

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

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Revision history of this document

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

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SECTION A. General description of small-scale project activity**A.1 Title of the small-scale project activity:***Title:* 15 MW Wind energy farm at Gopalpura, Karnataka by HZL*Version:* Version 2.2*Date:* 22 August 2012**A.2. Description of the small-scale 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. The project activity envisages implementation of a 15 MW wind power project in Karnataka, India, consisting of 10 WTGs of individual capacity 1.5 MW, sourced from Suzlon Energy Limited. The project activity is in line with the sustainable development priority of the country. The electricity generated from the project will be exported to the regional electricity grid and sold to the state electricity utility.

Purpose of the Project Activity

The project activity aims to mitigate Green House Gas (GHG) emissions through generation of renewable power, and export of power to the regional grid. The electricity generated from the project site will displace the electricity generated from thermal power stations feeding into regional grid. Since wind power is GHG emissions free, the power generated will displace the anthropogenic GHG emissions generated by the fossil fuel based thermal power stations.

Contribution of the project activity to sustainable development:

The Ministry of Environment and Forests, Govt. of India has stipulated the following 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 upliftment of society by 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.

¹ http://cdmindia.nic.in/host_approval_criteria.htm

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- 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, power infrastructure, transmission lines, etc.

- **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 is an environmentally safe renewable energy technology.

A.3. Project participants:

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

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

India

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

Karnataka

A.4.1.3. City/Town/Community etc:

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District: Hassan

Village: Chudanahalli, Tekanhalli, Mallappanabetta, Bittagaudanahalli

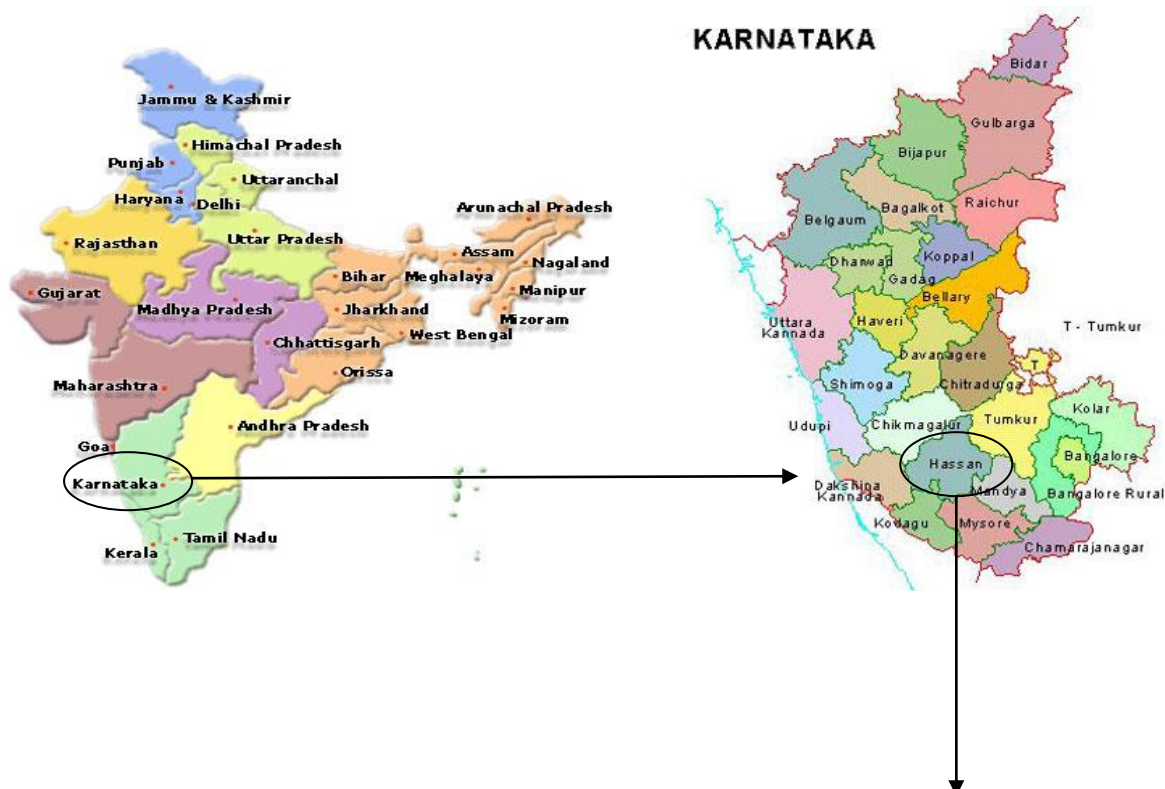
A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project activity consists of ten 1.5 MW wind turbine in the district of Hassan in the state of Karnataka, India.

The specific geographical coordinates of the individual WTGs are as follows:

Sr. No.	WTG. No.	Latitude	Longitude
1	G-02	N12° 57' 25.1"	E76° 17' 29.0"
2	G-03	N12° 57' 10.2"	E76° 17' 28.5"
3	G-04	N12° 57' 02.4"	E76° 17' 26.4"
4	G-17	N12° 55' 11.6"	E76° 17' 13.6"
5	G-23	N12° 54' 15.6"	E76° 16' 49.0"
6	G-24	N12° 54' 07.5"	E76° 16' 48.7"
7	G-28	N12° 53' 35.1"	E76° 16' 47.0"
8	G-29	N12° 53' 27.1"	E76° 16' 47.0"
9	G-30	N12° 53' 19.2"	E76° 16' 46.4"
10	G-31	N12° 53' 11.1"	E76° 16' 46.0"

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

Since the capacity of the wind farm project is 15 MW, which is equal to the maximum qualifying capacity of 15 MW, the project falls under the UNFCCC small-scale CDM project activity categories under Type-I with project activity being renewable electricity generation for a grid.

Sectoral Scope: 1 – Energy Industries (renewable-/non-renewable sources)

Type: I -Renewable Energy Projects

Category: I.D “Grid connected renewable electricity generation”

As per paragraph 1 under Category I.D of Appendix B of the UNFCCC-defined **simplified modalities and procedures (M&P) for small-scale CDM project activities** (Version 10: 23rd December 2006) Type I.D “comprises renewables, such as photovoltaics, hydro, tidal/wave, wind, geothermal, and biomass, that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit”. The project is a grid-connected wind based power plant and qualifies as a Category I. D project activity.

The technology consists of conversion of the energy available in the wind flow to mechanical energy using a wind turbine. By connecting the turbine to a generator, the mechanical energy is converted into electricity energy. Therefore, in this process, there are no greenhouse gas emissions or burning of any fossil fuels. Thus electricity is generated through sustainable means without causing any negative effect on the environment and hence the technology is environmentally safe and sound.

The project employs the use of wind energy for the purpose of electricity generation. Since, the technology employed by the project proponent does not result in GHG emissions; the project does not cause any negative effects on the environment. Hence, the technology used for the project activities do not pose any threat to the environment when compared to the fossil fuel-fired power plants.

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.

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

Technology Transfer

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 an independent third party assessment by Power & Energy Consultants is **19.91%**. However, a PLF of **26.5%** as per KERC tariff order dated 11th December 2009 has been considered (in accordance with “Guidelines on the assessment of investment analysis” EB 62 Annex 5.

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

Years	Estimation of annual emission reductions (tonnes of CO ₂ e)
2012-13*	31,875
2013-14	31,875
2014-15	31,875
2015-16	31,875
2016-17	31,875
2017-18	31,875
2018-19	31,875
Total estimated reductions (tonnes of CO₂e)	223,125
Total number of crediting years	7
Annual average of the estimated reductions over the crediting period (tCO₂e)	31,875

*1 December 2012 to 30 November 2013

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

There is no public funding involved in the proposed project activity. The project proponent hereby confirms that there is no divergence of Official Development Assistance (ODA) to the proposed project activity. The required funds have been raised through various financial institutions and in-house funding.

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

According to Appendix C, paragraph 2 of Simplified Modalities & Procedures for small scale CDM project activities, a proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- By the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and

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- Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point.

There are two large scale CDM wind power projects by the project proponent registered with UNFCCC. Following are the details of the projects:

1. Wind power project by HZL in Gujarat. ²
2. Wind power project by HZL in Karnataka. ³

The first project is located in Gujarat. The second project is located in Karnataka in the district of Gadag (which is different from the district Hassan of the project activity). Hence, the closest point of the proposed small- scale activity does not lie within 1 km of the above mentioned projects.

With reference to the above mentioned small scale CDM projects, it can be seen that there is no registered CDM project activity or an application to register another CDM project activity by Hindustan Zinc Limited in same project category, technology /measure which is within 1 km of the project boundary of the proposed small scale activity at the closest point. The proposed project activity qualifies for the use of simplified modalities and procedures for small-scale CDM project activities as it is not a debundled component of a large scale project activity.

² <http://cdm.unfccc.int/Projects/DB/BVQI1211956663.14/view>

³ <http://cdm.unfccc.int/Projects/DB/BVQI1208874936.63/view>

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

As per the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, Type-I D-Version 17 has been used.

Title: “Grid connected renewable electricity generation”.

Reference: AMS I D, Version 17, EB 61

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

The approved methodology uses the “Tool to calculate the emission factor for an electricity system” Version 02.2.0 for determination of the baseline scenario and also draws upon Appendix B of the simplified modalities and procedures for small-scale CDM project activities “Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories”.

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

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

- *This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:*
 - a. *Supplying electricity to a national or a regional grid;*
 - b. *Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling..*
- ✓ The project activity involves the installation of a green-field wind project for renewable electricity generation. It would supply electricity to the regional grid that is primarily dominated with fossil fuel fired generating units hence it satisfies this applicability criteria.
- *Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A2) applies is included in Table 2.*

Table 2: Applicability of AMS-I.D, AMS-I.F and AMS-I.A based on project types

	Project type	AMS-I.A	AMS-I.D	AMS-I.F
1	<i>Project supplies electricity to a national/regional grid</i>		√	
2	<i>Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)</i>			√
3	<i>Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as</i>		√	

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	wheeling)			
4	Project supplies electricity to a mini grid ⁴ system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

- ✓ The project activity would supply electricity to the Southern regional grid, hence it satisfies this applicability criteria.
- *This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement³ of (an) existing plant(s).*
- ✓ The project activity involves installation of a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant). Hence, this applicability criterion is satisfied.
- *Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:*
 - *The project activity is implemented in an existing reservoir with no change in the volume of reservoir;*
 - *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m²;*
 - *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m².*
- ✓ The project activity is a wind power project. Hence this criteria is not applicable to the project activity.
- *If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.*
- ✓ The project has a total capacity of 15.0 MW. The unit has no non-renewable components or provision for future addition of a co-fired fossil fuel system. Thus, the project activity meets the applicability condition.
- *Combined heat and power (co-generation) systems are not eligible under this category.*
- ✓ The project activity does not involve cogeneration and hence it satisfies the applicability criteria.
- *In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.*

⁴ The sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW.

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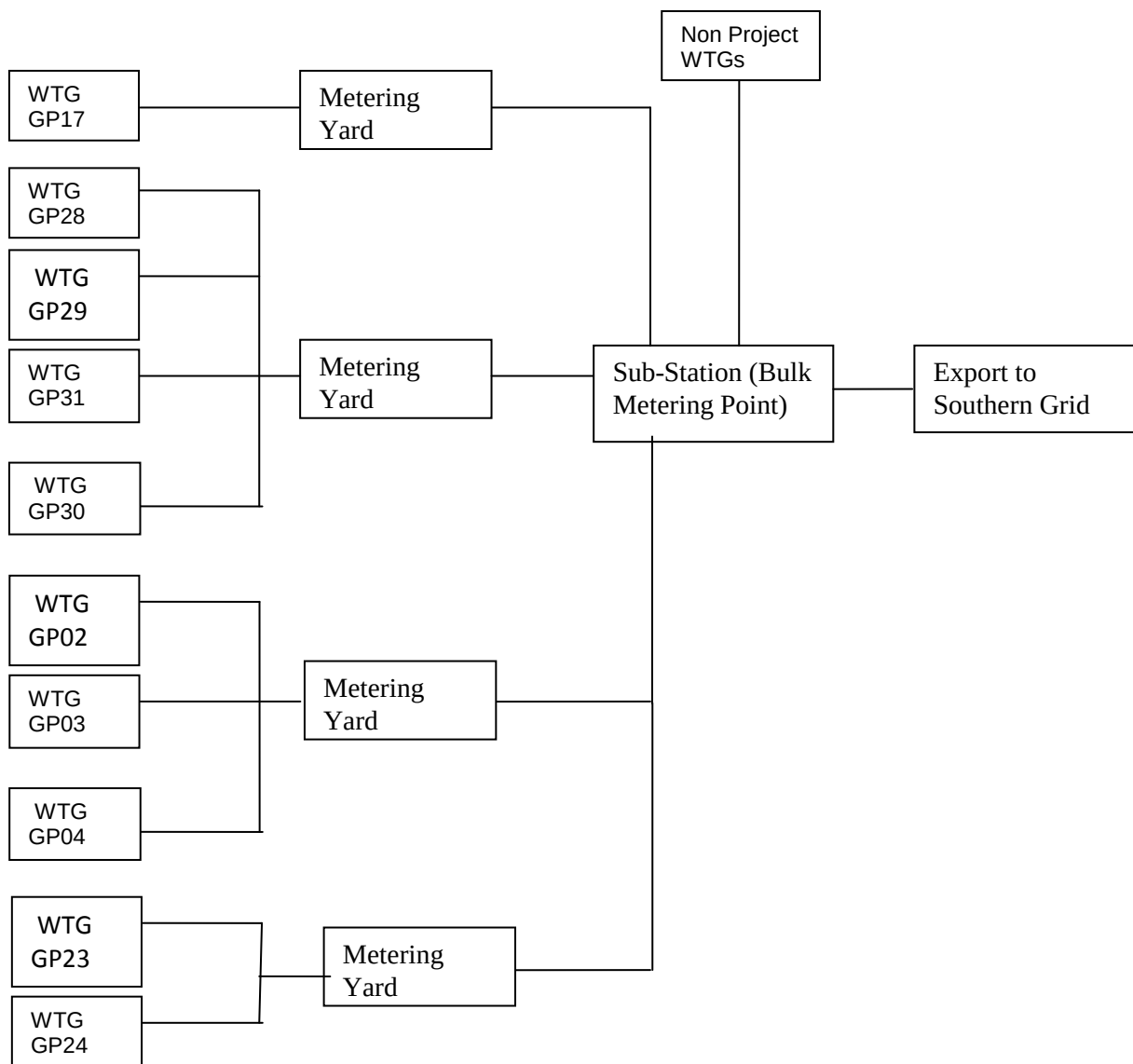
- ✓ This condition is not applicable to the proposed project activity as it is a greenfield project activity and does involve the addition of renewable energy generation units at an existing renewable power generation facility.
- *In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.*
- ✓ This condition is not applicable to the project activity as it is not a modification/ retrofit measure in an existing power plant.

B.3. Description of the project boundary:

As per the guidelines mentioned in paragraph 9 of AMS I.D, the spatial extent of the project boundary includes the project power plant and all power plant connected physically to the electricity system⁵ that the CDM project power plant is connected to. The project boundary is illustrated below.

⁵ Refer to the latest approved version of the .Tool to calculate the emission factor for an electricity system. for definition of an electricity system.

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B.4. Description of baseline and its development:

According to the methodology available in paragraph 10 of Type I.D., the baseline scenario is that the 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 into the grid.

As per paragraph 11, the baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

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

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)

As per paragraph 12, the Emission Factor can be calculated in a transparent and conservative manner as follows:

- a) A combined margin (CM), consisting of the combination of Operating Margin (OM) and Build Margin (BM) according to the procedures prescribed in the ‘Tool to calculate the emission factor for an electricity system’.

OR

- b) The weighted average emissions (in tCO₂/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.”

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 6.0) 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 02.2.0)’, the combined margin emission factor for the Southern Grid has been calculated.

Step 1: Identify the relevant electricity systems

For determining electricity emission factors, a **project electricity system** is defined by the spatial extent of power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

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.

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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	
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 & Nagar Haveli	-	Pondicherry, Lakshadweep

The Southern grid constitutes several states and union territories including Karnataka⁶. 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 determining the emission reductions achieved by the Project the "Tool to calculate the emission factor for an electricity systems" (Version 02.2.0, EB 61) states that the "*project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints*". On this basis the Central Electricity Authority, *CO₂ Baseline Database for the Indian Power Sector - Version 6.0*⁷ 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 Karnataka and is therefore as per the CEA's grid definitions it is within the Southern regional grid. Also, it is preferable to take the regional grid as project boundary than the state boundary as it minimizes effect of inter state power transactions, which are dynamic and vary widely. Considering free flow of electricity among member states and the union territory the entire Southern 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)

⁶ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf

⁷ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

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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:

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

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	2005-06	2006-07	2007-08	2008-09	2009-10
NEWNE	18.0%	18.5%	19.0%	17.4%	15.9%
South	27.0%	28.3%	27.1%	22.8%	20.6%
India	20.1%	20.9%	21.0%	18.7%	17.1%

Ref: CO₂ Baseline Database for the Indian Power Sector – CEA, Version 04, 05 and 06.

Percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) = 25.20 %

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*

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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.

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 CO ₂ emission factor of in year y (tCO ₂ /MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	= CO ₂ emission factor of power unit m in year y (tCO ₂ /MWh)
m	= All power units serving the grid in year y except low-cost / must-run power units
y	= 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:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{EG_{m,y}}$$

$EF_{EL,m,y}$	= CO ₂ emission factor of power unit m in year y (tCO ₂ /MWh)
$FC_{i,m,y}$	= Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO_2,i,y}$	= CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)
$EG_{m,y}$	= 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

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- 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>.

Operating Margin Estimation for Southern Grid (tCO ₂ / MWh)	
OM, 2007-08	0.9909
OM, 2008-09	0.9704
OM, 2009-10	0.9411
Net Electricity Generated (GWh), 2007-08	114634
Net Electricity Generated (GWh), 2008-09	121471
Net Electricity Generated (GWh), 2009-10	134717
Average OM ($EF_{grid, OM,y}$)	0.9661

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

The sample group of power units m used to calculate the build margin consists of either:

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

Project proponents should use the set of power units that comprises the larger annual generation.

Since in India, the installed capacity and corresponding annual generation from power plants is quite high, the sample group containing set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently comprise the sample group with the larger annual generation. Thus the sample group m consisting of option (b) is used for the estimation of build margin.

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.

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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.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

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

Where:

- $EF_{grid, BM, y}$ = Build margin CO₂ emission factor 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 = 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 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.

Build Margin Estimation for Southern Grid (tCO ₂ / MWh)	
BM ($EF_{grid, BM, y}$), 2009-10	0.7634

Step 7: Calculate the combined margin emissions factor

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 (%)

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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 conservativeness⁸.

Combined Margin Estimation for Southern Grid (tCO ₂ / MWh)	
Average OM (EF _{grid, OM, y})	0.9661
Weight of OM (w_{OM})	0.75
BM, 2009-10 (EF _{grid, BM, y})	0.7634
Weight of BM (w_{BM})	0.25
Combined Margin (EF _{grid, CM, y})	0.9154

The Combined Margin has been calculated using the “Tool to calculate the emission factor for an electricity system” Version 02.2.0. The Operating Margin (OM) and Build Margin (BM) emission factors have been considered from the information (CO₂ Baseline Database for the Indian Power Sector -Version 6.0) published by the Central Electricity Authority (CEA), Ministry of Power, Govt. of India which has been computed according to the procedures prescribed in the ‘Tool to calculate the emission factor for an electricity system’, version 02.2.0. 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 02.2.0)’, the combined margin emission factor for the Southern Grid has been estimated at 0.9154 tCO₂e/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 small-scale CDM project activity:

As per the “Guidance on the demonstration and assessment of prior consideration of the CDM” Version 03, for project activities with start date 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. Such a notification is required to be made within six months of the project activity start date and must contain the precise geographical location and a brief description of the proposed project activity. In accordance with this guidance, Hindustan Zinc Limited had informed the host party DNA as well as the UNFCCC Secretariat on 07/03/2r of its intention to seek CDM status so as

⁸ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

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to make the project activity financially viable. This notification falls within six months of the project activity start date which is described in detail in section C.1.1.

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:

Date	Project Activity	CDM activity
10-Dec-10	Note for approval for the project activity	Note for approval for the project activity
20-Dec-10	Equipment Supply Agreement for Gopalpura project	
20-Dec-10	Erection, Installation and Commissioning Agreement Gopalpura project	
20-Dec-10	Agreement for Civil works and Site Development Gopalpura project	
20-Dec-10	Agreement for maintenance (with parts & consumables) for Gopalpura project	
20-Dec-10	Operation and Maintenance agreement for services for Gopalpura project	
29-Dec-10	Start of construction of project activity	
7-March-11		Submission of Prior CDM Consideration Form to UNFCCC and DNA
11-March-11		Notice to local stakeholders / invitation for the stakeholder meeting
25-Mar-11		Local stakeholder consultation meeting
31-March-11 & 21-May-11	Commissioning of the project activity	
26-Aug-11		Appointment of DOE
14-Oct-11 to 12-Nov-11		Global stakeholder consultation period

As demonstrated above there is less than 2 years of a gap between two consecutive real actions towards securing CDM status for the project activity, Hence, as per paragraph 8 of Annex 22 of EB 49 Guidance on the demonstration and assessment of CDM awareness, continuing and real actions were taken to secure CDM status for the project activity.

As per the UNFCCC specified simplified modalities to demonstrate additionality, ‘The project participants shall provide an explanation to show that the project activity would not have occurred due to at least one of the four listed barriers in Attachment A to Appendix B of the simplified modalities and

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procedures for small-scale CDM project activities (SSC-PDD)'. The project activity faces the following barrier:

Investment Barrier

The project proponent has opted to demonstrate the additionality of the project activity by performing an investment analysis. Benchmark analysis has been carried out using post tax equity IRR as the financial indicator.

The Guidelines on the Assessment of Investment Analysis' Version 5.0, 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.

The project proponents have identified post tax equity IRR (Internal Rate of Return) as the most appropriate financial indicator for the project. 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 for the carrying out the investment analysis are as below:

Assumption	Value	Unit	Reference
Capacity			
Project Size	15	MW	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
Total Project Cost	90.20	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%)	90.20	INR (x 10 Million)	Investment decision
Operating Parameters			
Average Plant Load Factor ⁹	26.5	%	KERC Tariff Order dated 11/12/2009
Life of the WTG assumed	20	Years	WTG technical specifications
Operation & Maintenance Cost			

⁹ As per the independent third party PLF Study by Power & Energy Consultants, a PLF of 19.91% is expected for the project activity. However, the PLF as per KERC Tariff Order has been applied as the third party PLF report was not available at the time of investment decision.

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O & M Cost Exemption	2.00	years	Offer letter from Suzlon Energy Limited dated 04/12/2010 to Hindustan Zinc Limited
O & M Cost	1.425	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
Insurance cost			
Insurance Cost	0.11	Million/WTG	Insurance costs incurred in previously commissioned wind power projects
Depreciation Rate			
Yearly book depreciation	5.28	%	As per Companies Act ¹⁰
Yearly tax depreciation	7.69	%	As per IT Act ¹¹
Tax			
Income Tax Rate	33.22%	%	As per IT Act ¹²
Minimum Alternate Tax	19.93%	%	As per IT Act
Tariff			
Tariff	3.70	Rs	KERC Tariff Order dated 11/12/2009 (Page 31)
GBI	0.5	INR / kWH	http://mnre.gov.in/file-manager/UserFiles/faq_wind.pdf

Using the assumptions in the table above, the post-tax project IRR for the project activity works out to be **9.77%**, calculated in accordance with the “Guidance on the Assessment of Investment Analysis” Version 05, which clearly depicts the fact that the project activity is not very attractive as an investment option since the returns are much below the selected benchmark of **15.29%**.

Benchmark Analysis

¹⁰ <http://asa-india.com/asa/Depreciation%20Rates%20Companies%20Act.pdf>

¹¹ 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

¹²

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

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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 of return for an investor, is well documented.

It may be noted that three 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:

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

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 understood as the rate of return on an asset that is theoretically free of any risks. Therefore the weighted average yield of Government of India Securities are considered as risk free rate determined at the time of project start. This data is published by Reserve Bank of India. The latest risk free rate available at the time of decision making was for the year 2009-10 (20 years maturity period has been taken to be conservative) published on 09th December 2010 by RBI (reference: http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/26CT_BCS0211.pdf)

The applicable risk free rate is 8.43%.

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

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economic liberalization of the Indian economy started in 1991.¹³ 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%

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 this analysis is based on the beta values of the listed power producing companies engaged in similar business as the project activity at the time of investment decision estimated by regressing monthly returns on stock against local index, using 5 years¹⁴ of data. The equity beta values have been taken from BSE. The beta value for PTC has not been considered in the analysis as it is a

¹³ Reference: http://www.indiainbusiness.nic.in/economy/economic_reforms.htm

¹⁴ 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',

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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. The beta values for the five years period prior to the time of investment decision (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	CAPM
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

. The benchmark is a post-tax required rate of return on equity.¹⁵ The selected benchmark is appropriate for comparison with the post tax equity IRR for the project activity in line with paragraph 5 of EB 62 Annex 5. The Post tax equity IRR calculated for the project activity without CDM revenue is **9.77%** which is well below the applied benchmark.

¹⁵ The computation of the benchmark considers tax rates of individual companies for determination of average beta.

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Sensitivity Analysis

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 does not surpass the benchmark. The results of sensitivity analysis for the project activity are as given below:

Parameter	IRR with -10% variation	Base IRR	IRR with + 10% variation
PLF	8.08%	9.77%	11.38%
Tariff rate	8.11%	9.77%	11.35%
Capital cost	11.62%	9.77%	8.23%
O&M cost	9.98%	9.77%	9.56%

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

Further the variation in critical parameters required for the equity IRR to exceed the benchmark is tabulated below.

S. No.	Parameters	Variation required for IRR to reach benchmark
1.	PLF	36%
2.	Tariff rate	37%
3.	Capital Cost	-26%
4.	O&M cost	-313%

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

- The actual average PLF for the project activity since the time of commissioning has remained below the PLF considered. Further, as per the third party PLF report by Power & Energy Consultants, a PLF of 19.91% is expected for the project activity. Therefore the PLF considered for the investment analysis (26.5%) based on KERC Order dated 11/12/2009 is already conservative. An increase of such a huge quantum is highly unlikely.

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- The project proponent has entered into a power purchase agreement valid for 20 years. The tariff would not be varying further as the PPA has been signed.
- The post tax equity IRR remains below the benchmark at no O&M costs (-100% of O&M costs considered) 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. Therefore any decrease in the investment cost is not possible.

The project activity was not financially viable and the investment decision for the project activity was approved after considering the CDM revenues, which would be accrued upon registration of the project activity with UNFCCC.

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:

$$ER_y = BE_y - PE_y - LE_y$$

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 02.2.0, combined margin CO₂ emission factor for grid connected power generation is calculated stepwise in section B.4.

Project emissions

As per paragraph 20 and 21 of AMS.I.D, since the project activity is neither a geothermal power plant nor does it have a water reservoir, there would be no emissions due to the implementation of the project. Thus, the project emissions (PE_y) are estimated to be zero.

Leakage

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As per paragraph 20 of AMS I.D, ‘if the energy generating equipment is transferred from another activity, leakage is to be considered’. In the project activity, there is no transfer of energy generating equipment and therefore the leakage from the project activity is considered as zero. Further, according to EB 44, paragraph 50, leakage from equipment transfer from within to outside the project boundary may be excluded from consideration in SSC methodologies.

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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 Southern grid
Source of data used:	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority Version 6.0.
Value applied:	0.9661 tCO ₂ /MWh
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 three years vintage data (2007-08, 2008-09 and 2009-10).
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 Southern grid
Source of data used:	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority Version 6.0.
Value applied:	0.7634 tCO ₂ /MWh
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:	$EF_{grid,CM,y}/EF_{CO_2,grid,y}$
Data unit:	tCO ₂ /MWh
Description:	Combined Margin CO ₂ emission factor for Southern grid
Source of data used:	Estimated figure based on 75% of OM and 25% of BM values
Value applied:	0.9154 tCO ₂ /MWh
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.’
Any comment:	This value is determined ex-ante and will be fixed for the crediting period.

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B.6.3 Ex-ante calculation of emission reductions:**Baseline emissions (BE_y)**

Parameter	Value	Units	Source
Baseline Emission factor ($EF_{CO_2,grid,y}$)	0.9154	tCO ₂ /MWh	CEA Database Ver 6.0
Capacity per WTG	1.5	MW	Technical Specifications
Number of WTGs	10	-	Purchase Order
PLF for the project activity	26.5	%	Third Party PLF Study
Net Energy Generation ($EG_{BL,y}$)	34,821	MWh	Calculated based on project capacity and PLF
Baseline Emissions (BE_y) = $EF_{CO_2,grid,y} \times EG_{BL,y}$	31,875	tCO ₂ /y	Calculated

Project activity emissions (PE_y)

As there would be no emissions due to the implementation of the project, the project emissions are estimated to be zero.

Leakage (LE_y)

As per AMS I.D, 'if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered', in the project activity, there is no transfer of energy generating equipment and therefore the leakage from the project activity is considered as zero.

Emission reductions (ER_y) are calculated as follows:

Baseline Emissions (BE_y)	31,875	tCO ₂ /y
Project Activity Emissions (PE_y)	0	tCO ₂ /y
Leakage (LE_y)	0	tCO ₂ /y
Emission Reductions (ER_y) = $BE_y - PE_y - LE_y$	31,875	tCO₂/y

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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)
2012-13*	0	31,875	0	31,875
2013-14	0	31,875	0	31,875
2014-15	0	31,875	0	31,875
2015-16	0	31,875	0	31,875
2016-17	0	31,875	0	31,875
2017-18	0	31,875	0	31,875
2018-19	0	31,875	0	31,875
Total (t CO ₂ e)	0	223,125	0	223,125

*1 December 2012 to 30 November 2013

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

Data / Parameter:	EG _{BL,y}		
Data unit:	MWh/annum		
Description:	Net Electricity supplied to the grid by the project activity in year y		
Source of data to be used:	Joint Meter Reading statements		
Value of data	34,821		
Description of measurement methods and procedures to be applied:	The net electricity supplied to the grid would be calculated as: EG _{PJ,y} = EG _{EXP,y} – (1+15%) EG _{IMP,y} – EG _{TL,y} For measurement of electricity exported and imported, electronic trivector energy meters of accuracy class 0.2s will be used. Details of meters installed are given below:		
	Sr.No	Metering Point	Connected WTGs
	1	GP04	GP02,GP03 & GP04
	2	GP17	GP17
	3	GP23	GP23 & GP24
	4	GP31	GP28,GP29,GP30 & GP31
	On a monthly basis, joint meter readings (JMRs) of the energy meters at metering points would be taken by representatives of the project promoters and the KPTCL. Transmission losses would be computed by KPTCL and reported in the JMR statements. WTG controller data may also be used for proportioning of electricity generation data if billing cycles do not match with the monitoring period as described in section B.7.2.Reporting Frequency: Monthly Calibration frequency: Yearly		
QA/QC procedures to	The values of electricity export, import, and transmission loss would be cross-		

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be applied:	verified from the Pro Forma Invoices (statements on payment towards power purchased). QA/QC procedures are described in detail under section B.7.2.
Any comment:	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data / Parameter:	$EG_{EXP,y}$
Data unit:	MWh
Description:	Electricity exported from the project activity in year y
Source of data to be used:	Joint Meter Reading statements and Bills/receipts (statements on payment towards power purchased)
Value of data	-
Description of measurement methods and procedures to be applied:	Electronic trivector energy meters of accuracy class 0.2s will be used for measurement of electricity exported from the project activity. On a monthly basis, joint meter readings (JMRs) of the energy meters at metering points would be taken by representatives of the project promoters and KPTCL. Measured Continuously Reporting Frequency: Monthly Calibration frequency: Yearly
QA/QC procedures to be applied:	The values of electricity exported would be cross-verified from the Pro Forma Invoices (statements on payment towards power purchased). QC procedures are described in detail under section B.7.2.
Any comment:	The data will be kept for two years after the crediting period or from last issuance.

Data / Parameter:	$EG_{IMP,y}$
Data unit:	MWh
Description:	Electricity imported by the project activity in year y
Source of data to be used:	Joint Meter Reading statements and Bills/receipts (statements on payment towards power purchased)
Value of data	-
Description of measurement methods and procedures to be applied:	Electronic trivector energy meters of accuracy class 0.2s will be used for measurement of electricity imported by the project activity. On a monthly basis, joint meter readings (JMRs) of the energy meters at metering points would be taken by representatives of the project promoters and the respective government authorities. Measured Continuously Reporting Frequency: Monthly Calibration frequency: Yearly
QA/QC procedures to be applied:	The values of electricity imported would be cross-verified from the Pro Forma Invoices (statements on payment towards power purchased). QA/QC procedures are described in detail under section B.7.2. The main and check meters shall be tested for accuracy every calendar year with reference to a portable standard meter.
Any comment:	The data will be kept for two years after the crediting period or from last issuance.

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Data / Parameter:	$EG_{TL,y}$
Data unit:	MWh
Description:	Transmission losses in year y
Source of data to be used:	Joint Meter Reading statements
Value of data	-
Description of measurement methods and procedures to be applied:	The value of transmission losses would be calculated by KPTCL/ESCOM officials as per the equations described in the PPA and official notifications. The value would be determined from the bulk meter readings at the substation (from where electricity is exported to grid) and from all metering points connected to the substation. The value would be reported in the JMR statements.
QA/QC procedures to be applied:	The values of transmission losses would be cross-verified from the Pro Forma Invoices (statements on payment towards power purchased). QA/QC procedures are described in detail under section B.7.2.
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 / QC procedures and archiving procedures. The monitoring plan aims to ensure that the emission reductions from the project activity are reported accurately and transparently.

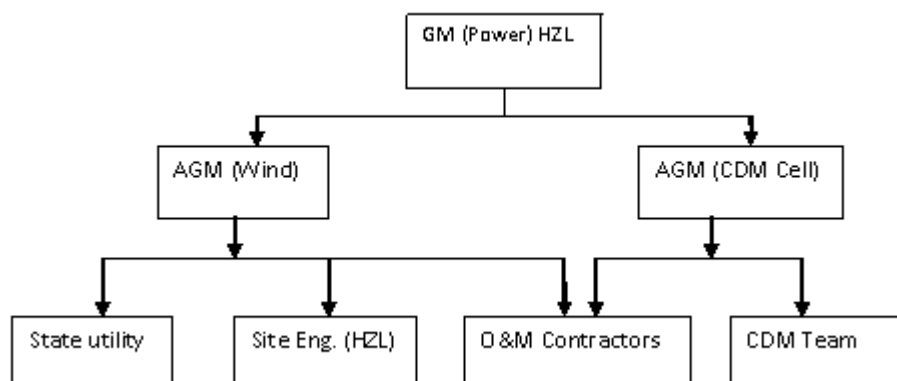
Roles and Responsibilities of the Monitoring Team

The authority and responsibility of project management as well as registration, 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 WTG manufacturing facility of Suzlon Infrastructure Limited.

The monitoring team 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:

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Monitoring Team	Roles & Responsibilities
General Manager (Power), HZL	- Communication with CDM EB - Communication with State utility
AGM (CDM Cell), HZL	- Overall coordination with monitoring team and DOE for verification activities - Maintaining data records, documentation and archiving
AGM (Wind) HZL	Coordinating with Site Engineer, O&M operators and State Utility.
Site Engineer, HZL	- Overseeing monitoring, operation and maintenance activities at site - Interacting with State Utility and O&M contractors for JMRs and calibration
O&M contractors	- Carrying out operation & maintenance of WTGs - Carrying out joint meter readings with state utility
State Utility	- Carrying out joint meter readings with representative of project proponent (O&M contractors) - Calibration of energy meters

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CDM Team	Assisting the AGM (CDM Cell) with coordination and maintaining data records, documentation, archiving, etc.
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Metering Arrangements and Procedures

The electricity exported from the sub-station will be metered using electronic trivector meters. A main and check meter is installed at every metering point for the project activity. There are four metering points for the project activity, the details of which as tabulated below¹⁶:

Sr.No	Metering Point	Connected WTGs	Total Capacity	Type of Meter	Accuracy Class
1	GP04	GP02,GP03 & GP04	3X1.5 = 4.5MW	ER300 P	0.2S
2	GP17	GP17	1X1.5 = 1.5MW	ER300 P	0.2S
3	GP23	GP23 & GP24	2X1.5 = 3MW	ER300 P	0.2S
4	GP31	GP28,GP29,GP30 & GP31	4X1.5 = 6MW	ER300 P	0.2S

On a monthly basis, a joint meter reading will be carried out in the presence of the KPTCL/ESCOM officials and representatives of the project promoters. Each of the metering points would be connected to the nearest KPTCL sub-station from where electricity will be exported to the grid. For the purpose of calculating transmission losses, KPTCL will monitor electricity export from the sub-station through the sub-station bulk meter, and also electricity export from all metering points connected to the sub-station. The transmission loss percentage is computed by KPTCL in accordance with equations specified in the PPAs and official KPTCL/ESCOM circulars as follows:

$$Z = \left\{ \frac{(X_1 + X_2 + X_3 + X_4 + \dots) - Y}{(X_1 + X_2 + X_3 + X_4 + \dots)} \right\} \times 100$$

Where

Z = percentage of transmission losses

(X₁+X₂+X₃+X₄+...) = sum of electricity export from energy meters connected to the receiving substation

Y = electricity export from bulk energy meter installed at the receiving substation

¹⁶ If any such changes occur in the metering arrangement (eg: connection of WTGs to metering points, etc.), the same would be transparently reported in the monitoring report for the respective monitoring period.

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For each metering point, transmission losses are computed each month as the product of the electricity export from the metering point (eg: X1) and the transmission loss percentage (Z).

Quality control and Quality Assurance procedures:

Calibration Procedures:

Main meters and check meters are installed for monitoring the energy exported and imported. The main and check meters shall be tested for accuracy every calendar year 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 0.2s 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:

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

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.

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

Date of completion of base line: 11 March 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.

SECTION C. Duration of the project activity / crediting period
C.1 Duration of the project activity:
C.1.1. Starting date of the project activity:

20/12/2010

This date corresponds to the date of placement of purchase orders for the project activity.

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

20 years

C.2 Choice of the crediting period and related information:
C.2.1. Renewable crediting period
C.2.1.1. Starting date of the first crediting period:

1/12/2012

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

C.2.1.2. Length of the first crediting period:

7 years, 0 months

C.2.2. Fixed crediting period:
C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

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

As per the Ministry of Environment and Forests (Government of India) notification the project activity does not fall under the purview of the Environmental impact Assessment thus the project activity is exempted from the environmental clearances. It should be noted here that though EIA is not a regulatory requirement in India for wind energy projects.

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 which 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) studies¹⁷ states that any project developer in India needs to file an 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.

¹⁷ 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>

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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 on 25/03/2011 at the Gopalpura sub-station office of M/s Suzlon Infrastructure Services Ltd. to inform the local people about the project activity and discuss their concerns, if any, regarding the project activity. An invitation for the meeting was sent out to the Sarpanchs and residents of the neighbouring villages.

The representatives of the project proponent presented the salient features of the project activity and requested for suggestions/comments. The opinions expressed by the stakeholders and the proceedings of the meeting were recorded.

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

E.2. Summary of the comments received:

A summary of comments and queries from the project participants and the stakeholders are presented below:

Comment / Query from Stakeholder	Response from Project Participant
Will the project help in improving the electricity supply to the villagers or neighbourhood areas?	The power generated will be transmitted to the state electricity grid. The state electricity board distributes the power according to the amount of power at its disposal and the power demand.
Does this project affect the ground water level?	No the wind power project does not affect either ground water level or drinking water quality in the area.
Does this project affect rainfall in the area?	No wind power projects do not have any impact on rainfall. The WTG height is approximately 80 meters and the clouds bearing rainfall are usually at a higher altitude.

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

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

There were no major comments or concerns raised during the consultation with stakeholders. All the minor comments were properly addressed to the satisfaction of stakeholders by the project proponent during the stakeholder meeting. The potential benefits and advantages of the project activity for the local stakeholders were well acknowledged.

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

Organization:	Hindustan Zinc Limited
Street/P.O.Box:	CPP-CLZS,
Building:	Chanderiya lead zinc smelter, Putholi
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State/Region:	Rajasthan
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Country:	India
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FAX:	+91-1472-256593
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	Mr.
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Middle Name:	
First Name:	V.
Department:	
Mobile:	91-9928140302
Direct FAX:	-
Direct tel:	
Personal E-Mail:	V.Jayaraman@vedanta.co.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Parties included in Annex I in the said project activity.

Annex 3

BASELINE INFORMATION

Information regarding baseline is discussed under section B.4.

Annex 4

MONITORING INFORMATION

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

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