” Version 02.2.1, combined margin CO₂ emission factor for grid connected power generation is calculated stepwise in section B.4.

The data used for the calculation of the baseline emission factor was obtained from the baseline calculations published by the CEA, *CO₂ Baseline Database for the Indian Power Sector – Version 7.0*⁴² which uses “Tool to calculate the emission factor for an electricity system”. The relevant parts of the calculations are referenced in the methodology outline below. A complete explanation of the assumptions employed by the CEA can be obtained from the *CO₂ Baseline Database for the Indian Power Sector - Version 7.0*.

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

Data / Parameter:	EF_{grid,OM,y}
Data unit:	tCO ₂ /MWh
Description:	Operating Margin emission factor for NEWNE grid
Source of data used:	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 7.0.
Value applied:	0.9842

⁴² <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

**CDM – Executive Board**

Justification of the choice of data or description of measurement methods and procedures actually applied :	The operating margin emission factor has been published by CEA in accordance with the ‘Tool to calculate the emission factor for an electricity system.’ The option of ex ante calculation based on Simple Operating Margin Method have been applied using a three year generation weighted average (2008-09, 2009-10 and 2010-11) and is calculated in section B.4
Any comment:	This value is determined ex-ante and will be fixed for the crediting period

Data / Parameter:	EF_{grid,BM,y}
Data unit:	tCO ₂ /MWh
Description:	Build Margin emission factor for NEWNE grid
Source of data used:	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 7.0.
Value applied:	0.8123
Justification of the choice of data or description of measurement methods and procedures actually applied :	The build margin emission factor has been published by CEA in accordance with the ‘Tool to calculate the emission factor for an electricity system.’ The build margin is calculated as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation. The build margin has been taken corresponding to the year 2009-10, the latest year for which data is available.
Any comment:	This value is determined ex-ante and will be fixed for the crediting period.

Data / Parameter:	EF_{grid,CM, y}
Data unit:	tCO ₂ /MWh
Description:	Combined Margin CO ₂ emission factor for NEWNE grid
Source of data used:	Calculated based on values given in the CO ₂ Baseline Database Version 7.0 for the Indian Power Sector prepared by Central Electricity Authority

**CDM – Executive Board**

Value applied:	0.9529								
Justification of the choice of data or description of measurement methods and procedures actually applied :	The combined margin emission factor has been determined based on data published by the CEA, applying a 75% weightage for $EF_{grid, OM, y}$ and 25% for $EF_{grid, BM, y}$ in accordance with the ‘Tool to calculate the emission factor for an electricity system.’ <table border="1"> <thead> <tr> <th colspan="2">Combined Margin Estimation for NEWNE Grid (tCO₂/MWh)</th></tr> </thead> <tbody> <tr> <td>Operating Margin ($EF_{grid, OM, y}$)</td><td>0.9842</td></tr> <tr> <td>Build Margin ($EF_{grid, BM, y}$)</td><td>0.8123</td></tr> <tr> <td>Combined Margin ($EF_{CO_2, grid, y}$)</td><td>0.9529</td></tr> </tbody> </table>	Combined Margin Estimation for NEWNE Grid (tCO ₂ /MWh)		Operating Margin ($EF_{grid, OM, y}$)	0.9842	Build Margin ($EF_{grid, BM, y}$)	0.8123	Combined Margin ($EF_{CO_2, grid, y}$)	0.9529
Combined Margin Estimation for NEWNE Grid (tCO ₂ /MWh)									
Operating Margin ($EF_{grid, OM, y}$)	0.9842								
Build Margin ($EF_{grid, BM, y}$)	0.8123								
Combined Margin ($EF_{CO_2, grid, y}$)	0.9529								
Any comment:	This value is determined ex-ante and will be fixed for the crediting period.								

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

The ex-ante estimation of emission reductions, based on baseline emission factor and expected electricity generation from the project activity, is tabulated below:

	Parameter	Value	Units	Source
A	Baseline Emission factor ($EF_{CO_2, grid, y}$)	0.9529	tCO ₂ /MWh	CEA Database Ver 7.0
B	Capacity per WTG	1.5	MW	Technical Specifications
C	PLF* ⁴³	20.16	%	Third Party PLF Study
D	Net Energy Generation	45,033	MWh	Calculated as: B x 13 x 24 x 365 x C%
E	Baseline Emissions ($BE_y = EF_{CO_2, grid, y} \times EG_{BL, y}$)	42,912	tCO ₂ /y	Calculated as: D x A

For a given year, the emission reductions contributed by the project activity (ER_y) is calculated as

⁴³ *The PLF chosen for emission reductions is taken from third party PLF study by “Power and Energy Consultants” in line with EB 48, Annex 11. This is conservative for emission reduction calculations as the PLF available in the offer letter (24.87%) at the time of investment decision was higher. PP has chosen this higher PLF of 24.67% for the IRR analysis and a lower PLF of 20.16% (from third party report) for emission reduction calculations to be conservative.

**CDM – Executive Board**

follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year y (tCO₂/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the version 02 of the “Tool to calculate the emission factor for an electricity system”

$$BE_y = 42,912 \text{ tCO}_2\text{e/annum}$$

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year y (t CO₂e/yr)

BE_y = Baseline emissions in year y (t CO₂e/yr)

PE_y = Project emissions in year y (t CO₂e/yr)

$$ER_y = 42,912 - 0 = 42,912 \text{ tCO}_2\text{e/annum}$$

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

Year	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)
2012*	0	42,912	0	42,912
2013	0	42,912	0	42,912
2014	0	42,912	0	42,912
2015	0	42,912	0	42,912
2016	0	42,912	0	42,912
2017	0	42,912	0	42,912
2018	0	42,912	0	42,912
Total (t CO ₂ e)	0	300,384	0	300,384

*1 December 2012 to 30 November 2013

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

**CDM – Executive Board****B.7.1 Data and parameters monitored:**

Data / Parameter:	EG_{facility, y}
Data unit:	MWh
Description:	Net electricity supplied to grid
Source of data to be used:	MSEDCL reports on energy delivered at MSEDCL grid (Credit Notes)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	45,033 MWh/year
Description of measurement methods and procedures to be applied:	The net electricity supplied to the grid is the basis for estimating emission reductions from the project activity. The power generated by each WEG is stepped up via a step-up transformer and fed into the 33 kV Feeder line. Power from WEGs of other project activities is also fed in the same 33 kV feeder line. This common feeder line culminates at the 33 kV/220 kV substation, where the joint-metering is done on monthly basis. A Main Meter and Check Meter of 0.2 accuracy class are connected to individual feeders at the sub-station where all the WEGs (including that of the project activity) are connected. Electricity exported and imported from each feeder (measured by main meter and check meter) is recorded on a monthly basis by MSEDCL officials and representatives of the project promoter (O&M contractors). Based on this monthly recording, MSEDCL carries out an apportioning to calculate the net electricity supplied by the project activity WEGs to the grid. The net electricity supplied to the grid is calculated as follows: $\text{Net Electricity supplied to the grid by Project Activity} = \text{Total electricity exported by project activity} - \text{Total electricity imported by project activity}$ The total electricity exported and imported by the project activity WEGs is determined based on the apportioning procedure described in section B.7.2 and in the measurement methods and procedures for the parameters $EG_{y, \text{Export}}$ and $EG_{y, \text{Import}}$.

**CDM – Executive Board**

	This parameter would be Monitored continuously, recorded monthly, summarized annually.
QA/QC procedures to be applied:	Calibration of the main and check meters will be carried out on an annual basis. Meters of accuracy class 0.2 would be used for main meters and check meters. Net electricity generation values recorded in reports issued by MSEDCL on energy delivered at MSEDCL grid (credit notes) will be cross-checked against payments received from MSEDCL against invoices raised by the project proponent for sale of electricity. Administrative charges would be deducted by MSEDCL from the payments against sale of electricity in accordance with the PPA.
Any comment:	Data will be kept for two years beyond each crediting period.

Data / Parameter:	EG _{y, Export}
Data unit:	MWh
Description:	Electricity exported to the grid by the project activity
Source of data to be used:	MSEDCL report on energy delivered at MSEDCL grid (Credit Notes)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	• There is a main meter and check meter for each feeder at the respective sub-station to which the project activity WTGs are connected. • The meters are electronic TOD meters with an accuracy class of 0.2. • The electricity export data will be monitored via monthly joint meter readings of the energy meters connected to feeders at sub-stations. • The joint meter readings would be carried out for Main & Check Energy meters of each feeder at the relevant substation by representatives of the project promoter (O&M contractors) and representatives of MSEDCL. • The O&M contractor would provide WTG controller generation data to

**CDM – Executive Board**

	MSEDCL for the respective month. • MSEDCL would carry out an apportioning based on the joint meter readings and the WTG controller data as follows: Total Electricity exported by Project activity = $(Y/X) * A =$ (Total electricity generated by the project proponent's WTGs(Y) / Total electricity generated by all WTGs connected to the same feeder(X)) * (Total electricity exported by the feeder at the sub-station(A)) • MSEDCL would generate a credit note reporting the apportioned electricity export and import for the project activity WEGs. The credit note will be forwarded to the project promoter . • This parameter would be measured continuously, Recorded Monthly and summarized annually.
QA/QC procedures to be applied:	Testing of energy meters will be carried out by MSEDCL officials on an annual basis. The primary monitoring is done through a main meter which is located at the sub-station. In the case the main meter malfunctions, the Check meter readings would be considered for billing purposes.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	EG _{y, Import}
Data unit:	MWh
Description:	Electricity imported from the grid by the project activity
Source of data to be used:	MSEDCL report on energy delivered at MSEDCL grid (Credit Notes)
Value of data applied for the purpose of calculating expected emission reductions in	-



CDM – Executive Board

section B.5	
Description of measurement methods and procedures to be applied:	• There is a main meter and check meter for each feeder at the respective sub-station to which the project activity WTGs are connected. • The meters are electronic TOD meters with an accuracy class of 0.2. • The electricity import data will be monitored via monthly joint meter readings of the energy meters connected to feeders at sub-stations. • The joint meter readings would be carried out for Main & Check Energy meters of each feeder at the relevant substation by representatives of O&M contractors and representatives of MSEDCL. • The O&M contractor would provide WTG controller generation data to MSEDCL for the respective month. • MSEDCL would generate the Credit Note based on the joint meter readings and the WTG controller data. The credit note would report the electricity imported by the project activity calculated as follows: $\text{Total Electricity imported by Project activity} = (Y/X) * B = (\text{Total electricity generated by the project proponent's WTGs}(Y) / \text{Total electricity generated by all WTGs connected to the same feeder}(X)) * (\text{Total electricity imported by the feeder at the sub-station}(B))$ • The credit note will be forwarded to the project promoter from MSEDCL. • This parameter would be measured continuously, Recorded Monthly and summarized annually
QA/QC procedures to be applied:	Testing of energy meters will be carried out by MSEDCL officials on an annual basis. The primary monitoring is done through a main meter which is located at the sub-station. In the case the main meter malfunctions, the Check meter readings would be considered for billing purposes.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.
Data / Parameter:	X

**CDM – Executive Board**

Data unit:	MWh/yr
Description:	Sum of Gross electricity generated by all WEGs connected to feeder
Source of data to be used:	Individual WEG Controller Readings
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined ex post (Value to be used while apportioning)
Description of measurement methods and procedures to be applied:	The WEG controllers measure the gross electricity generated by all the WEGs connected to the respective feeder. This parameter would be measured continuously, and recorded Monthly.
QA/QC procedures to be applied:	The WEG is programmed for automatic shut-down in case of any malfunctioning of the WEG controller. Therefore, the probability of error in the WEG controller generation data is negligible. Emission reductions would not be claimed for the respective period during which any malfunctioning occurs.
Any comment:	-

Data / Parameter:	Y
Data unit:	MWh/yr
Description:	Sum of Gross electricity generated by all WEGs owned by PP in project activity
Source of data to be used:	Individual WEG Controller Readings
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined ex post (Value to be used while apportioning)

**CDM – Executive Board**

Description of measurement methods and procedures to be applied:	The WEG controllers measure the gross electricity generated by all the WEGs owned by PP connected to the respective feeder. This parameter would be measured continuously, and recorded Monthly.
QA/QC procedures to be applied:	The WEG is programmed for automatic shut-down in case of any malfunctioning of the WEG controller. Therefore, the probability of error in the WEG controller generation data is negligible. Emission reductions would not be claimed for the respective period during which any malfunctioning occurs.
Any comment:	

Data / Parameter:	A
Data unit:	MWh/yr
Description:	Total electricity exported to the grid measured at the feeder (JMR is formed based on feeder readings)
Source of data to be used:	Joint Meter Reading
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined ex post (Value to be used while apportioning)
Description of measurement methods and procedures to be applied:	Main meter installed at the feeder/substation measure the total electricity exported to the grid continuously. A monthly meter reading taken jointly by state electricity board and PP representative is recorded in the JMR. There is also a check meter installed at the substation to measure the total electricity exported to the grid continuously, in case of the failure of the main meter, the

**CDM – Executive Board**

	readings are monitored from the check meter in a similar way as that for the main meter. This parameter would be measured continuously, and recorded Monthly.
QA/QC procedures to be applied:	These meters (main meter and the check meter) are the property of respective state electricity boards and calibration of the meters would be carried out yearly. The accuracy class of the main meter and the check meter would be 0.2.
Any comment:	-

Data / Parameter:	B
Data unit:	MWh/yr
Description:	Total electricity imported from the grid measured at the feeder (JMR is formed based on feeder readings)
Source of data to be used:	Joint Meter Reading
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined ex post (Value to be used while apportioning)
Description of measurement methods and procedures to be applied:	Main meter installed at the feeder measure the total electricity imported from the grid continuously. A monthly meter reading taken jointly by state electricity board and PP representative is recorded in the JMR. There is also a check meter installed at the feeder to measure the total electricity imported from the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter.
QA/QC procedures to be applied:	These meters (main meter and the check meter) are the property of respective state electricity boards and calibration of the meters would be carried out once

**CDM – Executive Board**

	in a year. The accuracy class of the main meter and the check meter would be 0.2. This parameter would be measured continuously and recorded Monthly.
Any comment:	-

B.7.2. Description of the monitoring plan:

The purpose of the monitoring plan, is to define the organizational structure of the monitoring team, monitoring practices, QA and QC procedures and archiving procedures. The monitoring plan will ensure that the emission reductions from the project activity are reported accurately and transparently.

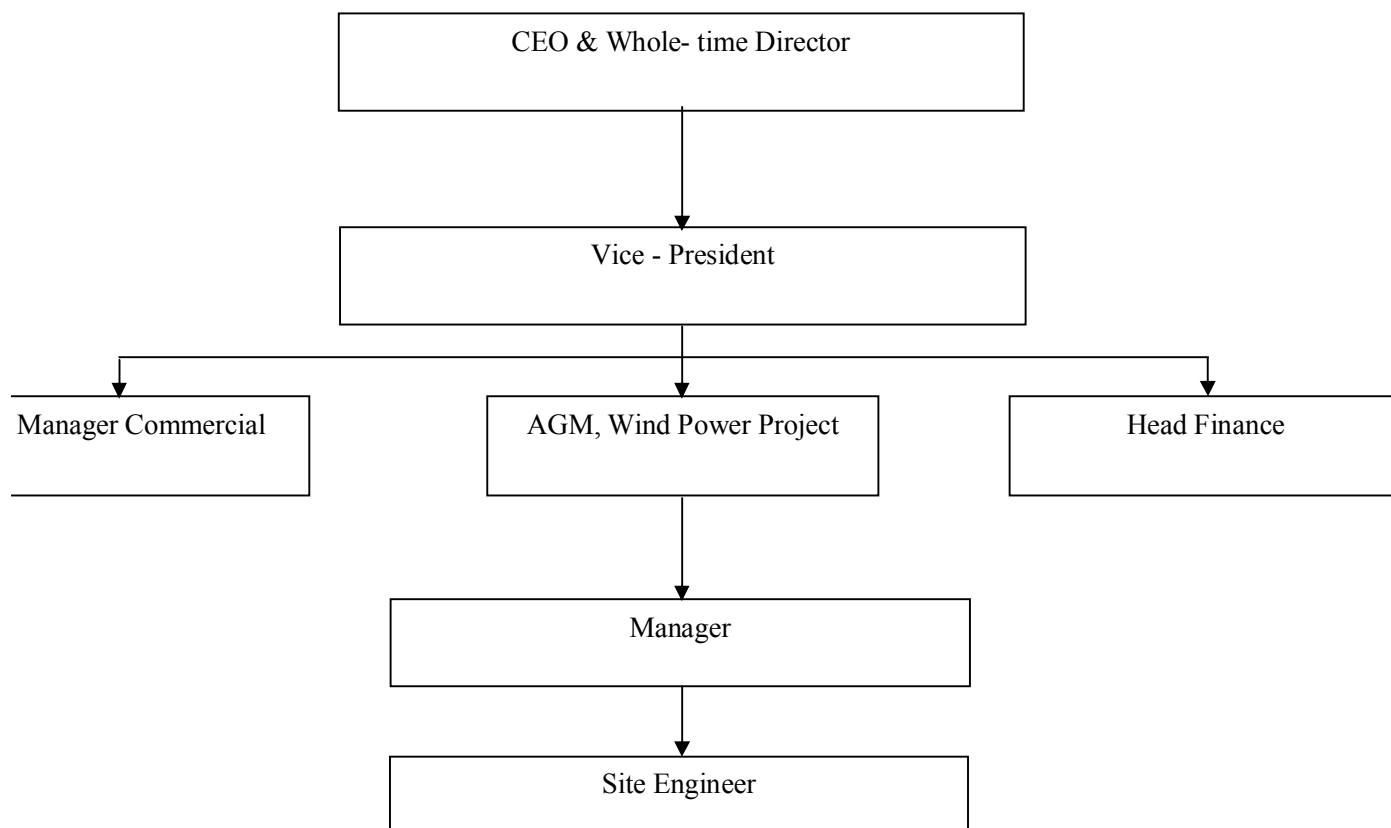
Roles and Responsibilities of the Monitoring Team

The responsibility of project management as well as monitoring, measurement and reporting lies with HZL. The project proponent has formulated a Monitoring Team to ensure proper and continuous monitoring of the emission reductions as well as performance of turbines and generation of power.

To ensure trouble free operation of all the wind turbines, HZL has entered into a comprehensive Operation and Maintenance agreement with the manufactures of the turbines. The contractor, Suzlon Infrastructure Limited, would be responsible for the operation and maintenance of the WTGs. The O&M personnel are qualified engineers and are trained at the WEG manufacturing facility of Suzlon Infrastructure Limited.

The monitoring will interact with the O&M contractors as well as the State Utility officials for executing the monitoring plan. The structure of the Monitoring Team is as follows:



CDM – Executive Board

The site engineer from HZL shall supervise the wind power plant operations under the guidance of the Manager. The Site Engineer of HZL will also interact with the O&M contractors and ensure that the WTG generation reports and JMR statements are forwarded to the Manager for review and electronic archiving. The O&M contractors would be responsible for forwarding monitoring data to Manager of HZL. The Manager would review the monitoring records and suggest corrective action as and when required. The Manager – Commercial will ensure that records of payments for sale of electricity to the state utility are maintained and archived electronically. HZL management will have a CDM review meeting on a bi-annual basis for review of the emission reductions and performance of the project activity.

Metering Arrangements and Procedures

The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication shall be as per the PPA (power purchase agreement). The electricity exported from the sub-station will be metered using electronic TOD meters. A main and check meter of 0.2 accuracy class would be installed for every feeder at the sub-station of the state electricity board. On a monthly basis, a joint meter reading will be carried out in the presence of the state electricity board officials and representatives of the project promoters.



CDM – Executive Board

The WTGs will be connected to different feeders, and each feeder will have a corresponding metering point at the sub-station. Each feeder would have several WTGs connected to it, some of which may not be part of the project activity. An apportioning procedure would be carried out to calculate electricity exported from the HZL project activity. This procedure is described below.

Apportioning Procedures for calculation of Net Electricity Exported from Project Activity

The net electricity exported to the grid by project activity is recorded in JMR statements. The main billing meter at substation records total export, and total import by all the connected WTGs to the particular feeder. Additionally, the O&M contractors maintain records of the electricity generation from individual WTGs which is monitored through the SCADA system. This data is used for the apportioning of electricity export and import to individual WTGs. The electricity export and import by the WTGs of HZL is calculated by using the following formulae.

- Total Electricity exported by Project activity = (Total electricity generated by the project proponent's WTGs (Y) / Total electricity generated by all WTGs connected to the same feeder (X))*(Total electricity exported from the feeder at the sub-station(A))
- Total Electricity imported by Project activity = (Total electricity generated by the project proponent's WTGs / Total electricity generated by all WTGs connected to the same feeder)*(Total electricity imported by the feeder at the sub-station(B))
- Net Electricity exported by Project Activity = Total electricity exported by project activity - Total electricity imported by project activity

Quality control and Quality Assurance procedures:**Calibration Procedures:**

Main meters and check meters are installed for monitoring the energy exported. The main and check meters shall be calibrated on an annual basis with reference to a portable standard meter. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2 accuracy class. The data registered by the main meter alone will be adopted for the purpose of calculation as long as the error in the main meter is within permissible limits. If during the annual accuracy tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the limits, the main meter reading shall be considered as usual. However, the check meter shall be calibrated immediately. If the main meter is found to be beyond the permissible limits of error, but corresponding check meter is within limits, then the check meter reading shall be adopted for that period. The main meter shall be calibrated immediately.

Apportioning Procedures in case the dates of monitoring period do not match with billing cycle dates

The monitoring period for the project activity may start from a date that does not coincide with the date of the initial reading of the respective JMR statement. For instance the monitoring period may start on the 20th of the month whereas the JMR Statement may report the net electricity generation data from the first of the month to the first of the next month. In such a scenario, the net electricity generation data from the start of the monitoring period to the first date of the next month (the apportioning period) would be determined as follows:

$$\text{Apportioned Net Electricity Generation} = \text{Apportioning Ratio} \times \text{Net Electricity Generation as per JMR Statement}$$



CDM – Executive Board

The apportioning ratio would be determined as the ratio of the electricity generation at the WTG for the apportioning period to the electricity generation at the WTG for the entire period covered under the JMR statement. This procedure would only have to be followed for the first and last month of the monitoring period if the start and end dates do not coincide with the date of the joint meter readings of the energy meters.

Data collection and archiving

The daily data on electricity generation from WTGs at the site is collected in electronic form. Monthly JMR statements are collected and maintained in hard copy, and archived electronically. The project proponent shall keep complete and accurate records of all the data as a part of monitoring for at least a period of 2 years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

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

Date of completion of base line: 27 September 2011

Name of person/entity determining the baseline: Hindustan Zinc Limited

The entity is also a project participant listed in Annex 1 of this document.



CDM – Executive Board**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:

28/03/2011

This date corresponds to the earliest date of placement of purchase orders for the project activity (purchase orders with Suzlon Infrastructure Services Ltd and Suzlon Energy Ltd.)

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

20 years, 0 months from the starting date of project activity.

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

The project activity shall use the renewable crediting period.

C.2.1. Renewable crediting period:**C.2.1.1. Starting date of the first crediting period:**

01/12/2012

The project proponent confirms that the crediting period will not commence prior to the date of registration.

C.2.1.2. Length of the first crediting period:

7 years, 0 months

C.2.2. Fixed crediting period:**C.2.2.0. Starting date:**

Not applicable

C.2.2.2. Length:

Not applicable



CDM – Executive Board**SECTION D. Environmental impacts****D.1. Documentation on the analysis of the environmental impacts, including Trans-boundary impacts:**

As per the Ministry of Environment and Forests (MoEF), Government of India notification S.O. 1533⁴⁴ dated September 14, 2006 regarding Environment Impact Assessment studies as per the Environment Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) Ministry of Environment and Forests), the project activity is not required to conduct an Environment Impact Assessment. The required clearance was obtained from the authorities as recommended by the procedures followed by the host government. The site does not involve any sensitive archaeological monuments as per the Archaeological Survey of India. No Historical and Cultural Monuments have been affected due to project location.

There are no negative environmental impacts that are envisaged due to the project activity. The following are the positive impacts due to the project activity.

- *Impact on air and water:* Wind energy is a form of renewable electricity generation; hence there would be no release of GHG into the atmosphere. Also as there is no fuel used for electricity generation no effluents or solid waste (such as ash) are generated.
- *Socio economic impact:* The project activity helps create demand for skilled and unskilled manpower in the region. The project will be providing employment opportunity to not only during the construction phase, but also during its operational life time. The project activity improves employment rate and livelihood of local populace in the vicinity of the project.

Moreover, the project generates eco-friendly, GHG free power, which contributes to sustainable development of the region

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

The project activity i.e. electricity generation from wind, clean and green source of power will result in no negative impact on environment. Further as per the applicable regulation, the implementation of the wind park does not require an environmental impact assessment. The Ministry of Environment and Forests (MoEF), Government of India notification dated 1 December 2009 regarding the requirement of Environment Impact Assessment (EIA) studies⁴⁵ states that any project developer in India needs to file an

⁴⁴ Reference : <http://envfor.nic.in/legis/eia/so1533.pdf>

⁴⁵ As per the Environment Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) MINISTRY OF ENVIRONMENT AND FORESTS)
<http://envfor.nic.in/legis/eia/so1533.pdf>

**CDM – Executive Board**

application to the Ministry of Environment and Forests (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Wind parks are not included in this list and thus an EIA is not necessary.

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

The project activity being undertaken envisages the installation of a wind farm for supply to grid. The stakeholders for a project activity are defined as the public, including individuals, groups or communities, affected, or likely to be affected, by the proposed CDM project activity.

A meeting was organized by Suzlon Infrastructure Services Ltd. on 20/10/2011 at Shanimandal village, Nandurbar district, Maharashtra to inform the local stakeholders about the project activity and discuss their concerns, if any, regarding the project activity. Local stakeholders including Sarpanchs and residents of the neighbouring villages were invited to the meeting through a public notice and personal invitations.

The agenda of the meeting was as follows:

- Welcome Speech
- Introduction to Climate Change and Clean Development Mechanism
- Views expressed by the villagers
- Interactive session with the stakeholders
- Vote of Thanks

The representatives of Suzlon Infrastructure Services Ltd. and the project proponent presented the salient features of the project activity to the stakeholders. The opinions expressed by the local stakeholders and the respective responses were recorded.

E.2. Summary of the comments received:

A summary of the comments and queries from the stakeholders are presented below along with the responses from the representatives of the project participants:

Comment / Query from Stakeholder	Response from Representative of the Project Participant
We feel that more projects can be brought here. Can the number of projects be increased? (By Jitender Panwar)	With support given by villagers, state electricity board, and government officials, the number of wind turbines in the region can be increased.
Can electricity be supplied to the villagers and neighbourhood areas? (By Subhash Sawant)	The power generated will be transmitted to the state electricity grid. The state electricity board distributes the power to according to the amount of power at its disposal and the power demand.



CDM – Executive Board

The stakeholders also acknowledged the socio-economic benefits of the project activity including improved infrastructure in the region, and employment opportunities for local residents.

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

There were no concerns raised by the local stakeholders. The potential benefits of the project activity for the local stakeholders were acknowledged.



CDM – Executive BoardAnnex 1CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Hindustan Zinc Limited
Street/P.O.Box:	CPP-CLZS,
Building:	Chanderiya lead zinc smelter,Putholi
City:	Chittorgarh-312021
State/Region:	Rajasthan
Postfix/ZIP:	312021
Country:	India
Telephone:	91-9928140302, +91-1472-2564801
FAX:	+91-1472-256593
E-Mail:	-
URL:	http://www.hzlindia.com/
Represented by:	-
Title:	-
Salutation:	Mr.
Last Name:	Jayaraman
Middle Name:	-
First Name:	V.
Department:	-
Mobile:	91-9928140302



PROJECT DESIGN DOCUMENT FORM (CDM PDD) - Version 03



CDM – Executive Board

Direct FAX:	-
Direct tel:	-
Personal E-Mail:	V.Jayaraman@vedanta.co.in



CDM – Executive Board

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from parties included in annex I in the said project activity.



CDM – Executive Board

Annex 3**BASELINE INFORMATION**

The calculation of the combined margin emission factor is tabulated below:

Calculation based on Combined margin emission factor for NEWNE CEA Version 7			
Parameter	Unit	Value	Reference
2009-09 : Net Electricity Generated	GWh	421802.63	CEA CO2 Baseline database Version 07 dtd Jan 2012
2009-10 : Net Electricity Generated	GWh	458043.08	CEA CO2 Baseline database Version 07 dtd Jan 2012
2010-11 : Net Electricity Generated	GWh	476986.72	CEA CO2 Baseline database Version 07 dtd Jan 2012
2008-09: Simple Operating Margin including imports	tCO ₂ /MWh	1.0066	CEA CO2 Baseline database Version 07 dtd Jan 2012
2009-10: Simple Operating Margin including imports	tCO ₂ /MWh	0.9777	CEA CO2 Baseline database Version 07 dtd Jan 2012
2010-11: Simple Operating Margin including imports	tCO ₂ /MWh	0.9707	CEA CO2 Baseline database Version 07 dtd Jan 2012
Operating Margin (OM) - 3 Year generation weighted average	tCO ₂ /MWh	0.9842	Computed Value $((421802.63 * 1.0066) + (458043.08 * 0.9777) + (476986.72 * 0.9707)) / (421802.63 + 458043.08 + 476986.72)$
Build Margin (BM)	tCO ₂ /MWh	0.8588	CEA CO2 Baseline database Version 07 dtd Jan 2012
Weight of OM (w _{OM})	-	0.75	Tool to calculate the emission factor for an electricity system version 01.1
Weight of BM (w _{BM})	-	0.25	Tool to calculate the emission factor



PROJECT DESIGN DOCUMENT FORM (CDM PDD) - Version 03



CDM – Executive Board

			for an electricity system version 01.1
Combined Margin (BEF)	tCO ₂ /MWh	0.9529	Computed Value (0.9842* 0.75 + 0.8588 * 0.25)



Annex 4

MONITORING INFORMATION

The monitoring plan has been already explained in section B.7.2.



CDM – Executive BoardAppendix-1**WTG Locations**

Sr. No.	WTG. No.	Latitude	Longitude
1	C-02	21°18'10"N	74°18'32"E
2	C-03	21°17'55"N	74°18'28"E
3	C-04	21°17'17"N	74°18'16"E
4	C-05	21°17'30"N	74°18'32"E
5	C-06	21°17'47"N	74°18'09"E
6	C-07	21°17'59"N	74°18'05"E
7	C-18	21°17'14"N	74°17'51"E
8	C-19	21°17'29"N	74°17'51"E
9	C-20	21°17'43"N	74°17'49"E
10	C-26	21°18'47"N	74°17'09"E
11	C-27	21°18'54"N	74°16'51"E
12	C-28	21°17'31"N	74°17'05"E
13	C-29	21°17'38"N	74°16'56"E
14	C-30	21°17'25"N	74°16'42"E
15	C-32	21°17'17"N	74°16'10"E
16	C-37	21°15'45"N	74°19'33"E
17	C-67	21°15'06"N	74°16'20"E



CDM – Executive Board

Appendix 2**Implementation Plan for Sustainable Development Initiatives**

HZL is committed to contribute a minimum of 2% of the CER revenue accrued every year for sustainable development activities. The table below provides an estimation of the revenue that would be committed every year for sustainable development activities.

Years	Estimation of annual emission reductions (tonnes of CO₂e)	Estimated CER price* (Euro)	Exchange rate * (Euro to INR)	Estimation of CER Revenue generated by the project (INR million)	Estimation of minimum revenue for sustainable development ** (INR million)
2012*	42,912	11	60	28.32	0.57
2013	42,912	11	60	28.32	0.57
2014	42,912	11	60	28.32	0.57
2015	42,912	11	60	28.32	0.57
2016	42,912	11	60	28.32	0.57
2017	42,912	11	60	28.32	0.57
2018	42,912	11	60	28.32	0.57
Total	300,384	-	-	198.24	3.99
Total number of crediting years	7				

* Actual CER revenues may vary depending on CER price and exchange rate at the time of revenue realization.

** The revenue committed will vary every year as per the actual CERs generated, and actual CER price at the time of transaction



CDM – Executive Board

*** 1 December 2012 to 30 November 2013

HZL would allocate revenues from sale of CERs for the environmental and socio-economic development of the region. The following is the indicative implementation plan for the sustainable development activities, funded by CER revenues:

Sustainable Development Initiative	Estimated Annual Budget (INR million)
Tree plantation programmes	0.2
Promotion of education by providing supplies such as uniforms, shoes, school bags, books for school children	0.2
Promoting vocational training and skill development	0.1
Promoting health initiatives such as free medical camps, awareness-building programmes, etc.	0.066

HZL will undertake discussions with the local stakeholders on development activities in areas that are of most concern to the local population. A CSR team will be appointed to oversee the activities towards sustainable development and also to ensure that activities are undertaken and concluded in a timely manner each year. HZL will undertake an annual review of the actual CERs accrued and the price transacted. On the basis of the actual price and exchange rate, HZL will contribute 2% of the revenue for sustainable development activities in the local areas. Finally, HZL would carry out an annual internal audit the actual activities carried out, and actual expenses incurred towards sustainable development activities each year, as against the CER revenues accrued.
