



**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

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

>>

Wind power project by HZL in Karnataka.

Version 03
02/12/2008**A.2. Description of the project activity:**

>>

Description and purpose of the project

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 34.4 MW wind power project consisting of 43 WEGs of individual capacity 0.8 MW sourced from Enercon India Limited at Gadag in Karnataka, India. The project activity is in line with the sustainable development priority of the country. The electricity generated from the wind farm will be exported to the regional electricity grid and sold to the state electricity utility thereby marginally contributing to reducing the energy demand supply gap in the state of Karnataka, diversification of grid supply and reduce greenhouse gas emissions.

The wind power generated from the project site will be displacing the electricity generated from thermal power stations feeding into regional grid (during power surplus time) for meeting the power demand during shortage periods. Since wind power is Green House Gas (GHG) emissions free, the power generated will prevent the anthropogenic green house gas GHG emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to carbon dioxide (CO₂) only. Thus the proposed project activity leads to an emission reduction of 455,252 t CO₂e over the chosen crediting period of seven years.

View of the project participants on the contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects:

A > Social well being

- The proposed project activity leads to alleviation of poverty by establishing direct and indirect benefits through employment generation and improved economic activities by strengthening of local grid of the state electricity utility.
- The infrastructure in and around the project area has also improved due to project activity. This includes development of road network and improvement of electricity quality, frequency and availability as the electricity is fed into a deficit grid.

B>Economic well-being

- The project activity leads to an investment of about INR 167.7 Crores to a developing region which otherwise would not have happened in the absence of project activity.
- The generated electricity is fed into the Southern regional grid through local grid, thereby improving the grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants) which will provide new opportunities for industries and economic activities to be setup in the area thereby resulting in greater local employment, ultimately leading to overall development.
- The project activity also leads to diversification of the national energy supply, which is dominated by conventional fuel based generating units.

C > Environmental well being



CDM – Executive Board

page 3

- The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fossil fuel based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions.
- As wind power projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power.
- Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

D > Technological well being

- The project activity leads to the promotion of Wind Electric Generators (WEGs) into the region (demonstrating the success of wind based renewable energy generation), which is fed into the nearest sub-station (part of the Southern Regional Grid), thus increasing energy availability and improving quality of power under the service area of the substation. Hence the project leads to technological well being.

A.3. Project participants:

>>

Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly 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.:

>>

Karnataka

A.4.1.3. City/Town/Community etc:

>>

District - Gadag

Villages – Kurthkoti and Malasamudra

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

>>

The project activity is located at Gadag district in Karnataka. The site is composed of elevated plains with an elevation of 680-710 m.a.s.l. The nearest airport is Hubli Airport wherein daily flights from Bangalore and Mumbai are operated. The WEG wise details of geographical coordinates are as follows:

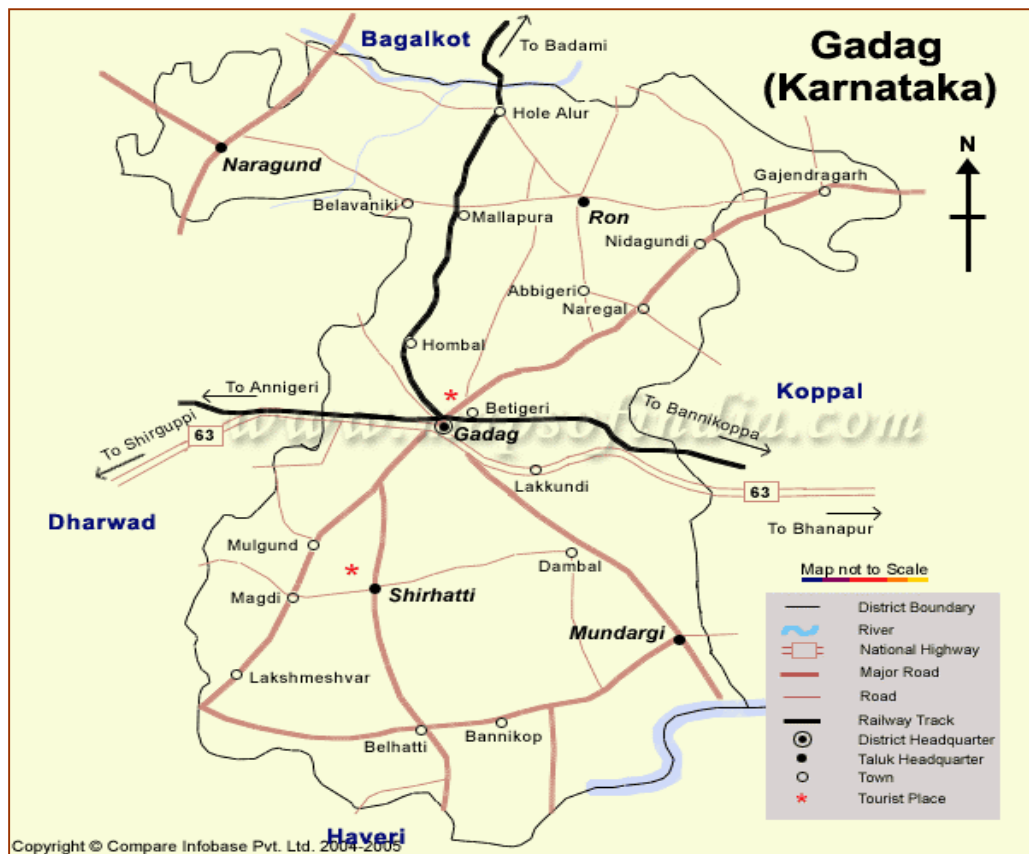
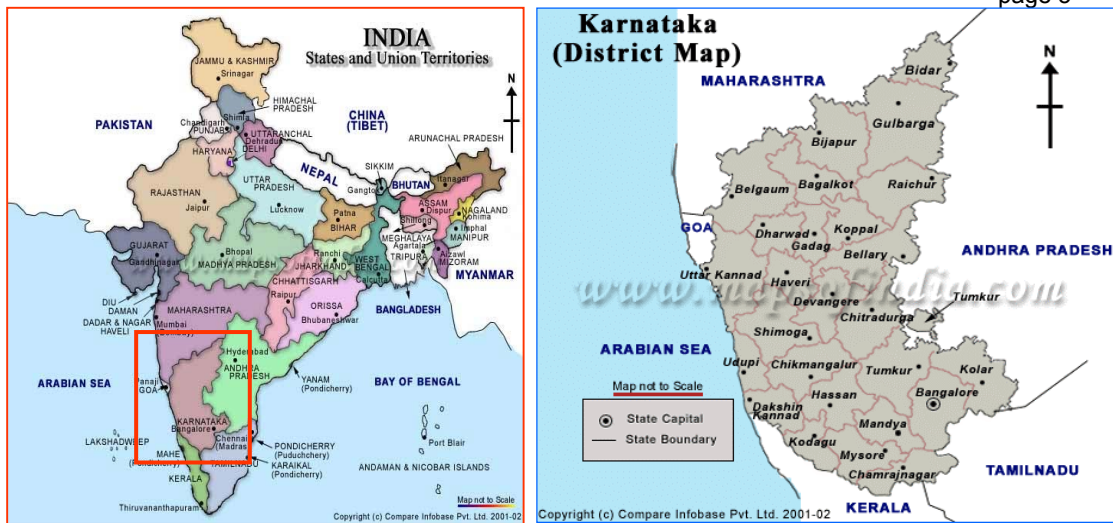


Location Details for Gadag, Karnataka Wind Power Project				
S. No.	Village	Loc. No.	Latitude (N)	Longitude (E)
1	Kurthkoti	142	15°21'28.2"	75°33'42.8"
2		143	15°21'34.0"	75°33'40.7"
3		144	15°21'40.5"	75°33'38.2"
4		145	15°21'46.7"	75°33'36.3"
5		146	15°21'53.8"	75°33'34.4"
6		147	15°22'00.6"	75°33'30.7"
7		148	15°22'06.3"	75°33'28.6"
8		149	15°22'12.9"	75°33'26.2"
9		149A	15°22'10.9"	75°33'10.0"
10		150	15°22'19.4"	75°33'23.8"
11		150A	15°22'17.4"	75°33'07.6"
12		151	15°22'25.6"	75°33'20.9"
13		151A	15°22'31.8"	75°33'14.5"
14		159A	15°23'11.3"	75°33'03.7"
15		160	15°23'13.2"	75°33'20.6"
16		160A	15°23'03.7"	75°33'05.8"
17		161A	15°22'58.2"	75°33'08.5"
18		162A	15°22'52.6"	75°33'11.4"
19	Mallasamudra	182	15°22'23.4"	75°33'56.2"
20		183	15°22'30.0"	75°33'54.1"
21	Kurthkoti	184	15°22'36.9"	75°33'51.8"
22		185	15°22'43.3"	75°33'49.0"
23		186	15°22'49.4"	75°33'46.5"
24		187	15°22'55.8"	75°33'44.0"
25		188A	15°22'54.8"	75°33'29.8"
26		189	15°23'09.0"	75°33'39.1"
27		190	15°23'14.8"	75°33'36.2"
28		191	15°23'21.1"	75°33'33.4"
29		192	15°23'28.4"	75°33'32.1"
30		213	15°23'43.2"	75°33'43.3"
31	Mallasamudra	214	15°23'36.7"	75°33'45.7"
32		215	15°23'30.5"	75°33'48.1"
33		216	15°23'23.8"	75°33'50.6"
34		217	15°23'17.2"	75°33'53.0"
35		218	15°23'10.8"	75°33'55.4"
36		219	15°23'04.4"	75°33'57.0"
37		220	15°22'57.7"	75°34'00.3"
38		221	15°22'51.1"	75°34'02.1"
39		222	15°22'44.8"	75°34'05.1"
40		223	15°22'38.6"	75°34'07.0"
41		224	15°22'32.0"	75°34'09.9"
42		225	15°22'25.3"	75°34'12.4"
43		253	15°23'19.3"	75°34'09.2"



CDM – Executive Board

page 5



**A.4.2. Category(ies) of project activity:**

>>

The project activity is considered under “Zero emissions grid-connected electricity generation from renewable sources”, the project activity has a capacity 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).

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

>>

Wind turbines produce electricity by using the natural power of wind to drive a generator. Wind has considerable amount of kinetic energy when blowing at high speeds. When this kinetic energy passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity. The Project activity envisages installation of 43 WEGs of E-48 SL Enercon make (800 kW WEGs). The WEGs generate 3-phase power at 400V, which is stepped up to 33 KV. The project can operate in the frequency range of 46–54 Hz and in the voltage range of 400 V $\pm$ 20%. The other salient features of the state-of-art-technology are:

- Gearless Construction - Rotor & Generator Mounted on same shaft eliminating the Gearbox.
- Variable speed function – has the speed range of 12 to 29 RPM thereby ensuring optimum efficiency at all times.
- Variable Pitch functions ensuring maximum energy capture.
- Near Unity Power Factor at all times.
- Minimum withdrawal (less than 1% of kWh generated) of Reactive Power from the grid.
- No voltage peaks at any time.
- Operating range of the WEG with voltage fluctuation of -20 to +20%.
- Less wear & tear since the system eliminates mechanical brake, which are not needed due to low speed generator which runs at maximum speed of 29 rpm and uses Aerodynamic Braking system as primary brakes.
- Three Independent Braking Systems with emergency backup supply.
- Generator achieving rated output at only 29 rpm.
- Incorporates lightning protection system, which includes blades.
- Starts Generation of power at wind speed of 3 m/s.

E-48 SL TECHNICAL DATA

Rated capacity	: 800 kW
Rotor diameter	: 53 m
Hub height	: 75 m

Rotor with Pitch Control

Type	: Upwind rotor with active pitch control
Direction of rotation	: Clockwise
Number of blades	: 3
Swept area	: 2198 m ²
Blade material	: Fiberglass (reinforced epoxy) with integral lightning protection
Rotor speed	: Variable, 12-29 rpm
Tip speed	: 80 m/s max.
Pitch control	: Continuous variable pitching mechanism

Generator

: Synchronous - Type

This is a multi-pole variable speed generator. Due to this and Power electronics the Gear Box which steps up the speed to meet the speed of Induction Generator is eliminated resulting in reduced transmission losses,



and elimination of wear and tear of the Gear Box and oil leakage associated with it.

Hub	: Casted Steel
Bearings	: Tapered roller bearings
Grid Feeding	: AC-DC-AC through Convertor - Invertor
Braking System	: 3 independent Aero Brakes with power back up supply.
Yaw Control	: Active through adjustment gears, friction damping
Cut-in Wind Speed	: 3 m/s
Rated Wind Speed	: 12 m/s
Tower	: E-48 SL– Concrete, 74 m height

Enercon (India) Ltd has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are being manufactured. There is no technology transfer involved in the project activity.

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

>>

Year	Annual Emission Reduction tCO₂e
2008-09	65,036
2009-10	65,036
2010-11	65,036
2011-12	65,036
2012-13	65,036
2013-14	65,036
2014-15	65,036
Total estimated reductions (tonnes of CO ₂ e)	455,252
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ e)	65,036

A.4.5. Public funding of the project activity:

>>

There is no recourse to any public funding by HZL 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.

**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 baseline methodology: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”.

Title of the monitoring methodology: “Consolidated monitoring methodology for zero-emissions grid connected electricity generation from renewable sources”.

Reference: ACM0002, Version 06 (19th May, 2006), Sectoral scope: 1.

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 approved methodology also draws upon “Version 04 of the tool for demonstration and assessment of additionality”

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

>>

Justification of the choice of methodology

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

Conditions in the methodology	Applicability
Applies to electricity capacity additions from: - Run-of-river hydro power plants; hydro power projects with existing reservoirs where the volume of the reservoir is not increased. - New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m². - Wind sources; - Geothermal sources; - Solar sources; - Wave and tidal sources.	The proposed project activity is a renewable electricity generation project utilising energy from wind to generate electricity. Thus it meets the first applicability condition.
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;	Since this is a Greenfield project activity, no fuel switch from fossil fuels to renewable energy at the project site is involved. Hence this applicability condition is also satisfied.
The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available;	The project activity exports the generated electricity to the southern region grid through Karnataka state electricity utility. The geographic and system boundaries of the Southern grid can be clearly defined and information on the characteristics of the grid is available and being documented in the PDD. Thus this applicability condition is also satisfied.
Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline	This condition is not required to be satisfied by the proposed project activity as it is not grid connected electricity generation from landfill gas capture.



methodology for landfill gas project activities" (ACM0001)	
--	--

This baseline methodology has been used in conjunction with the approved monitoring methodology ACM0002 ("Consolidated monitoring methodology for grid-connected electricity generation from renewable sources").

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

>>

ACM0002 specifies that the project boundary will be:

For **emissions sources**, only CO₂ emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity.

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

The proposed project activity would be feeding the generated electricity in the Southern Regional Grid, which serves the four Southern states and one union territory. The proposed project would have a marginal impact on all the generation facilities in the Southern grid. Thus all the power generation facilities connected to this grid form the project boundary for the purpose of baseline estimation. The Southern grid is also connected with other regional grids, however, the net exchange of energy within the regional grids is very small, and thus the other regional grids are not included in the boundary (however for conservative and accurate estimation, the imports of electricity from other regional grids has been included in the baseline calculation).

The wind farm (project activity) has a distinctive physical demarcated boundary.

	Source	Gas		Justification / Explanation
Baseline	Electricity generation from power plants connected to Southern region	CO ₂	Included	Main emission source
		CH ₄	Excluded	Not required as per ACM0002
		N ₂ O	Excluded	Not required as per ACM0002
Project Activity	Electricity generation from the project activity	CO ₂	Excluded	Electricity generation from wind does not lead to emissions of greenhouse gases.
		CH ₄	Excluded	Excluded for simplification.
		N ₂ O	Excluded	Excluded for simplification.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>>

For project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:

Electricity delivered to the grid by the project 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 step wise under section B.6.

Choice of grid

The Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Power generation and supply within the

**CDM – Executive Board**

page 10

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.

Table 1: States connected to different regional grids

Regional grid	Northern	Western	Southern	Eastern	North Eastern
States	Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaraanchal, Delhi	Gujarat, Madhya Pradesh, Maharashtra, Goa, Chattisgarh	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu,	Bihar, Orissa, West Bengal, Jharkhand	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

For the purpose of calculating the emission reductions achieved by any CDM project, the CDM Executive Board requires that the “project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints”. This implies that the grid emission factors are most appropriately calculated at the level of the five regional grids¹.

Southern Regional (SR) grid is a large system comprising of 651000 sq. kms. of area encompassing 4 states system viz Andhra Pradesh, Karnataka, TamilNadu and kerala and Union Territory of Pondicherry and Central Sector, State sector and Independent Power Producing Generating stations. Different states are interconnected with each other through 400 KV grid network and some 200 KV inter-state lines. 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. SRLDC facilitates the share of power generated by the central generating stations. Presently the share from central generating stations is a small portion of their own generation.

The installed capacity of Southern Region at the end of financial year 2005-06 as per CEA was 36447.52 MW. The total installed capacity comprises of Hydro – 10967.71 MW, Gas – 3434.5 MW, Coal- 15992 MW, Nuclear- 880 MW, RES – 4233.49 MW and Diesel – 939.32 MW². The Hydro: Thermal mix is of the order of 31: 69³.

The proposed project activity lies in the state of Karnataka. The following tables illustrate the installed capacity of power generation in Karnataka:

¹ CO₂ Baseline Database for the Indian Power Sector - CEA

² http://www.cea.nic.in/power_sec_reports/executive_summary/2006_03/6.pdf

³ Annual Grid Report, Southern Region Load Dispatch Centre, 2005-06.



CDM – Executive Board

page 11

Table 2: Installed Capacity (in MW)

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Thermal	1309.92	1647.92	1673.12	1754.42	1964.42	1964.42	1964.42	1964.42
Hydro	2645.55	2685.55	2745.51	2938.75	2938.75	2953.75	3298.15	3427.90
Gas	0	0	0	220.00	220.00	220.00	220.00	220.00
Others	17.01	34.22	37.82	54.80	96.20	124.30	432.48	916.92
Total	3972.48	4367.69	4456.45	4967.97	5219.37	5262.47	5915.05	6329.24

Reference: Southern Region Power sector profile – Ministry of Power (November 2006)

Table 3: Installed Capacity by Ownership (in MW)

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
State Sector	3810.05	4058.14	4092.80	4298.07	4508.07	4523.07	4871.97	5489.43
Private Sector	162.43	309.55	363.65	669.90	711.30	739.00	1043.08	1039.81
Total State And Private Sector	3972.48	4367.69	4456.45	4967.97	5219.37	5262.07	5915.05	6529.24
Share in Central Sectors Stations	0	0	674.00	674.00	674.00	674.00	674.00	1255.45
Total	-	-	5130.45	5641.97	5893.37	5936.07	6589.05	7784.69

Reference: Southern Region Power sector profile – Ministry of Power (November 2006)

*The gaps illustrate non availability of data for that period.

It is inferred from the above tables that the Karnataka state power sector is primarily constituted of fossil fuel based installations and hydro power projects depending on them for meeting its power requirements. The share of other power generation sources is comparatively small. The following table further illustrates the power supply position in the state of Karnataka:

Table 4: Power Supply Position in Karnataka

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Energy (MUs)								
Requirement	26061.00	28201.00	30242.00	32556.00	32173.00	36153.00	35156.00	34578.00
Availability	22626.00	25851.00	27490.00	28493.00	29008.00	31145.00	33687.00	34327.00
Shortage (%)	13.20	8.30	9.10	12.50	9.80	13.90	4.20	0.70
Peak (MW)								
Requirement	4411.00	4591.00	5037.00	5338.00	6118.00	6213.00	5927.00	6160.00
Peak Met	3726.00	3881.00	4371.00	4428.00	4805.00	5445.00	5612.00	5558.00
Shortage (%)	15.50	15.50	13.20	17.00	21.50	12.40	5.30	9.80



Reference: Southern Region Power sector profile – Ministry of Power (November 2006)

The table depicts that the average requirement of power in Karnataka is higher than the availability leading to consistent power shortages in the state for various years reaching to a maximum energy shortage of 13.9% in the year 2003-04. The peak load is further showing an increasing trend in the amount of shortage between peak requirement and peak met.

Thus in the absence of the proposed CDM project activity by HZL, taking into account energy shortages in the region and specifically the state of Karnataka, the electricity delivered to the grid by the project would have otherwise been generated by the continued operation of grid-connected power plants and by the addition of new generation sources to meet the existing and future power requirement which is the chosen baseline scenario. The alternatives selection has been elaborated under step 1 of the additionality tool under section B.5.

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): >>

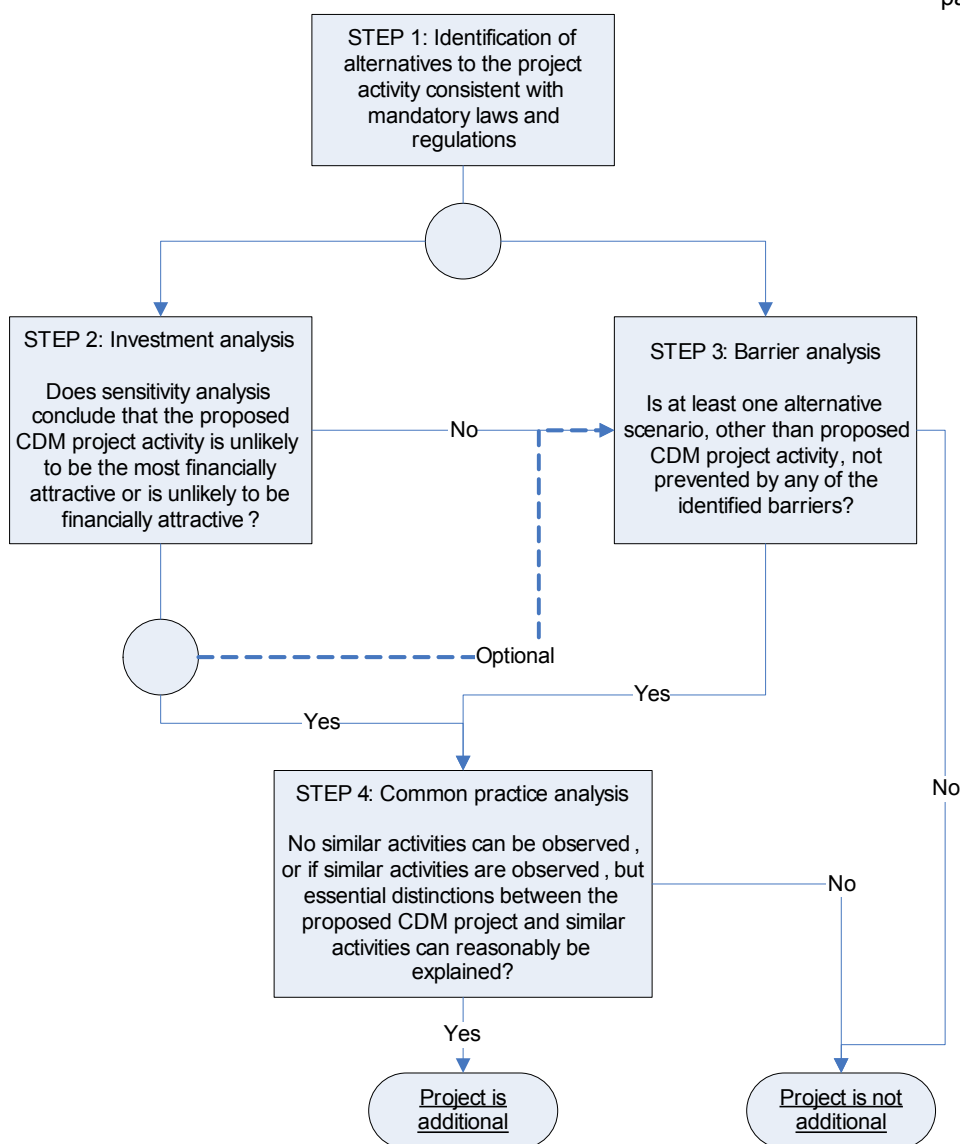
>>

As per the decision 17/cp.7, paragraph 43, a CDM project activity is additional if anthropogenic emissions of green house gases by sources are reduced below those that would have occurred in absence of registered CDM project activity. The methodology requires the project proponent to determine the additionality based on 'Tool for the demonstration and assessment of additionality', Version 04.

HZL was fully aware of the possible revenues through CDM for mitigating financial risks associated with investing in an unreliable source of power generation i.e. wind. They had factored in these possible benefits in the form of CER revenue during the financial planning stage of the project in order to aid in decision to proceed with the project activity. The following is available as evidence to prove that the incentive from CDM was seriously considered by HZL during their decision to proceed with the project activity:

1. Communication between HZL and various CDM consultants even before the letter of intent was submitted to the EPC contractor
2. Letter from HZL to Enercon and Suzlon enquiring about eligibility of getting carbon credits from wind power projects
3. Presentation dated November 2006 made by Mr. Naveen Singhal to the management on investment in wind power and necessity of revenue from CDM for financial viability of the project
4. Extract from the Meeting of Board members approving project activity based on consideration of CDM revenues alleviating risks to the project activity.

The step-wise approach to establish additionality of the project activity is as follows:



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

Sub-step 1a. Define alternatives to the 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.

The proposed project activity involves implementation of 43 WEGs of individual capacity 0.8 MW to generate electricity and export it to the Southern regional grid. The alternatives which were available with the project participants are as follows:

Alternative 1 - The proposed project activity not undertaken as a CDM project activity.

In the said alternative HZL would have gone ahead with the implementation of project activity, generating renewable electricity and exporting the same to the state electricity grid under a power purchase agreement thereby displacing equivalent units of power generated by fossil fuel based plants in the grid. There would be no emissions of greenhouse gases to atmosphere. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline scenario. However there exist barriers to the implementation of the proposed project activity without CDM as explained in step 2 and step 3 below.

Alternative 2 - No project activity and equivalent amount of energy would have been produced by the



project grid electricity system through its currently running power plants and by new capacity addition to the grid i.e. Continuation of current situation.

Outcome of Step 1a: The “no project option” where in the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions (which are mostly thermal) is the most plausible alternative as baseline option for the project in accordance with ACM0002. Thus suitable grid mix has been selected as the baseline scenario.

Sub-step 1b. Enforcement of applicable laws and regulations:

The alternative(s) shall be in compliance with all applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This sub-step does not consider national and local policies that do not have legally-binding status.).

All the above alternatives are in compliance with all applicable legal and regulatory requirements as follows: The implementation of project activity is a voluntary initiative and it is not mandatory or a legal requirement. For power generation, the electricity act 2003 does not restrict or empower any authority to restrict the fuel choice, the applicable environmental regulations do not restrict the use of wind energy and there is no legal requirement on the choice of a particular technology.

Outcome of Step 1b: Thus, considering that all the alternatives are in line with the applicable legal and regulatory requirements, the “no project option” i.e. continuation of current practise where in the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions is the chosen baseline scenario which would have happened in the absence of the proposed project activity.

The project was under request for review, wherein the PP/DOE was asked to provide additional information on the following:

1. Choice of benchmark following the non-applicability of the KERC benchmark as per paragraph 40, EB 40 and whether 16% rate of return on equity is applicable for renewable energy and/or non renewable energy projects or not.
2. Provide a spreadsheet with the formulae readable to enable replication of the investment and sensitivity analyses.
3. The common practice analysis, in particular, similar projects should be described and the essential distinction between them and the project activity should be clearly indicated.

Following this the PP and the DOE submitted their clarifications.

Taking into account the responses by the PP and the corresponding responses from the DOE, the EB in its 44th meeting had agreed to register the project “if the PP and DOE submit a revised PDD and the corresponding validation report which incorporate the information submitted in response to the request for review regarding the validation of suitability of the benchmark and the common practice analysis”.

In light of the above, we have revised the benchmark and the common practice analysis sections of the PDD incorporating the information submitted in response to the request for review. The responses are included in the specific sections as follows:

1. Justification of the earlier benchmark – (included as Annex 5 to the PDD)
2. Alternate benchmarks applicable to the project activity – (included in Sub-step 2(b) Section B5 of the PDD)
3. Spreadsheet with all formulae readable enabling replication (provided a separate document)
4. Additional clarifications regarding common practice analysis (included in Sub-step 4 of the section B.5 of the PDD)

Step 2. Investment analysis



Determine whether the proposed project activity is economically or financially less attractive than at least one other alternative, identified in step 1, without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps:

Sub-step 2a. Determine appropriate analysis method

As the electricity generated from the HZL wind farm will be sold to Electricity Supply Company (ESCOM), 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 wherein the Internal Rate of Return (IRR) of the project activity serves as a benchmark to assess the financial attractiveness of 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

Post tax Equity IRR is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. The project proponents have hence identified post tax equity IRR (Internal Rate of Return) as the most appropriate financial indicator for the project and carried out an investment analysis of the project activity. The project was initially assessed with a 16% benchmark based on CERC and KERC prescribed values (refer annex 5 of the PDD). However, in response to the request for review by the EB, we have assessed the post tax equity IRR for the following appropriate benchmarks:

Benchmark 1-

The benchmark has been determined in accordance with para 6(a) sub step 2b of the Additionality tool i.e. *Government bond rates increased by a suitable risk premium to reflect private investment and / or project type.*

The required rate of return on equity for the project has been calculated using the Capital Asset Pricing Model (CAPM). As per CAPM, the required return on equity investment is the return of a risk-free security plus beta times the difference between the market return and the risk-free return. The Government Securities have been taken to represent the risk free return. Stock index has been used to represent the market return.

While considering a new project, CAPM can provide the required rate of return that the project needs to yield, taking into account the volatility (risk) of the stock relative to the market (Beta). This required return on equity represents the cost of equity benchmark for the project.

The formula of CAPM is as follows:

$R_i = R_f + \beta (R_m - R_f)$ where:

R_i = Rate of return on equity;

R_f = Risk-free rate of return;

B = Beta or systematic risk for this type of equity investment coefficient reflecting the volatility (risk) of the stock relative to the market,;

R_m = Expected market returns

$R_m - R_f$ = Market risk premium;

Risk free rate:

At the time of start of the project the data available for the average Government bond rate was that of the year 2005-06, which was 7.34% (source: Reserve Bank of India, web-link: <http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/80303.pdf>).



The β in the CAPM equation helps to account for the systematic risk by quantifying the sensitivity of the stocks of the companies representing a particular project type/sector with the market returns. Thus, it incorporates the risk of a specific sector in the calculation of the cost of equity. The Beta value taken for this analysis is based on the beta values of the listed private companies engaged in similar business as the project activity (i.e. the power sector) at the start of the project activity estimated by regressing weekly returns on stock against local index, using 10 years of data if available otherwise the data since incorporation of the company has been used. The beta values have been taken from Bloomberg⁴.

Company Name	Beta
Tata Power	0.885
Reliance Infra	0.867
Jaiprakash Hydro	1.009
BF Utilities	1.326
Average Beta	1.02

The guidance on investment analysis requires the use of benchmark which represents standard market returns. These returns are assumed to reflect the risk free rate of return plus a market premium. The capital asset pricing model requires the adjustment of the market premium with the factor 'beta' which represents the volatility of a stock relative to a well diversified market portfolio.

Wind power is the not core business of HZL and hence the beta factor of HZL cannot be used for the calculation of the risk premium. Also, in order to understand the standard market returns, it is essential to consider a wider range of companies. Hence an attempt to study the beta values of private sector companies with relatively significant investment in wind power was made. BF Utilities was the only one company identified with mainstream wind power business, listed on the Indian bourses and actively traded with a historic beta value of 1.326 since the incorporation of the company in August 2001. Hence, the portfolio of the companies considered for the study was widened to include the companies with significant investment in the power sector including in renewable and non renewable energy.

Conventional (Thermal and Large Hydro) power projects are a more attractive investment option as compared to non conventional (renewable energy power projects) projects, primarily because of the lower risks that such project activities face as compared to renewable energy projects and in particular wind power projects. Conventional power plants supply firm power, operate on higher Plant Load Factor (PLF) and are not subject to the vagaries of nature as wind power plants. Wind power projects on the other hand operate at much lower PLF (22-28%) and have much higher capital costs. Thus, from the perspective of a private investor, investments in thermal power plants are a safer option. A study of the baseline scenario, indicating that over 55% of the power generation in the country is from thermal sources⁵, also reinforces the fact that generation from thermal sources provides a more attractive and assured source of return as compared to investments in renewable energy sources like wind power.

Hence it is assumed that such private companies with significant investments in non renewable energy projects face lower risk as compared to the wind power project and hence the value of beta for such companies should also be lower. Thus, as the use of the beta value for companies with significant investment in non renewable power projects is representative of the returns generated in the baseline scenario and is also conservative, the same has been considered appropriate for the analysis. The average beta has been estimated as 1.02 and the same has been chosen for further analysis.

R_m – R_f (Market Risk Premium): The market risk premium is the return that an investor expects over and above the risk free return available in the market. The market risk premium has been estimated using

⁴ Screenshots from Bloomberg terminal have been submitted to the DOE.

⁵ http://cea.nic.in/power_sec_reports/Executive_Summary/2008_07/27-33.pdf

historical approach. This can be defined as the historical differential return of the market and the risk-free rate. The most common method of calculating this is the difference between historical return of the stock market index and the historical return of the risk free rate. The differential can be calculated as arithmetic or geometric average. The geometric average⁶ usually is a more accurate representation of the risk premium, accordingly we have calculated market risk premium as the historical geometric mean return on the stocks (using the BSE Sensex⁷ Index since it start in 1979) minus the historical geometric mean return on government securities. This would give the incremental returns over and above the risk free rate.

Market Rate of Return (R_m) = $\left[\frac{\text{(BSE index at the time of start of project)}}{\text{(BSE index at its start in 1979)}} \right]^{(1/\text{no. of years from 1979 till start of project})} - 1$

$$= \left[\frac{(14,090/100)}{(1/27.83)} \right] - 1$$
$$= 19.46\%$$

Average risk free rate (R_f) = The average risk free rate represents the historical risk free rate and is calculated as the geometric mean of the compounded annual return.

Geometric mean of compounded return for the year 2005-06 = $\left[\frac{\text{(Compounded return for year 2005-06)}}{\text{Return for the year 1979-80}} \right]^{(1/\text{number of years from 1979-80 to 2005-06})} - 1$

$$= \left[\frac{(1281/100)}{(1/26)} \right] - 1$$
$$= 10.31\%$$

Please refer to the excel sheet of calculations for further details.

[Source for risk free rate is Reserve Bank of India]

$$\text{Market Risk Premium} = 19.46\% - 10.31\% = 9.15\%$$

Rate of return on equity or cost of equity benchmark is $R_i = R_f + \beta (R_m - R_f)$

$$= 7.34\% + 1.02 \times 9.15\%$$
$$= 16.69\%$$

Hence the benchmark for equity IRR of the project is the Cost of equity of companies engaged in similar business as that of the project which is calculated as **16.69%**.

Benchmark 2 -

Further, in accordance with the guidance provided by EB to the request for review of Project activity number 1856 which is also HZL's project, Benchmark has also been estimated using the Government **Deposit Rates** applicable at the time of start of the project activity. The average RBI deposit rate applicable in the year 2005-06 was **6.625%**.

(Source: - <http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/87456.pdf>)

Market returns and beta are the same as estimated in Benchmark 1.

Average risk free deposit rate (R_f) = The average risk free rate is calculated as the geometric mean of the compounded annual return.

Geometric mean of compounded return for the year 2005-06 = $\left[\frac{\text{(Compounded return for year 2005-06)}}{\text{Return for the year 1979-80}} \right]^{(1/\text{number of years from 1979-80 to 2005-06})} - 1$

$$= \left[\frac{(1204.18/100)}{(1/26)} \right] - 1$$
$$= 10.04\%$$

⁶ The compounded return is computed by taking the value of the investment at the start of the period (Value₀) and the value at the end (Value_N), and then computing the following:

$$\text{Geometric Average} = \left(\frac{\text{Value}_N}{\text{Value}_0} \right)^{1/N} - 1$$

⁷ <http://www.bseindia.com/histdata/hindices.asp>



Refer the excel sheet of calculations for further details.

[Source for risk free rate is Reserve Bank of India]

Market Risk Premium = 19.46% - 10.04% = 9.41%

The benchmark i.e. deposit rate increased by Market Risk Premium is:

$R_i = R_f + \beta (R_m - R_f)$

= (6.625 + 9.41 * 1.02) %

= **16.24 %**

Hence the benchmark for equity IRR of the project is the Deposit Rates increased by Market Risk Premium adjusted to incorporate risk of companies engaged in similar business as that of the project which is calculated as **16.24%**.

Benchmark 3 -

According to the tool for demonstration and assessment of additionality, the benchmark can also be derived from *estimates of the cost of financing and required return on capital for the country and type of project activity concerned*), based on bankers views on comparable projects.

One of India's largest private banking institution ICICI Bank Limited which has been financing private sector wind energy projects (**type of project activity concerned**) over the past few years has stated that, an Internal Rate of Return of over 16% for the capital employed in their view is desirable to ensure economic viability and adequate cash flows of a high risk wind power project. This return was also applicable during the start date of the project activity as clarified by the bank in a subsequent letter. According to the financial institution, this desired IRR is also expected to ensure adequate coverage to service debt. The letters from ICICI Bank have been submitted to the DOE.

Hence in accordance with the additionality tool, this Bankers view is a suitable benchmark for comparison against the IRR.

Thus the assessment of the above three benchmarks illustrate that the benchmark for rate of return on equity for the project activity ranges from 16% to 16.69%. Hence conservatively the lowest of the range i.e. 16% can be considered as the benchmark of the proposed project activity for comparison with the post tax equity IRR chosen as the financial indicator.

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

The internal rate of return for the proposed project activity without CDM revenues was computed for a period of 20 years, corresponding to the lifetime of the 34.4 MW wind farm based on the following assumptions including various benefits available to the project activity from the National and Sectoral policies for promoting renewable energy generation in India:

Description	Value	Reference
Capacity of wind farm	34.4 MW	Contract agreement between HZL and Enercon India Limited required for wind energy farm at Hanumanhatti, Karnataka (HZL/PROJ/WPP-UMBRELLA/07).
Number of WEGs	43	
Capacity of each WEG	800 kW	
Plant Load Factor	24.971 %	The PLF has been estimated based on the generation guarantee provided by the equipment supplier which inturn is based



CDM – Executive Board

page 19

		upon the historically measured wind data at that particular site.
Guaranteed annual generation per WEG	1,750,000 kWh (Units generated at 100% grid availability.)	Contract agreement between HZL and Enercon India Limited required for wind energy farm at Hanumanhatti, Karnataka (HZL/PROJ/WPP-UMBRELLA/07).
Losses	7% of gross generation	As appraised by the equipment supplier as being the general trend.
Residual Value	5 %	As per norms
Annual Operation and Maintenance Cost	INR 4.48 Lakh per WEG with 5% escalation every year starting from the 2 nd year	O & M contract between HZL and Enercon - HZL/WPP/O&M/KARNATAKA-001/07
Insurance cost	0.18% on P & M value	As per quotation for insurance cover of wind farm by The Oriental Insurance Company Limited.
Depreciation	80% of WDV	As per relevant Indian tax regulations/policies
KPTCL Tariff rate	INR 3.40 / kWh	KERC order dated 18 th Jaunary 2005.
Total Project Cost	INR 167.7 Crore	Contract agreement between HZL and Enercon India Limited required for wind energy farm at Hanumanhatti, Karnataka (HZL/PROJ/WPP-UMBRELLA/07).
Means of finance	100% equity	Can be verified from the balance sheets of HZL
Income tax rate	33.99%	As per relevant Indian tax regulations/policies
Administration/Miscellaneous expenses	INR 0.75 Crore / year	Assumed as per norms

The post tax-equity IRR for the project activity was found to be 11.96% (***the workings to calculate IRR are attached as Enclosure***) which is lower than the benchmark selected for the proposed project activity.,

Sub-step 2d. Sensitivity analysis

The project activity has been found sensitive to the following parameters:

1. Plant Load Factor (PLF) -. The plant load factor includes the variations in wind profiles, variations in offtake (including grid availability) and machine downtimes.
2. O&M escalation rate
3. SEB buy back rate (Tariff) – The SEB buy back rate (tariff) applicable to the proposed project activity is fixed for a period of 10 years in accordance with the PPA. It is uncertain whether the tariff would increase or decrease. The impact of increase/decrease in tariff on the IRR is demonstrated below.

S. No.	Parameters	Variation	IRR	Comments
	Project scenario		11.96 %	--



1.	PLF of the wind farm	+ 10 %	14.08%	The PLF used to arrive at the estimated generation in the IRR computation is already high as it has been referred from the equipment supplier's generation guarantee. The presentation from KREDL to the Chief Minister of Karnataka specifies the average PLF in the state to be about 23 %. Further, various proposals submitted to KERC of the ranges in PLF observed in Karnataka by different agencies such as InWEA (PLF in the range of 23%-28%), IWPA (PLF of 23% as observed in Karnataka for the past three years), Reliance Energy (PLF of 25%) and Senergy Global (PLF in the range of 23%-28%) to be considered for determination of tariff as documented in the KERC order are different. Additionally the prevailing wind patterns and operating conditions makes it unlikely for 10% increase in PLF at the site.
		+5 %	13.21%	
		- 5 %	11.06%	PLF may reduce due to change in wind patterns and any other unforeseen circumstances resulting in very less IRR.
		- 10 %	9.82%	
2	O & M escalation rate Current Rate – 5%	+ 10 %	11.66%	The O&M cost has been increasing and with the rising trend, there is a possibility that it may increase in the future leading to additional financial burden and decrease in IRR.
		+5 %	11.83%	
		- 5 %	12.06%	There is a little possibility that the O&M costs would



		- 10 %	12.15%	decrease in the future.
3	SEB buy back rate - Tariff Variation after 10 th year (Base Tariff INR 3.40 per kWh)	+10 %	12.42 %	The current buy back rate of Karnataka SEB is less than that in other states like Maharashtra and Madhya Pradesh, so considering a 10% rise in SEB buy back rate in the state, the IRR would increase but will still be less than the benchmark.
		+5 %	12.20 %	
		-5 %	11.72 %	There can be a decrease in buy back rate in the future due to competitive bidding. This would further decrease the IRR for the project activity.
		-10 %	11.46 %	

The purpose of the sensitivity analysis is to demonstrate the sensitivity of the return on project due to uncertainty in plant load factor, O & M escalation rate and tariff variation after 10 years. The risk on the uncertainty in PLF remains outside the control of the project activity; it basically depends on wind pattern and the infrastructure facility of the off-taker. Similarly the risk on uncertainty of tariff after the tenth year of operation is also dependent on relevant regulation of the KERC and remains outside project proponent's control.

The PLF assumed in the investment analysis for the project activity is 24.97% (based on equipment supplier's generation guarantee) whereas the PLF as assumed by KERC tariff order dated 18 January 2005 is 26.5%. The project proponent has used the project specific values which have been arrived at from the generation guarantee supported by the wind mast prognosis data provided by equipment supplier Enercon India Limited for the particular site in Gadag Plains where the WEGs of HZL are being installed. This represents the most reliable data as it takes into consideration the micro level measurement of wind availability and density particularly at the project site. However, the KERC assumption is a holistic representation of PLF of Karnataka state which will vary from location to location based on local site conditions. This is evident from the various proposals submitted to KERC of the ranges in PLF observed in Karnataka by different agencies such as InWEA (PLF in the range of 23%-28%), IWPA (PLF of 23% as observed in Karnataka for the past three years), Reliance Energy (PLF of 25%) and Senergy Global (PLF in the range of 23%-28%) to be considered for determination of tariff as documented in the KERC order.

From the above analysis it is apparent that there is significant risk associated with the project activity that impacts the viability of the project as highlighted through the sensitivity analysis. The above results confirm that the post-tax equity IRR for the project activity remains lower than the benchmark even under circumstances which could bring about variations in some of the critical factors of the project activity.

Hence, it can be justifiably concluded that CDM revenue that the project activity would obtain through sale of the emission reductions, is very crucial to sustain the operations of the project activity.

Step 3: Barrier Analysis:

The project additionality has been established by conducting the Step 3: Barrier Analysis.

Herein the project proponent is required to determine whether the proposed project activity faces barriers that:

- Prevent the implementation of this type of proposed project activity; and
- Do not prevent the implementation of at least one of the alternatives through the following sub-steps:



Sub-step 3a: Identify barriers that would prevent the implementation of the type of the proposed project activity.

Hindustan Zinc Ltd. (HZL) is a vertically integrated natural resources enterprise having broad operations ranging from exploration, mining, ore processing to smelting of non-ferrous metals. The project proponent had earlier decided to take up an investment in wind power in the year 2001-2002. The initial documentation was prepared but the HZL management became reluctant to invest in wind energy as there exist various barriers in investing in an unreliable source of energy with higher initial investment per MW as compared to other forms of electricity generation, regulatory risks, lower returns and which is susceptible to vagaries of nature. Additionally, the investment in the expansion of current business of zinc mining and smelting would be a more profitable venture considering the rising demand of zinc globally and higher rates of return (IRR ranging from 19 - 32%)⁸ to the company. As the financial position of HZL improved over time after its transformation from PSU to a private entity, along with it arose increased consciousness of social responsibility and realization of plausible contribution in mitigating global threat caused by increased concentrations of greenhouse gases in the atmosphere. In wake of this, the management decided to implement the wind power project in the year 2006 after taking into account the possible mitigation of risks caused by revenues after sale of CERs.

The following barriers have been identified by the project proponents that would hinder the implementation of the proposed project activity:

Institutional barrier

The biggest risk that the project proponent has faced is due to institutional barrier presently observed in the state of Karnataka dominated by forest land. The EPC contractor Enercon India Limited offered a capacity of 34.4 MW to HZL at Hanumanhatti in Belgaum District of Karnataka. The site was a hilly terrain with better and more promising performance capability of the wind farm. The capacity allocation by KREDL was completed along with signing of contract and schedule for commissioning of WEGs. According to the schedule promised by Enercon the wind farm was to be commissioned by the end of September 2007. However, Enercon informed HZL that due to its inability to get the clearance for carrying out wind farm project activities on a forest land in time, the project could not be completed in accordance with the schedule promised. The major reason for the same was the dissolution of Forest Advisory Committee (FAC) by the Supreme Court of India and without the clearance from FAC the wind farm cannot be commissioned, thus causing indefinite delay in implementation of the project. Enercon had no choice but to offer HZL another site at Gadag Plains in Karnataka which is a virgin site with no prior exploitation of land for wind farm activities in comparison to Belgaum which has been extensively developed for wind farm operations. There are lots of uncertainties associated and could be a serious threat to existence/sustenance of the project activity. This is clearly a risk which the project proponent is shouldering and has implications in its own way, if the results are otherwise. Furthermore, HZL has to bear an increased opportunity cost of time due to delay in implementation (schedule slippage) of the wind farm.

Regulatory Barriers

As wind power is infirm, it is not amenable to grid dispatch instructions. Most of the costs of wind energy generation are fixed in nature. For these reasons the KERC decided to have a Single Part tariff for wind power. However, this implies a higher investment risk for the proposed project activity than the utility scale fossil fuel and hydro projects where the investment recovery is decoupled from the level of actual generation achieved by the project due to variations in off-take. Thus, transmission unavailability, back-down of generation or part-load operations, which are beyond the control of the investors are likely to affect the project activity more severely and therefore the project activity investors would require higher rate of return to compensate them for these risks. Furthermore, the tariff for wind energy projects has been fixed for a period of 10 years and at the moment there are no indications from the Regulatory Commission on the type

⁸ The figure has been taken from various Board meeting minutes of Hindustan Zinc Limited for projects undertaken by them in the past 5-7 years



CDM – Executive Board

page 23

of returns that would be allowed to the investor after the expiry of this 10 year period. Due to the Back loading of tariff, the investment recovery in case of wind projects is not possible within first 6-7 years of the operational life of the project and usually the payback period for a wind energy project races beyond 10 years. The PPA entered with the Discom is valid for a period of 10 years, whereas the operating life of the project is more than 20 years. This means that for a large part of the project's life, there is a great deal of uncertainty over the project's ability to sell the generated electricity. Even though open access regulations permit a generator of electricity to use the state's transmission network and supply directly to the consumer, finding a buyer for the project's electricity will be difficult, considering its infirm nature and high cost, more so when cheaper and more reliable options like coal are abundantly available. Thus full investment recovery itself is at stake in case of wind projects in Karnataka.

Further, more than 75% of Karnataka's wind capacity has been added in the last three years. It is interesting to note that during this period the regulatory framework for wind investments in Karnataka have reduced the tariff benefits to wind projects. . We analyze the tariff that would be applicable to the project under the different regulatory policy regimes that have come up for wind power projects in Karnataka over the years.

Electricity tariff (Rs/kWh)	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Average
MNES Policy ⁹	3.60	3.72	3.83	3.94	4.05	4.17	4.28	4.39	4.50	4.62	4.11
KERC Order 2003 ¹⁰	3.29	3.35	3.41	3.47	3.53	3.60	3.66	3.72	3.78	3.84	3.57
KERC Order 2005 ¹¹	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40

Clearly the various policies and regulatory directives have progressively decreased the electricity tariffs benefits for wind power projects in the state.

Furthermore, the penalty on reactive power consumption in Karnataka by wind turbines is Rs. 0.40 per KVARh which is the highest than any other state with wind power potential. This poses a future financial burden on the project proponent in case of an event of high reactive power consumption by wind mills which is also beyond the control of project proponent.

Prevailing practice barrier

There has been a considerable rise in number of installations of WEGs in the country especially in the past few years. States like Maharashtra and Tamil Nadu have seen high number of installations. Till last year Karnataka was among the favourite destinations for wind farm implementation due to high wind power density and wind speed in the country has. However for the past two years the rate of increase in installed capacity and number of installations has decreased inspite of increase in capacity allotment. Tamil Nadu and Maharashtra have overtaken Karnataka in terms of the installed capacity. The table below further illustrates the trend in growth of installed capacity in Karnataka. The capacity commissioned in 2005-06 has been lesser than that commissioned in 2004-05. It is to be noted that in the same time period, states like Maharashtra and Tamil Nadu have seen considerable increase in capacity addition.

State	Capacity added in 2005-06
Tamil Nadu	857.6 MW

⁹ MNES came out with its tariff guidelines for NCE projects on 13.09.1993. The policy states that tariff would be Rs.2.25 for 1994-95 and 5% annual escalation thereafter, <http://mnes.nic.in/wp4.htm>

¹⁰ Rs.3.10 for 2003-04 and 2% annual escalation thereafter, <http://www.kerc.org/orders2003/Void%20PPAs-2.doc>

¹¹ Rs.3.40 for 2005-06, fixed for next 10 years, [http://www.kerc.org/order2005/Order%20on%20NCE%20Tariff%20\(FINAL\).doc](http://www.kerc.org/order2005/Order%20on%20NCE%20Tariff%20(FINAL).doc)



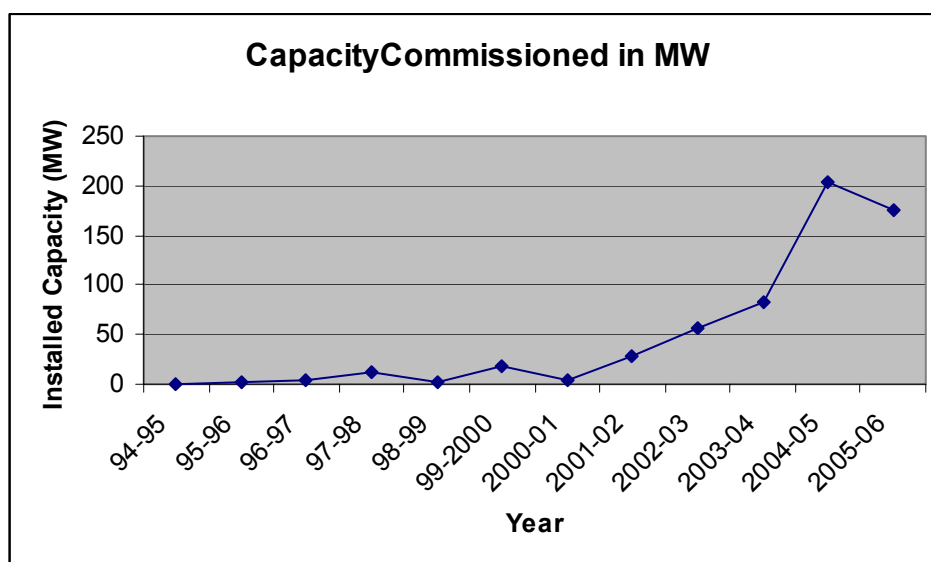
CDM – Executive Board

page 24

Maharashtra	545.1 MW
Karnataka	173.8 MW

The following table highlights the capacity addition in the state of Karnataka:

Sl.No	Financial year	Capacity allocated in MWs	Capacity commissioned in MW
1	94-95	0.55	0.55
2	95-96	4	1.35
3	96-97	26.555	3.945
4	97-98	40.5	12.040
5	98-99	45.6	1.250
6	99-2000	450.41	18.09
7	2000-01	294.5	3.75
8	2001-02	527.45	28.8
9	2002-03	890.35	55.46
10	2003-04	491.6	83.170
11	2004-05	218.35	204.55
12	2005-06	1367.35	174.63



Thus it is concluded from the above discussion that inspite of Karnataka having the highest wind power density in the country, it has failed to attract further investment growth as compared to other states in the country. The reason being attributed to better infrastructure availability in terms of grid transmission and access to site in other states and also due to ease in getting statutory approvals from the concerned authorities.

Other barriers:

Wind turbines convert kinetic energy of the moving air into rotational energy, which in turn is converted to electricity. Since wind speeds vary from month to month and even second to second, the amount of

electricity wind can produce varies constantly. Sometimes, a wind turbine will produce no power at all. The capacity utilization factor (CUF) is a ratio of actual energy produced in a given period to the hypothetical maximum possible, i.e. that produced by a turbine running full time at its rated power. As the sites identified previously to be suitable sites for wind power generation have been exploited fully, new sites are being identified, which have a comparatively lower CUF leading to lower generation potential for new investors like HZL. Moreover, in most of the wind power projects the CUF predicted in the pre-investment studies and that obtained after the installation of wind power plant vary; in most cases, the actual CUF is much less than that predicted in the studies¹². The best example of 'lower realization of CUF in Karnataka thereby leading to lower returns from the wind farm' is the largest wind farm owner in Karnataka - MSPL whose project is also registered with the UNFCCC. Many other projects such as even the IPP project of Enercon itself in Karnataka have sought for CDM revenues due to lower realization of returns from their projects in Karnataka being sensitive to variability in CUF. There are various other wind power projects in the CDM pipeline from the state of Karnataka who have sought CDM revenues in anticipation of lower returns due to variable CUF in state.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

As stated the above alternatives are specifically hindering the implementation of wind farm projects including the proposed project activity. None of these barriers are applicable to the other alternative.

Step 4: Common practice analysis

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

Wind potential and installations in India

The all India generating capacity (including the captive connected to grid) as on March 2007 is 146965.21MW¹³, whereas the installed capacity of wind till that time is only 7114.6 MW¹⁴. Thus just 4.8% of the total generating capacity in India is through wind generation sources. Given that the gross potential for wind power in India is 45195 MW¹⁵, installed capacity of wind in India is only about 15% of its potential. Hence it can be seen that both as a proportion of total installed capacity of the country and as a percentage of the potential of wind power, wind energy penetration in the country is very low.

Wind potential and installations in Karnataka

Specifically analyzing the situation in the state of Karnataka, it is seen that against an assessed wind potential of 7023 MW, the state has installed wind capacity of 853 MW as of 31 March 2007 (Source: KREDL data given below in the table). This shows that until March 2007, the installed capacity of wind energy in Karnataka was only about 12% of its potential.

Wind capacity additions over the years and proportion of CDM projects in the capacity additions

The table below provides details of wind capacity additions in Karnataka since the promotional policy for wind was first introduced in 1994-95:

Sl. No.	Financial year	Capacity allocated (MW)	Capacity commissioned (MW)
1	1994-95	0.55	0.55
2	1995-96	4.00	1.35

¹² Wind power: experiences and future directions - The proceedings of the Workshop held on 23 July 1999 in New Delhi, TERI

¹³ http://www.cea.nic.in/power_sec_reports/Executive_Summary/2007_03/6.pdf

¹⁴ Source - Ministry of New and Renewable Energy of India <http://www.windpowerindia.com/statstate.html>

¹⁵ Source – MNRE <http://www.windpowerindia.com/statest.html>



CDM – Executive Board

page 26

3	1996-97	14.56	3.95
4	1997-98	32.50	12.04
5	1998-99	45.60	1.25
6	1999-00	394.16	18.09
7	2000-01	125.60	3.75
8	2001-02	358.30	28.80
9	2002-03	806.05	55.46
10	2003-04	409.10	83.17
11	2004-05	555.40	204.55
12	2005-06	1,575.10	174.63
13	2006-07	2,397.20	265.95
14	2007-08	305.00	-
	Total	7,023.12	853.54

Source: Karnataka Renewable Energy Development Limited¹⁶**Wind Electricity generation in Karnataka**

Another relevant common practice test is the amount of wind power generation as compared to the overall electricity generation availability for Karnataka. In 2004–05, wind electricity generation in Karnataka was 489.53 GWh¹⁷ and the total electricity availability at bus-bar in the state of Karnataka was 33,523.92 GWh¹⁸. This works out to 1.45%, showing that wind energy generation is insignificant as compared to other power generation sources in Karnataka. Please note that this wind generation is for all wind projects (including CDM projects). If one were to remove the CDM wind generation from the above data, the percentage would be still lower.

Wind projects of similar scale

According to additionality tool version 04, similar project activities are those that 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. The project activity under consideration is a large scale project activity with installed capacity 34.4 MW. Similar project activity has been defined as any large scale project activity with size above 15MW and set up by a single project proponent within a particular time frame in the state of Karnataka. Small scale wind power project activities bundled together from a large scale CDM project have not been considered for the analysis as the size of these projects and the scale of investment is not comparable to the project activity under consideration.

The wind projects of similar scale commissioned in state of Karnataka at the time of investment in the project activity i.e. as on 31st December 2006 (prior to the start date of HZL's wind project) were analysed from the list of projects commissioned provided by the state energy development agency KREDL.

An analysis of the data indicate that there were only 5 projects of similar scale in the state of Karnataka and all the 5 projects have been setup considering CDM funds. Thus if we were to exclude CDM project activities from the list of projects commissioned from further analysis, **there are no other large scale project activities implemented in the state of Karnataka without CDM.**

¹⁶ http://www.kredl.kar.nic.in/docs/Yearwise_allotment_and_commissioned_wind_power_projects.xls

¹⁷ Table 3.4 titled “Gross Electrical Energy Generation (Utilities Only) Prime mover-wise, Region-wise / State-wise During 2004-05” in chapter 3 of the CEA general review 2006 available at http://www.cea.nic.in/power_sec_reports/general_review/index_general_Review.html

¹⁸ Table 5.3 titled “Statewise System Losses During 2004-05” in chapter 5 of the CEA General review 2006 available at http://www.cea.nic.in/power_sec_reports/general_review/index_general_Review.html



The identified project activities of similar scale are tabulated below:

Name of Investor	Project size (MW)	Project Size under CDM (MW)	UNFCCC Reference
VSL Mining Company (P) Ltd.,	28.7	27.5	VSL Wind power project - http://cdm.unfccc.int/UserManagement/FileStorage/1V5DW5ZJNU9BGYUL8N04SIF0NERRP4
Ramgad Minerals & Mining Pvt. Ltd.,	41.4	38.75 + 2.65 = 41.4	0315 - 125 MW wind power project in Karnataka http://cdm.unfccc.int/Projects/DB/DNV-CUK1142448670.58/view 8.35 MW wind power project at Guddarangavana Halli, Chitradurga, Karnataka in India - http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf
Nuziveedu Seeds Ltd.	32.65	27.65	0998 - NSL 27.65 MW Wind Power Project in Karnataka, India - http://cdm.unfccc.int/Projects/DB/DNV-CUK1173772302.89/view
MSPL	89.65	78.9 + 4.75 + 6.0 = 89.65	0315 - 125 MW wind power project in Karnataka - http://cdm.unfccc.int/Projects/DB/DNV-CUK1142448670.58/view 8.35 MW wind power project at Guddarangavana Halli, Chitradurga, Karnataka in India - http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf Emission free electricity generation at Harihar, Karnataka - http://cdm.unfccc.int/UserManagement/FileStorage/Q7FCFG27XNUZ6IB32EM7CTVC7KZG6R
Enercon India Limited	127.6	125.20	1259 - Enercon Wind Farm (Hindustan) Ltd in Karnataka - http://cdm.unfccc.int/Projects/DB/DNV-CUK1185356859.49/view 1291 - Enercon Wind Farms in Karnataka Bundled Project- 30.40 MW - http://cdm.unfccc.int/Projects/DB/SGS-UKL1187092432.51/view 1299 - Enercon Wind Farms in Karnataka Bundled Project- 33 MW -



			http://cdm.unfccc.int/Projects/DB/SGS-UKL1187708460.15/view 1286 - Enercon Wind Farms in Karnataka Bundled Project- 73.6 MW - http://cdm.unfccc.int/Projects/DB/SGS-UKL1186566570.26/view 0276 - Bundled wind power project in Chitradurga (Karnataka in India) managed by Enercon (India) Ltd. (16,8 MW) - http://cdm.unfccc.int/Projects/DB/DNV-CUK1140782658.34/view
--	--	--	---

It was noted that few of the project owners from above like Nuzivedu Seeds Ltd., Enercon India Limited and VSL & Sons have some other small scale installations in Karnataka are not under the CDM. However, since these installations were implemented in a different time frame at different location and not as a single project activity having size less than 15 MW, these were deemed to be incomparable to the HZL project activity.

Thus, after exclusion of the above project activities which are under CDM as stipulated by the guidance for conducting common practice analysis provided by the additionality tool, **it was found that there were no similar scale project activities under operation in the state of Karnataka.**

It is thus even more evident that the development of similar wind power projects has been heavily dependent on CDM funds.

From the above discussions the following can be concluded:

- ✓ Installed capacity of wind in India is about **15%** of its potential.
- ✓ Until March 2007, the installed capacity of wind energy in Karnataka is only about **12%** of its potential.
- ✓ Even after including CDM projects only **1.45%** of the total electricity generation in Karnataka is through wind energy sources.
- ✓ All the similar wind farm projects in Karnataka of 15 MW or more capacity undertaken by private investors **are CDM projects** indicating that implementation of wind power projects in the state of Karnataka without CDM do not exist.

The above analysis shows that:

- ✓ Wind power project development is insignificant when compared to the total installed generating capacity of the power sector as well as in terms of realisation of the total wind potential.
- ✓ Further it also shows that wind power project development is substantially dependent on CDM and non CDM wind energy generation is not widely observed and hence is not common practice.

Sub-step 4b: Discuss any similar options that are occurring:

The additionality tool states in Sub-step 4b that “*If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3).*”

On the basis of the conclusions of the analysis in Sub-step 4a, it is seen that:

- ✓ Similar activities i.e. non CDM wind projects **are not widely observed**
- ✓ Further to this **non CDM wind farm projects of project size greater than 15 MW are not present in the state of Karnataka.**

Hence as per additionality version 4 tool further analysis of step 4 (b) is not required.



The approval and registration of the proposed project activity as a CDM project would lead to annual flow of additional revenue to the project proponent for the crediting period thereby improving the returns from the project activity alleviating investment and regulatory policy risk to a certain extent. The successful registration also provides an incentive for other entrepreneurs to invest in wind power projects. Additionally the project activity leads to reduction of greenhouse gases which would have been released in the absence of the proposed project activity by the operation of fossil fuel based plants in the grid. Also the project activity leads to diversification of regional grid supply making it more sustainable in the long term. Thus the CDM revenue acts as a risk mitigation tool in overcoming barriers and imparting viability to the HZL project activity.

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 (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y$$

where the baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh).

$$BE_y = EF_y * EG_y$$

The baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps:

Step 1: Calculating the Operating Margin emission factor ($EF_{OM,y}$)

The consolidated methodology ACM0002 provides four options for calculating the operating margin, and guidance for how to choose which options for the corresponding project activity. The options are:

- a) Simple OM, or
- b) Simple adjusted OM, or
- c) Dispatch Data Analysis OM, or
- d) Average OM.

The methodology (ACM0002) relies on Dispatch data analysis as its first methodological choice, which requires hourly fuel consumption and power generation data for a set of plants falling within the top 10% of the system (grid) dispatch. To determine the set of plants it requires obtaining from national dispatch center:

- the grid system dispatch order of operation for each power plant of the system and
- the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating

For the proposed project activity, the dispatch data analysis could not be used because of lack of availability of data for conducting such an analysis in the Indian context. The Southern regional grid (and all other regional grids in India) operates as loose power pool, in which the constituent states have full operational autonomy, and the state load dispatch centers (SLDCs) have the total responsibility for scheduling/dispatching their own generation, regulating the demand of their customers, scheduling their drawal from the Inter-State Generation Stations (ISGS) within their entitlement in the respective plant's available capability), arranging any bilateral interchanges, and regulating their net drawal from the regional grid. There is no merit order dispatch prepared by the Southern Regional Load Dispatch Centre- it merely collates the drawal schedule of the SLDCs, which are restricted to ISGSs only. Further, the hourly drawal schedule prepared by the SLDCs is not publicly available. Furthermore, hourly fuel consumption data for all

generation sources is not available in public domain. In most cases, the thermal stations are paid the variable (fuel) charges based on normative station heat rate (efficiency) and not on actual efficiency. Some thermal stations may publish annual or monthly average station heat rate (efficiencies) but not hourly fuel consumed.

The choice of other options for calculating the operating margin emission factor depends on the generation of electricity from low cost/must run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

Table 8: Share of Low Cost / Must-Run (% of Net Generation)

Share of Must-Run (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.3%	42.1%	45.8%	41.8%	55.4%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Ref: CO₂ Baseline Database for the Indian Power Sector – CEA

Percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) = 21.72 %

Thus the average emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation and detailed data to apply Simple adjusted OM is not available.

The **Simple Operating Margin** can be used for the proposed project activity because low-cost/must run resources constitute less than 50% of total generation. The Simple OM emission factor can be calculated using either of the two following data vintages for year(s) y :

- (*ex-ante*) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,
- the year in which project generation occurs, if EFOM, y is updated based on *ex-post* monitoring.

The choice between *ex-ante* and *ex-post* vintage is to be specified in the PDD, and cannot be changed during the crediting period.

The Simple OM emission factor has been calculated *ex-ante* based on the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

Simple OM: The simple OM emission factor (EF_{OM, y}) is calculated as the generation weighted average emissions per electricity unit (tCO₂/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM, simple, y} = \frac{\sum_{i,j} F_{i,j,y} \otimes COEF_{i,j}}{\sum_j GEN_{j,y}}$$

where

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y , j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.



$COEF_{i,j,y}$ is the CO₂ emission coefficient of fuel i (tCO₂ / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y , and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j .

The CO₂ emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO_2,i} \otimes OXID_i$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i ,

$OXID_i$ is the oxidation factor of the fuel (2006 Revised IPCC Guidelines for default values),

$EF_{CO_2,i}$ is the CO₂ emission factor per unit of energy of the fuel i .

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated separately for the most recent three years and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,y}$).

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,y}$

The Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation weighted average emission factor (tCO₂/MWh) of a sample of power plants m , as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \otimes COEF_{i,m}}{\sum_m GEN_{m,y}}$$

Where

$F_{i,m,y}$ = quantity of fuel i used in plant m (kt/yr) in year y

$COEF_{i,m}$ = carbon emissions factor for fuel i in plant m (tCO₂/kt), taking into account the carbon content of the fuels by power sources and the percent oxidation of the fuel

$GEN_{m,y}$ = annual generation from plant j (MWh/yr) in year y

As per the methodology ACM0002, Version 06, project participants shall choose between one of the following two options. The choice among the two options should be specified in the PDD, and cannot be changed during the crediting period.

Option 1: Calculate the Build Margin emission factor $EF_{BM,y}$ *ex-ante* based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Option 2: For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated *ex-ante*, as described in option 1 above. The sample group m consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.



Of these, option 1 has been adopted. The BM emission factor will be calculated ex-ante based on the most recent information available on plants already built for sample group m of regional grid at the time of PDD submission. The sample group m consists of the 20 % of power plants supplying electricity to grid that have been built most recently, since it comprises of larger annual power generation. Further, none of the power plant capacity additions in the sample group have been registered as CDM project activities.

Step 3. Calculation of Baseline Emission Factor EF_y

Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} EF_{OM,y} + w_{BM} EF_{BM,y}$$

Where the weights w_{OM} and w_{BM} , by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO₂/MWh.

For wind and solar projects, the default weights are as follows: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature).

The Central Electricity Authority has calculated the baseline emission factors using the approved methodology ACM0002, for the 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 conservativeness¹⁹. Further the updated Version (i.e. Version 3.0) of the CO₂ Baseline Database for the Indian Power Sector has been used, as it is more conservative than the earlier version and includes the most recent data available for emission factor computation.

Project activity emissions

According to the chosen baseline methodology ACM0002, for wind energy based renewable energy project activities, $PE_y = 0$.

Leakage

According to ACM0002, the main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using ACM0002 shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. Thus the leakage emissions are nil.

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

(Copy this table for each data and parameter)

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO ₂ /MWh
Description:	Operating Margin emission factor for Southern regional grid
Source of data used:	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 3.0.
Value applied:	1.004 tCO ₂ /MWh
Justification of the choice of data or	CEA has Calculated it as per ACM0002 with 3years vintage data (2004-05, 2005-06 and 2006-07) and option of ex ante calculation based on Simple

¹⁹ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



CDM – Executive Board

page 33

description of measurement methods and procedures actually applied :	Operating Margin Method. Computed once during PDD finalization.
Any comment:	This data will be archived for 2 years beyond the crediting period.

Data / Parameter:	EF_{BM,v}
Data unit:	tCO ₂ /MWh
Description:	Build Margin emission factor for Southern regional grid
Source of data used:	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 3.0.
Value applied:	0.7054 tCO ₂ /MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	CEA has Calculated it as per ACM0002 for the year 2005-06. The build margin is calculated in this database as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation and option of ex ante calculation. Computed once during PDD finalization.
Any comment:	This data will be archived for 2 years beyond the crediting period.

Data / Parameter:	EF_y
Data unit:	tCO ₂ /MWh
Description:	Combined Margin CO ₂ emission factor for Southern regional grid
Source of data used:	Estimated figure based on 75% of OM and 25% of BM values, Version 3.0.
Value applied:	0.9293 tCO ₂ /MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	CEA has calculated it as per ACM0002 with 3years vintage data and option of ex ante calculation based on “75% of OM and 25% of BM values approach. Computed once during PDD finalization.
Any comment:	This data will be archived for 2 years beyond the crediting period.

B.6.3 Ex-ante calculation of emission reductions:

>>

Installed Capacity (MW)
= 34.4

Number of WEGs
= 43

Capacity of individual WEG (MW)
= 0.8

PLF
= 24.97 %

Number of days of operation
= 365

Total number of hours of operation in an year
= 8760



CDM – Executive Board

page 34

Gross Generation of one WEG in an year (MWh)
= 1750 MWh

Gross Generation from 43 WEG in an year (MWh)
= 1750 x 43
= 75250 MWh

Net Losses @ 7% of gross generation (MWh)
= Losses due to machine consumption, transformer and transmission
= 7% of gross generation
= 5267.5 MWh

Net Generation from the project (MWh) - EG_y
= (Gross Generation – Net Losses)
= 75250 – 5267.5
= 69982.5 MWh

Baseline emission factor (Combined Margin) Southern region grid (tCO₂/MWh) - EF_y

$$EF_y = w_{OM} EF_{OM,y} + w_{BM} .EF_{BM,y}$$

$$= [0.75 \times \{(1.001+1.008+1.003)/3\} + (0.25 \times 0.71)]^{20}$$

$$= (0.75 \times 1.004) + (0.25 \times 0.71)$$

$$= 0.7530 + 0.1764$$

$$= \mathbf{0.9293 \text{ tCO}_2/\text{MWh}}$$

Baseline emissions (tCO₂)

$$BE_y = EG_y \times EF_y$$

$$= 69982.5 \times 0.9293$$

$$= 65036 \text{ tCO}_2$$

Project emissions (PE_y)

$$= 0 \text{ tCO}_2$$

Leakages (L_y)

$$= 0 \text{ tCO}_2$$

Emission reductions (tCO₂)

$$ER_y = BE_y - PE_y - L_y$$

$$= 65036 - 0 - 0$$

$$\mathbf{65036 \text{ t CO}_2}$$

Particulars	2008	2009	20010	2011	2012	2013	2014
Baseline emission factor (tCO ₂ /MWh)	0.929	0.929	0.929	0.929	0.929	0.929	0.929
Net Generation from the project (MWh)	69982	69982	69982	69982	69982	69982	69982
Baseline emissions (tCO ₂)	65036	65036	65036	65036	65036	65036	65036
Project activity emissions (tCO ₂)	0	0	0	0	0	0	0
Leakage (tCO ₂)	0	0	0	0	0	0	0
Emission reductions (tCO ₂)	65036	65036	65036	65036	65036	65036	65036

²⁰ CO₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 2.0.

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

>>

Year	Estimation of Project activity emissions (tonnes of CO ₂ e)	Estimation of Baseline emissions (tonnes of CO ₂ e)	Estimation of Leakage (tonnes of CO ₂ e)	Estimation of overall emission reductions (tonnes of CO ₂ e)
2008-09	0	65,036	0	65,036
2009-10	0	65,036	0	65,036
2010-11	0	65,036	0	65,036
2011-12	0	65,036	0	65,036
2012-13	0	65,036	0	65,036
2013-14	0	65,036	0	65,036
2014-15	0	65,036	0	65,036
TOTAL	0	455,252	0	455,252

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

>>

B.7.1 Data and parameters monitored:*(Copy this table for each data and parameter)*

Data / Parameter:	EG _y
Data unit:	MWh/yr
Description:	Net Quantity of Electricity supplied to KPTCL facility
Source of data to be used:	Calculated from Joint Meter Reading Sheets
Value of data applied for the purpose of calculating expected emission reductions in section B.5	69,982.5 MWh/yr
Description of measurement methods and procedures to be applied:	Net electricity generated will be calculated from the readings of electricity exported to the grid and electricity imported from the grid indicated by the main meter connected to the incoming feeder of KPTCL. The Delivered Energy shall be metered by the Parties at the high voltage side of the step up transformer installed at the Receiving Station. The electricity generated by the Project shall be metered by the Parties at the high voltage side of the step up transformer installed at the Project Site. The WEGs of a single customer (HZL in this case) at a particular site are connected to a Vacuum Circuit Breaker metering yard (VCB) which in turn connects to a feeder that ultimately leads to the shared main KPTCL meter at the substation maintained by Enercon India Limited. Data monitoring takes place at the VCB metering yard and WEG (through SCADA system). The electricity metered at the KPTCL meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the VCB end. The emission reduction calculations are done on the basis of the KPTCL Main meter reading.
QA/QC procedures to be applied:	Annual calibration of all the meters will be undertaken and faulty meters will be duly replaced immediately. The KPTCL meter will be calibrated once in an year or as and when required.
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, Export}
Data unit:	MWh
Description:	Quantity of Electricity exported to KPTCL facility
Source of data to be used:	Joint meter reading sheets
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This data will be used to arrive at the net electricity exported to the grid.
Description of measurement methods and procedures to be applied:	Electricity exported to KPTCL will be measured at the main meter connected to the incoming feeder of KPTCL. The Delivered Energy shall be metered by the Parties at the high voltage side of the step up transformer installed at the Receiving Station. The electricity generated by the Project shall be metered by the Parties at the high voltage side of the step up transformer installed at the Project Site. The WEGs of a single customer (HZL in this case) at a particular site are connected to a Vacuum Circuit Breaker metering yard (VCB) which in turn connects to a feeder that ultimately leads to the shared main KPTCL meter at the substation maintained by Enercon India Limited. Data monitoring takes place at the VCB metering yard and WEG (through SCADA system). The electricity metered at the KPTCL meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the VCB end. The emission reduction calculations are done on the basis of the KPTCL Main meter reading.
QA/QC procedures to be applied:	Annual calibration of all the meters will be undertaken and faulty meters will be duly replaced immediately.
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:	Quantity of Electricity imported from KPTCL
Source of data to be used:	Joint meter reading sheets
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This data will be used to arrive at the net electricity exported.
Description of measurement methods and procedures to be applied:	Electricity imported from KPTCL will be measured at the main meter connected to the incoming feeder of KPTCL. The Delivered Energy shall be metered by the Parties at the high voltage side of the step up transformer installed at the Receiving Station. The electricity generated by the Project shall be metered by the Parties at the high voltage side of the step up transformer installed at the Project Site. The WEGs of a single customer (HZL in this case) at a particular site are connected to a Vacuum Circuit Breaker metering yard (VCB) which in turn connects to a feeder that ultimately leads to the shared main KPTCL meter at the substation maintained by Enercon India Limited. Data monitoring takes place at the VCB metering yard and WEG (through SCADA system). The electricity metered at the KPTCL meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the VCB end.



CDM – Executive Board

page 37

	The emission reduction calculations are done on the basis of the KPTCL Main meter reading.
QA/QC procedures to be applied:	Annual calibration of all the meters will be undertaken and faulty meters will be duly replaced immediately.
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 _{WEG}
Data unit:	kWh
Description:	Electricity generated by each WEG
Source of data to be used:	Daily generation reports provided by Enercon India Limited
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This data is not used for the calculation of emission reductions per say but would act as a backup data for the net electricity generated.
Description of measurement methods and procedures to be applied:	Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm through communication cables (SCADA system). The generation data of individual WEG can be monitored as a real-time entity at CMS. This data for each individual WEG will be recorded daily.
QA/QC procedures to be applied:	Annual calibration of all the meters will be undertaken and faulty meters will be duly replaced immediately.
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. This data will be maintained by HZL in electronic form.

Data / Parameter:	EG _{VCB}
Data unit:	kWh
Description:	Electricity generation recorded at the Vacuum Circuit Breaker (VCB)
Source of data to be used:	Daily generation reports provided by Enercon India Limited
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This data is not used for the calculation of emission reductions per say but would act as a backup data for the net electricity generated. This data will also be recorded daily.
Description of measurement methods and procedures to be applied:	The individual WEGs at a particular site connect to a meter at the VCB end where the secondary metering is done and reported in the daily generation report.
QA/QC procedures to be applied:	Annual calibration of all the meters will be undertaken and faulty meters will be duly replaced immediately.
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. This data will be maintained by HZL in electronic form.

B.7.2 Description of the monitoring plan:

>>



The monitoring plan is being devised as per approved consolidated monitoring methodology ACM0002 - **“Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources”**.

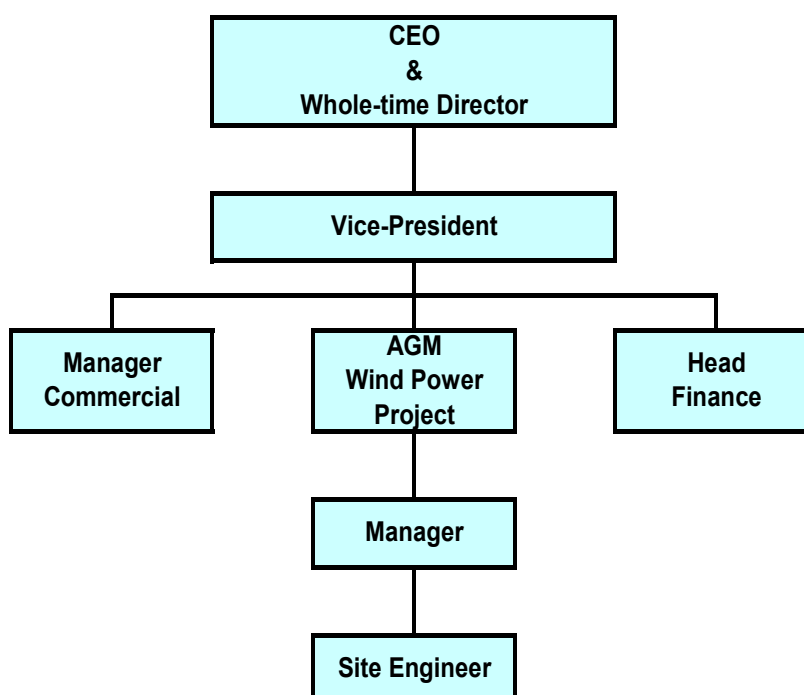
The methodology requires monitoring of the following parameters:

- Electricity generation from the proposed project activity;
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002);
- Data needed to recalculate the build margin emission factor, if needed, consistent with “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”(ACM0002);

For the project activity to establish its creditable emission reduction, it has to record the actual electricity generation, which would displace equivalent units of electricity at the operating and build margin of the grid. Since the simple OM emission factor is calculated based on a 3 year average, based on the most recent statistics available at the time of PDD preparation, its updation based on ex post monitoring is not required. For BM calculation, option 1 (refer ACM 0002) has been chosen, which is calculated ex ante based on the most recent information, hence its monitoring is also not required. Hence, under the monitoring protocol for the project it is required to: Monitor and record the electricity generated and exported by the wind farm to the regional grid.

To ensure trouble free operations and efficient generations through all the wind turbines, HZL has entered into a comprehensive Operation and Maintenance agreement with the manufactures of the turbines for a period of 10 years. The contractor EIL, under the O&M contract with HZL would be responsible for the operation and maintenance of the project activity for the entire crediting period.

The authority and responsibility of project management as well as registration, monitoring, measurement and reporting lies with Hindustan Zinc Limited. HZL has formulated a Project Team to ensure proper and continuous monitoring of the performance of turbines and generation of power. The same has been outlined as follows:



The O&M personnel are qualified engineers and are trained at the WEG manufacturing facility of Enercon India Limited at Daman for operating and ensuring best performance of the WEGs.

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) with KPTCL.

- 1. Metering:** The Delivered Energy shall be metered by the Parties at the high voltage side of the step up transformer installed at the Receiving Station. The electricity generated by the Project shall be metered by the Parties at the high voltage side of the step up transformer installed at the Project Site. The WEGs of a single customer (HZL in this case) at a particular site are connected to a Vacuum Circuit Breaker metering yard (VCB) which in turn connects to a feeder that ultimately leads to the shared main KPTCL meter at the substation maintained by Enercon India Limited. Data monitoring takes place at the VCB metering yard and WEG (through SCADA system). The electricity metered at the KPTCL meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the VCB end. The emission reduction calculations are done on the basis of the KPTCL Main meter reading.
- 2. Metering Equipment:** Metering equipment shall be electronic trivector meters of accuracy class 0.2% required for the Project (both main and check meters). The main meter shall be installed and owned by the Company, whereas check meters shall be by the Corporation. Dedicated core of both CT's and PT's of required accuracy shall be made available by the Company to Corporation. The metering equipment shall be maintained in accordance with electricity standards. Such equipment shall have the capability of recording half-hourly and monthly readings. The Company shall provide such metering results to the Corporation. The meters installed shall be capable of recording and storing half hourly readings of all the electrical parameters for a minimum period of 35 days with digital output.
- 3. Meter Readings:** The monthly meter readings (both main and check meters) at the Project Site and the Receiving Station shall be taken simultaneously and jointly by the Parties on the first day of the



following month at 12 Noon. The recorded metering data shall be downloaded through meter recording instrument.

4. **Inspection of Energy Meters:** All the main and check energy meters (export and import) and all associated instruments, transformers installed at the Project shall be of 0.2% accuracy class. Each meter shall be jointly inspected and sealed on behalf of the Parties and shall not be interfered with by either Party except in the presence of the other Party or its accredited representatives.
5. **Meter Test Checking:** All the main and check meters shall be tested for accuracy every calendar quarter with reference to a portable standard meter which shall be of an accuracy class of 0.1%. The portable standard meter shall be owned by the Corporation at its own cost and expense and tested and certified at least once every year against an accepted laboratory standard meter in accordance with electricity standards. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2% accuracy class. The consumption registered by the main meters alone will hold good for the purpose of billing as long as the error in the main meter is within the permissible limits.
 - a. If during the quarterly tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then billing will be as per the main meter as usual. The check meter shall, however, be calibrated immediately.
 - b. If during the quarterly tests, the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible limits of error, then the billing for the month upto the date and time of such test shall be as per the check meter. There will be a revision in the bills for the period from the previous calibration test upto the current test based on the readings of the check meter. The main meter shall be calibrated immediately and billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
 - c. If during the quarterly tests, both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the meters shall be immediately calibrated and the correction applied to the reading registered by the main meter to arrive at the correct reading of energy supplied for billing purposes for the period from the last month's meter reading upto the current test. Billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
 - d. If during any of the monthly meter readings, the variation between the main meter and the check meter is more than that permissible for meters of 0.2 % accuracy class, all the meters shall be re-tested and calibrated immediately
6. **Records:** O&M Contractor Enercon will maintain an accurate and up-to-date operating log at the wind farm site with records of:
 - a. Hourly logs of real and reactive power generation, frequency, transformer tap position, bus voltage(s), Main meter and Back up meter readings and any other data mutually agreed.
 - b. Any unusual conditions found during operation/inspections
 - c. Chart and printout of event loggers, if any, for system disturbances/outages
 - d. All the records will be preserved for 2 years beyond the crediting period.
7. The billing will be on monthly basis. The KPTCL will be billed by HZL based on statement given by SLDC at the end of each month for the energy supplied.

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 completing the final draft of this baseline section (DD/MM/YYYY):

25/06/2007

Name of person/entity determining the baseline:



CDM – Executive Board

page 41

Hindustan Zinc Limited has determined the baseline for the project activity. The entity is a project participant listed in Annex-I where the contact information has also been provided.

**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:**

>>

31/01/2007

Date of contract agreement between HZL and Enercon India Limited. This activity is considered as real action.

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

>>

20 years, 0 months

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

>>

01/06/2008

HZL hereby 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 and 0 months

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

>>

Not chosen

C.2.2.2. Length:

>>

Not chosen

**SECTION D. Environmental impacts**

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

According to Indian 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 September 14, 2006 regarding the requirement of Environment Impact Assessment (EIA) 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) 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 required. The project activity has no significant impact on the environment. However, certain foreseen impacts due to the project activity are discussed below:

During construction*Impact on air*

Movement of construction material during construction will have some impact on the air. As the transportation is quite less for the project activity, the impacts will be negligible.

Impact on water

Not much water discharge takes place during construction. However proper sanitary arrangements were provided by project proponents.

Impact on Land use

The land on which the project activity takes place is largely unproductive. Prior to the project activity, most of the land had no beneficial use. The project proponents had bought the land for a worthwhile application and obtained necessary approvals for installation of windmills. No dislocation of people is involved in the course of the project activity.

Impact due to noise

Personal protective equipments were provided to workers involved in the construction activity to mitigate the effects of noise pollution, but they have no impact on ambient noise level.

Taking into consideration the project life cycle, the magnitude of the impacts during the construction phase is negligible and exists for a temporary period of time till the end of construction phase. Therefore, it would not effect the environment considerably. The impacts on the environment due to construction activities of wind turbines are negligible

Operation and Maintenance Phase

Enercon maintains highest level of safety standards. Systematic and scientific maintenance of all equipments has been undertaken to ensure the best safety standards.

Impact on air

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

Impact on water

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

Impact on ecology

There are no known migratory birds/endangered species in the region of project activity. Therefore no harm on the ecological environment is envisaged.

*Impact due to noise*

Noise is generated due to the movement of rotor blades. Noise is very much below the regulatory norms. It has no direct effect on the population, as the area is less populated and noise generated will be attenuated by ambient conditions. The considering the overall impact of the project in reducing GHG's, creation of employment etc., makes this effect negligible.

Socio-Economic Impacts

There is no inconvenience to the local community due to the transmission lines. The locals have benefited economically through land sales. The project activity helps up-liftment of skilled and unskilled manpower in the region. The project will be providing employment opportunities not only during the construction phase, but also during its operational lifetime. 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.

Conclusion

The net impact under environmental pollution category would be positive as all necessary abatement measures would be adopted and periodically monitored. The project activity does not have any major adverse impacts on environment during its construction or operational phase. The human interest parameters would show positive impacts due to increased job opportunities at the facility as well as other ancillary units coming up.

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:

>>

As discussed above, the project activity would not have any adverse environmental impacts. The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. Hence EIA is not required to be undertaken by the host party.

**SECTION E. Stakeholders' comments**

>>

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

>>

HZL wind farm project is located at district Gadag in the state of Karnataka. The stakeholders are defined as the public, including individuals, groups or communities, affected, or likely to be affected, by the proposed CDM project activity. The local stakeholders identified for the proposed project activity are as follows:

1. Local villagers and representatives of village governing body
2. Ministry of new and renewable energy sources
3. Supplier of WEG
4. Karnataka Renewable Energy Development Limited
5. Karnataka Power Transmission Corporation Limited (KPTCL)
6. Operation and Maintenance staff of Enercon India Limited
7. Representatives of Non governmental organisation
8. Ministry of Environment and Forests

Local villagers and representatives of village governing body

The varied sections of the local population, village panchayat local elected body of representatives administering the local area are a true representative of the local population in a democracy like India. Hence, their consents / permissions to set the project are necessary. HZL had organised a stakeholder consultation meeting with them on 29th May 2007 at Hotel Ananth Residency in order to inform them on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity.

Ministry of new and renewable energy sources

The government of India, through Ministry of new and renewable energy sources, has been promoting energy conservation, demand side management and renewable energy projects including wind, small hydro and hydro / bio-mass power. HZL's effort in implementing the wind power project is in line with the goals and targets of the said Ministry and hence supported by them.

Karnataka Renewable Energy Development Limited

KREDL is the principal agency in Karnataka responsible for development of renewable energy sources in the state. HZL has obtained permission from KREDL for setting up the wind power project. KREDL is also responsible for transfer of wind farm from Enercon to HZL.

Supplier of WEGs

Enercon India Ltd. is the supplier of WEGs and is also responsible for the operation and maintenance of the HZL project activity.

Karnataka Power Transmission Corporation Limited (KPTCL)

KPTCL will issue an interconnection approval and at a later stage will be providing the commissioning certificate when all the WEGs are commissioned.

Electricity Supply Company (ESCOM)

HZL is in the process of signing a power purchase agreement with ESCOM for selling the units generated from the project activity at a price fixed by the ESCOM according to the power purchase agreement.

Designated National Authority - Ministry of Environment & Forest (MoEF), Government of India

The Ministry of Environment & Forests is the Designated National Authority in India. The government of India, through Ministry of Environment and Forests (MoEF) is encouraging project participants to take up such Climate Change initiatives. HZL will be submitting the Project Concept Note and Project Design



Document to the MoEF for Host Country Approval.

Identified stakeholders were invited personally by HZL representatives; a week ahead of the meeting and the turn out was approximately 40 on the day of the meeting.

E.2. Summary of the comments received:

>>

The project activity is environmentally benign and there are no perceived negative impacts on the environment (Indeed the project activity has many positive impacts on environment). Moreover, the project activity contributes to social upliftment by providing direct and indirect employment benefits to the local populace. There was appreciable participation from the audience and they got clarified on the various queries they had about the Kyoto protocol and CDM cycle. In totality they lauded HZL's concern for the environment and their efforts in developing the project activity as a CDM project activity. In an open house session that followed the presentation, the Superintending Engineer of Karnataka Power Transmission Limited Mr. R.P. Chavate gave a detailed lecture on the power scenario in India (deficit status of Karnataka), subsidies, energy theft and contribution of renewables in capacity additions to the grid. Further, Mr. Chavate enlightened the audience on transmission losses, significance of CDM and benefits that would accrue, once the project activity is in place. All the stakeholders encouraged the upcoming of the project activity and provided their responses in writing in the questionnaires provided to them.

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

>>

No negative comments were raised by the local stakeholders, infact the stakeholders appreciated the initiative of HZL towards clean electricity generation and strengthening of local grid.

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

Organization:	Hindustan Zinc Limited
Street/P.O.Box:	--
Building:	Yashad Bhawan
City:	Udaipur
State/Region:	Rajasthan
Postfix/ZIP:	313004
Country:	India
Telephone:	+91 294 2420813-15
FAX:	+91 294 2427752
E-Mail:	naveen.singhal@vedanta.co.in
URL:	www.vedantaresources.com
Represented by:	Mr. Naveen Kumar Singhal
Title:	Vice President - Commercial
Salutation:	Mr.
Last Name:	Singhal
Middle Name:	Kumar
First Name:	Naveen
Department:	Wind Power Project
Mobile:	+91- 9829040936
Direct FAX:	+91 294 2427752
Direct tel:	+91 294 2427715
Personal E-Mail:	naveen.singhal@vedanta.co.in



Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the proposed project activity. The total investment in the wind farm has been accrued from internal sources.



Annex 3

BASELINE INFORMATION

The Central Electricity Authority (CEA) under the Ministry of Power, Government of India, has estimated the Combined Margin emission factor for the Southern grid, the details of which are available on the following website.

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

The procedures and formulas used for estimation of the baseline factor and the assumptions made have also been detailed in there.



Annex 4

MONITORING INFORMATION

The monitoring plan has been already explained in section B.7.2. Furthermore a CDM manual has been prepared outlining all the responsibilities and procedures related to monitoring of emission reductions in the CDM project activity.

**Annex 5****CERC Benchmark**

The project at the requesting registration stage was analysed with a 16% benchmark as prescribed by CERC and KERC. The explanation for this benchmark that was provided in the earlier version of the PDD was that post tax equity IRR is used as the appropriate financial indicator because in Indian power sector, the post tax equity return is an established benchmark for projects in public or private sector based on cost plus regulations prescribed by Central Electricity Regulatory Commission (CERC) that is mandated by the statute of Electricity Act 2003 to set the terms and conditions for determination of tariff for electricity generation, transmission and distribution activities. The CERC in its order dated 2nd January 2004 has specifically stated that a post tax equity return of 16% can be considered as appropriate for Independent Power Producers (IPPs). Incentives, foreign exchange variations and efficiency in operations are in addition to this benchmark of 16%. In India the tariff is set on a principle that allows the power generator a full cost recovery plus a required rate of return. This required rate of return is the post tax return on equity, the value for this is determined by the state electricity regulatory commissions, guided by the CERC regulations. The Karnataka Electricity Regulatory Commission has considered a 16 % post tax equity IRR as the benchmark equity return for non conventional energy based power projects in private sector (Source: Karnataka Electricity Regulatory Commission (KERC) order, dated 18th January 2005). The same is used as benchmark for comparison with the equity IRR of the proposed project activity as the regulatory commissions provide a very reliable, thorough and transparent basis for the benchmark returns.

However subsequently the project was taken under request for review and the PP and DOE were asked to provide further clarification (a) the choice of the benchmark and (b) whether 16% return on equity is applicable for renewable energy and/or non-renewable energy projects or not.

To this the PP had provided clarification along with alternate benchmarks, which the EB had accepted and agreed to register the project if the same was incorporated in the PDD.

The following was the clarification provided for the CERC benchmark.

The proposed project activity was submitted for request for registration to the CDM Executive Board on 23/04/2008 and the confirmation for the processing of registration fee was received on 02/05/2008. The EB 40 was held on 15/06/2008 till 17/06/2008. Further the project was webhosted under request for registration on 13/08/2008 till 09/10/2008.

Thus, the proposed CDM project activity was submitted to the CDM EB before the EB guidance against the acceptability of the CERC based benchmark of 16% came into place (EB 40). Till then, there was no guidance regarding the consideration of this benchmark. However, in view of the EB's guidance, the PP has provided justification with regards to the following

- a) Justification as to how does the KERC benchmark fit in accordance with the considerations to be made while using the benchmark as provided in the Guidance on investment analysis and also the Additionality tool
- b) Justification on the appropriateness of the benchmark inspite of it being applicable for both CDM and non CDM project
- c) Comparison of the equity IRR with other benchmarks.

Choice of Benchmark

The following is an extract from the para 40 of the EB 40 meeting report,



“The Board noted that many proposed CDM project activities in the energy sector in India seek to demonstrate additionality by means of investment analysis applying a benchmark of 16%, which is based on tariff orders published in accordance with the Central Electricity Regulation Commission. The Board is concerned with the use of this value as a benchmark for proposed CDM project activities, as this value is used in tariff determination for CDM projects and for non-CDM projects. Therefore the Board is of the view that this value is not a suitable benchmark”

In context of the above EB guidance, the EB is of the view that the Return on Equity of 16% as set by the **Central Electricity Regulatory Commission (CERC)** is not a suitable benchmark. However, in the present proposed CDM project, the benchmark used is as set by the **State Electricity Regulatory Commission of Karnataka i.e. KERC** in its tariff order formulated exclusively for non-conventional sources of power (and specifically for wind power) dated 18th January 2005.

HZL is vertically integrated enterprise with its operations being limited to exploration, mining, ore processing to smelting of non-ferrous metals. The proposed project activity is a diversification of mainstream business of HZL into wind power sector economics. This is a part of the first project activity being undertaken by HZL with the intention of diversification into wind power exporting the generated electricity from its wind farm to the regional electricity system.

EB Guidance on selection of Benchmarks

The project activity is such that it could have been developed by any entity other than the project participant as well. As per the guidance on the investment analysis issued by the EB, for such project activities, a benchmark determined by relevant national authorities should be used and should also be such that it can be validated by a DOE. The excerpts from the guidance on the assessment of investment analysis are reproduced below:

“In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on publicly available data sources which can be clearly validated by the DOE. Such data sources may include local lending and borrowing rates, equity indices, or benchmarks determined by relevant national authorities.”

This guidance, however, does not detail the considerations for setting up the benchmark and hence the additionality tool has been used as the reference for further guidance. The additionality tool states that benchmark used should represent standard returns in the market, considering specific risk of the project type, but should not be linked to the subjective profitability expectation or risk profile of a particular project developer.

In India, activities in the electricity sector such as generation, distribution, transmission and trading of power come under the purview of a comprehensive legislation called the Electricity Act 2003 (EA 2003)²¹. As per the EA 2003, the power to determine the tariff relating to generation, transmission and distribution of electricity is vested with the Electricity Regulatory Commissions. One of the provisions laid down by the Electricity Act for tariff determination under section 61(d) is “*safeguarding of consumers' interest and at the same time, recovery of the cost of electricity in a reasonable manner*”. Apart from this the act under section 61 (c) also requires that the commissions take into account “*the factors which would encourage competition, efficiency, economical use of the resources, good performance and optimum investments*”.

The EA 2003 required the Government of India to prepare a national electricity policy and a national tariff policy which was to act as guidance for the state electricity regulatory authorities for framing of tariffs for their respective states. In compliance with EA 2003, the government of India issued the National electricity

²¹ <http://www.cercind.gov.in/08022007/Act-with-amendment.pdf>



policy in the year 2005²². The policy required offering investors a rate of return on investment based on a clear understanding and evaluation of the risks and opportunities involved in the sector in order to attract investment in the sector (refer section 5.8.4 of the policy). At the same time, the policy also requires maintenance of an appropriate balance between the interests of the consumers and the need for investment while choosing the appropriate return on investment (section 5.8.4). The National Tariff policy, issued subsequently in the year 2006, also stated similar requirements for consideration while calculating tariffs.

The discussion in the above two paragraphs shows that the tariff setting is done on the basis of a rate of return on investment that is conservative (safeguard's the interest of consumers) and at the same time is specific for investment in the sector considering the risks and opportunities involved in the sector.

It should be kept in mind that the applicable tariff for the wind power project has been set by the State Electricity Regulatory Commission (KERC). The project proponents have therefore looked at the approach adopted by KERC while determining the appropriate benchmark for the project.

Tariff setting process of KERC

The KERC undergoes a thorough, transparent and detailed process of consultation with the public known as the public hearing process while setting the generation tariffs for wind power projects. This public hearing process takes into account the views of all the stakeholders of the wind power projects representing the interest of the IPPs, the consumers and the government. KERC sets the tariff for wind energy projects on a cost plus return on equity basis.

Each of the parameters that impact the tariff (i.e. all the costs and the return on equity) is discussed in this consultation and relevant data in relation to each parameter is obtained from the various stakeholders. The regulatory commission goes through this extensive public process and using the various cost parameters, the key operating parameters and the required rate of return (post tax equity return), it establishes the tariff for wind energy generation by aggregating the costs (including required rate of returns) and dividing by the expected generation from the wind projects. The regulatory commission while choosing the appropriate values for different parameters also carries out its mandate as striking a balance between the consumers' interests and generator's interests. Clearly, the regulatory commission cannot allow any generator to make excess profits at the expense of the consumers and as the tariff is set *ex ante* based on various parameters, the parameters themselves are chosen on a reasonable basis (lower benchmark rate of return for equity, higher benchmark for plant load factor/expected generation, etc.) so as to lead to a conservative per unit generation tariff.

From the above discussion it is evident that:

- a) the benchmark has been set by a relevant and authorized national authority (KERC), and has also been validated by a DOE,
- b) it represents the standard returns in the market taking into account the risks and opportunities in the power sector (by the help of the consultative process for choosing various parameters) and;
- c) is not linked to the subjective profitability expectation or risk profile of the project developer (as the KERC determines the benchmark keeping in view that consumers interest).

Keeping in mind the above discussion and that the benchmark applied meets the requirements of the guidelines issued by the EB for benchmark analysis; the same was chosen as the appropriate benchmark for the project activity.

Applicability of the benchmarks for both CDM as well as non CDM projects:

As explained in the additionality tool the benchmark should be based on the standard returns in the market taking into account the characteristics of the project type. The standard returns in the market for a project type will be a value that would be applicable to the project type (in this case wind energy projects), which

²² http://powermin.nic.in/indian_electricity_scenario/national_electricity_policy.htm



includes both CDM as well as non CDM. Hence, although the benchmark is applicable for CDM as well as non CDM projects, the benchmark still can be deemed appropriate as per the EB's guidelines and the additionality tool.

The national authority does not make a distinction between CDM and non CDM projects. The benchmark considered is applicable for both CDM as well as non CDM projects and the tariff is designed to provide the investors with the required rate of return. However, there is an essential distinction between CDM and non CDM projects which has been explained in the subsequent paragraphs.

The tariff determined for wind power projects is based on cost plus approach wherein, the tariff is not set on a project to project basis. A single tariff is made applicable for all the wind power projects implemented over a period of years. While determining tariff, multiple assumptions with respect to the incurrence of the operational and implementation cost for the project activity are made by the state electricity regulatory commission. Assumptions on the different parameters including capital cost, operating cost, means of finance, plant load factor, etc. are made, to arrive at the tariff that would provide a costs plus post-tax equity return. The commission in an attempt to not allow any generator to make excess profits at the expense of the consumers sets the tariff based on the various parameters, which are chosen on a conservative basis (lower capital costs, higher plant load factor/expected generation, etc.) so as to lead to a conservative per unit generation tariff.

The above discussion shows that the tariff for all wind projects is fixed ex ante based on conservative assumptions made by the KERC relating to a typical wind power plant, any incidents of variations (as compared to the KERC assumed values) in capital costs, financing costs and structures, operating costs, etc. are borne by the individual wind power projects. An investor would get the desired rate of return only if all the project parameters are exactly same as the assumptions made by the KERC or if positive assumptions exactly offset the negative ones. Therefore even though this benchmark rate of return is considered in setting this single wind energy generation tariff, the expected return of equity of the individual wind projects would obviously differ from the benchmark equity rate of return. In this project the values of various parameters such as capital costs, means of finance etc, vary considerably as compared to the commission's assumptions and hence the equity return is not equal to the benchmark return.

The commission's assumptions can be referred in the KERC tariff order dated 18 January 2005, *In the matter of Determination of Tariff in respect of Renewable Sources of Energy*. When we compare the parameters taken by KERC for computation of tariff (fixed tariff of INR 3.40 per unit with no escalation set at 16% ROE) and the actual project parameters, it is seen that KERC assumes the capital cost for wind projects to be INR 4.25 crores per MW whereas for the project under consideration, the capital cost is INR 4.88 Crores per MW.

As can be seen, the per MW capital cost assumption taken by KERC is extremely conservative and the actual cost per MW of the project activity is much higher than the KERC assumption. For the development of such project activities (like HZL's), which have higher costs than the KERC's assumptions, CDM funds would need to be considered by the project developers as an additional source of revenue, for the project to attain the benchmark returns. On the other hand, if a project had parameters exactly similar to the assumptions made by KERC, the tariff set would have given them the benchmark returns even without CDM revenue.

Thus, though the benchmark for a CDM and a non CDM project would be the same. However non CDM projects may be able to generate the desired rate of return through the sale of electricity alone while CDM projects need to generate additional source of revenue by sale of CERs to make the project financially feasible. The benchmark set by the National Authorities does not make any distinction between CDM and non-CDM projects. However, projects which are unable to meet the benchmark with sale of electricity alone can proceed ahead with the setting up of the project considering CDM funds.

Applicability of the benchmark for Renewable sources



The benchmark considered for the project activity is the 16% ROE set by the KERC in its order specifically issued for renewable energy projects. The order is titled “In the matter of Determination of Tariff in respect of Renewable Sources of Energy”. After taking into account the views of various stakeholders of renewable energy projects, the order states that “to promote investments in projects of renewable sources of energy, the Commission decides that the ROE shall be 16%”. This is the return on investment that has been taken for setting tariff for wind and other renewable energy generation sources. It is in the context of this order (which is exclusive for renewable energy projects) that the benchmark ROE number was set and hence the KERC benchmark taken for this project is applicable to renewable energy projects.

Further substantiation of the required return on equity:

Return recommended by ENVIS Centre of Renewable Energy and Environment - TERI

The Energy Resources Institute of India (TERI), a Government of India ENVIS (Environmental Information System) Centre for Energy and Environment in the year 2005-06 issued a report “Wind Energy Information” which discussed extensively about the basics of wind energy, the processes involved in setting up of a wind project, the advantages with respect to sustainability, global status of renewable energy, wind energy development in India and various other aspects. As a part of its extensive study on wind energy generation in India, TERI has also studied the cost of wind power and has recommended a rate of return higher than the 16%²³ that was being offered by the government of India.

The extract from the publication is reproduced verbatim ‘As per Govt. of India guidelines for Private Sector participation it (return on equity) should be minimum 16% though a higher return may be justified in view of uncertainties involved in wind flow pattern.’

ENVIS²⁴ program was started by the Government of India to provide environmental information to decision makers, policy planners, scientists and engineers, research workers, etc. all over the country and has specific centres that are responsible for research on different sectors. TERI is the regional ENVIS centre for Renewable Energy and Development. The benchmark recommended by TERI can be validated by the DOE and does not represent the subjective expectations of private investors as well.

The above account substantiates the choice of 16% benchmark as stipulated by the KERC against comparison with the equity IRR of the project activity under consideration.

However, we have also assessed the additionality of the project using other benchmarks available with the project proponent in accordance with the Additionality Tool. These have been mentioned in Sub Step 2(b) of section B5 of the PDD and the project has now been analysed vis a vis the new benchmark.

²³ Wind Energy Information 2005/2006 by TERI- ENVIS centre on Renewable Energy and Environment

²⁴ ENVIS due to its comprehensive network has been designed as the National Focal Point (NFP) for INFOTERRA, a global environmental information network of the United Nations Environment Programme (UNEP). In order to strengthen the information activities of the NFP, ENVIS was designated as the Regional Service Centre (RSC) of INFOTERRA of UNEP in 1985 for the South Asia Sub-Region countries.



Appendix 1

List of Abbreviations

ABT	Availability Based Tariff
ACM	Approved Consolidated Baseline Methodology
BE	Baseline Emissions
BM	Build Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CM	Combined Margin
CUF	Capacity Utilisation Factor
DISCOM	Distribution Company
EF	Emission factor
EIA	Environment Impact Assessment
EIL	Enercon India Limited
EPC	Engineering, Procurement, Construction
ER	Emission Reductions
GHG	Green House Gas
HT	High Transmission
HZL	Hindustan Zinc Limited
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
ISGS	Inter-State Generation Stations
KV	Kilo Volts
kW	Kilowatt
KERC	Karnataka Electricity Regulatory Commission
KREDL	Karnataka Renewable Energy Development Limited
KPTCL	Karnataka Power Transmission Corporation Limited
MoEF	Ministry of Environment and Forest
MU	Million Units
MW	Megawatt
NHPC	National Hydro Power Corporation
NOC	No objection Certificate
NTPC	National Thermal Power Corporation
ODA	Official Development Assistance
OM	Operating Margin
PDD	Project Design Document
PE	Project activity emissions
PLF	Plant Load Factor
PPA	Power Purchase Agreement
QA	Quality Assurance
QC	Quality control
RES	Renewable Energy Sources
ROE	Return on equity
RLDC	Regional Load Dispatch Centre
KPCL	Karnataka Power Corporation Limited
RPC	Regional Power Committees
RPM	Rotations per minute
SLDC	State Load Dispatch Centers
T&D	Transmission and Distribution
tCO₂e	Tonnes of Carbon Dioxide Equivalent



CDM – Executive Board

page 57

UNFCCC	United Nation Framework Convention of Climate Change
WEG	Wind Electric Generator
WEC	Wing Energy Converter
