



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

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

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Wind power project by HZL in Gujarat.

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

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Description of the project

Hindustan Zinc Ltd. (HZL), a vertically integrated natural resources enterprise, headquartered at Udaipur, Rajasthan having broad operations ranging from exploration, mining, and 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 an 88.8 MW wind power project consisting of 111 WEGs of individual capacity 0.8 MW at Samana Site in Gujarat, 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 Gujarat.

Purpose

The proposed project activity is an initiative by Hindustan Zinc Limited to export Wind Electric Generator (WEG) generated renewable electricity to the power deficit western region grid in order to decrease power shortage, diversify the grid and reduce greenhouse gas emissions.

Technology

Enercon India Limited has supplied the wind energy technology to HZL. WEG is ingeniously devised to convert kinetic energy from the “air in motion” directly into electricity without using conventional sources like coal, oil or natural gas for power generation. The project activity implements gearless Enercon E-48 and E-48SL WEGs with synchronous generator, pitch regulation, low cut-in speed and aerodynamic braking system. The specification for the WEGs is provided in section A.4.3.

Emission Reductions from anthropogenic sources

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) and will be replacing the usage of diesel generators 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 1,106,890t 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 CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.*

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

- The project activity leads to an investment of about INR 432.9 Crores to a developing region which otherwise would not have happened in the absence of project activity.
- The generated electricity is fed into the western 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 - *This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.*

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

- The 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 Western 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:

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

A.4. Technical description of the project activity:

**A.4.1. Location of the project activity:**

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A.4.1.1. Host Party(ies):

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India

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

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Gujarat

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

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District: Jamnagar

Taluk: Kalavad, Jamjodhpur

Site: Samana

Village: Methan, Dhun Dhoraji, Sadodar, Laloi, Narmana, Haripar mevasa, Bagadhara and Jamwadhi

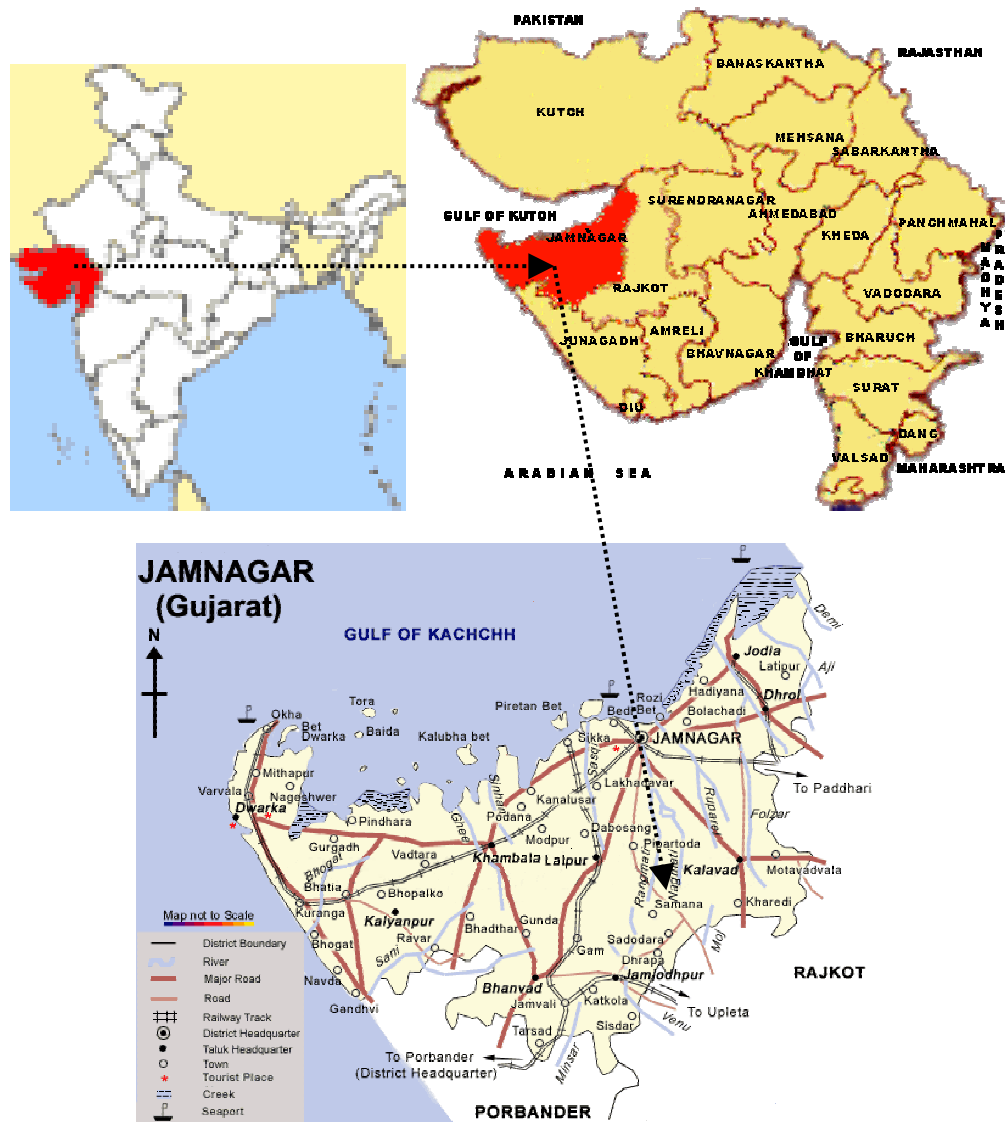
A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project activity is located in the Kalavad and Jamjodhpur taluk of Jamnagar district in Gujarat.

	Latitude	Longitude	Elevation above mean sea level	Wind Power Density
Kalavad	21°48'	70° 41'	132 m	212 w/m ²
Jamjodhpur	21°44'	70° 03'	160 m	221 w/m ²

The nearest airport and railway station is at Jamnagar city which is located at a distance of approximately 60 kms from the project activity site. The WEG wise details of location are provided in Annexure 5.



Maps not to scale

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

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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:

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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 111 WEGs of E-48 and 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 16 to 31.5 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 31.5 rpm and uses Aerodynamic Braking system as primary brakes.
- Three Independent Braking Systems with emergency backup supply.
- Generator achieving rated output at only 31.5 rpm.
- Incorporates lightning protection system, which includes blades.
- Starts Generation of power at wind speed of 3 m/s.

E-48 and E-48 SL TECHNICAL DATA

Rated capacity	: 800 kW
Rotor diameter	: E-48 - 48 m E-48SL – 52.9 m
Hub height	: E-48 - 56.85m E-48 SL – 75 m

Rotor with Pitch Control

Type	: Upwind rotor with active pitch control
Direction of rotation	: Clockwise
Number of blades	: 3
Swept area	: E-48 - 1810 m ² E-48 SL – 2198 m ²
Blade material	: Fiberglass (reinforced epoxy) with integral lightning protection
Rotor speed	: Variable, 16-31.5 rpm
Tip speed	: E-48 - 41 - 78 m/s



Pitch control	E-48 SL – 33-80 m/s
Generator	: Continuous variable pitching mechanism : 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 - Steel Tubular, 56 m height E-48 SL – Concrete, 74 m height

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

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

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Year	Annual Emission Reduction tCO ₂ e
2008-09	158,127
2009-10	158,127
2010-11	158,127
2011-12	158,127
2012-13	158,127
2013-14	158,127
2014-15	158,127
Total estimated reductions (tonnes of CO ₂ e)	1,106,890
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ e)	158,127

A.4.5. Public funding of the project activity:

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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:**

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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:

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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 western region grid through Gujarat Urja Vikas Nigam Limited (GUVNL). The geographic and system boundaries of the western 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.



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Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001)	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.
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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

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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 would be feeding the electricity in the Western regional grid, managed by Western Region Electricity Board (WREB) which constitutes five states (viz Maharashtra, Madhya Pradesh, Chhatisgarh, Gujarat and Goa) and two Union territories (Daman & Diu and Dadra & Nagar Haveli). The proposed project would have marginal impact on all the generation facilities in the Western grid. Thus all the power generation facilities connected to this grid form the project boundary for the purpose of baseline estimation. The Western 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 Western 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:

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

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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 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, Uttarakhand, 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.

The Western Region grid managed by Western Region Electricity Board (WREB) constitutes five states (viz Maharashtra, Madhya Pradesh, Chhattisgarh, Gujarat and Goa) and two Union territories (Daman & Diu and Dadar & Nagar Haveli). 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. WREB 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 Western Region at the end of financial year 2005-06 as per CEA was 35118.95 MW (effective capacity 33866.70 MW). The total installed capacity comprises of Hydro – 6658.83 MW, Gas – 5102.31 MW, Coal- 20941.50 MW, Nuclear- 1300 MW, RES – 1098.83 MW and Diesel – 17.48 MW. The Hydro : Thermal ratio is of the order of 24.37 : 75.63.

The Western Regional grid registered maximum demand of 26575 MW in October 2005 during the year, indicating an increase of 3.22% over the previous year. The unrestricted maximum demand was 33065 MW in the month of December 2005. The capacity shortage in the region was of the order of 14.10 % to 24.04%

¹ CO₂ Baseline Database for the Indian Power Sector - CEA



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during the year 2005-06. The capacity shortages were of the order of 2.72 % to 24.94 % in Madhya Pradesh, 6.18 % to 22.24% in Gujarat, 13.16 % to 28.09 % in Maharashtra and 2.77 % to 14.57 % in Chhattisgarh.

The maximum gross energy availability of Western Region was 576.99 MUs/day during the month of February 2006. The total net energy consumption of the Western Region for the year 2005-06 was 187483.92 MUs, which was 3.06 % more than the previous year. The monthly regional energy shortages varied from 4.94 % to 18.24 %. The maximum monthly energy shortages were of the order of 24.21% in Maharashtra, 23.83 % in Madhya Pradesh, 12.28% in Gujarat and 7.13% in Chhattisgarh².

The proposed project activity lies in the state of Gujarat. From the above data it is clear that the state of Gujarat, along with other states in the western grid is incurring high energy shortages. The following tables illustrate the installed capacity of power generation in Gujarat:

Table 2: Installed Capacity (in MW)

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Thermal	4586.48	4836.48	4836.48	4836.48	4836.48	4836.48	4961.48	5086.48
Hydro	547.00	547.00	547.00	547.00	563.00	563.00	713.00	745.00
Gas	1673.04	1673.04	1673.04	1802.10	1757.10	1836.72	1863.72	1908.72
Others	166.90	166.90	166.90	166.90	166.90	173.10	236.67	306.88
Total	6973.42	7223.42	7223.42	7352.48	7323.48	7436.30	7774.87	8047.08

Reference: Western 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	4333.62	4583.62	4583.62	4712.68	4683.68	5210.30	5685.30	5769.73
Private Sector	2639.80	2639.80	2639.80	2639.80	2639.80	2226.00	2289.57	2277.35
Total State And Private Sector	6973.42	7223.42	7223.42	7352.48	7323.48	7436.30	7974.87	8047.08
Share in Central Sectors Stations	-	-	1538.30	1538.30	1538.30	1538.30	1538.37	1801.29
Total	-	-	8761.72	8890.78	8861.78	8974.60	9513.17	9848.37

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

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

It is further clarified from the above tables that the Gujarat state power sector is dominated by fossil fuel based installations and depends on them for meeting its power requirements. The share of other power generation sources such as hydro and others is comparatively small. The following table further illustrates the power supply position in the state of Gujarat:

² WREB Annual Report 2005-2006



Table 4: Power Supply Position in Gujarat

	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Energy (MUs)								
Requirement	45685.00	51202.00	53038.00	53693.00	60175.00	57171.00	59681.00	57129.00
Availability	42835.00	46994.00	47787.00	47530.00	53316.00	50292.00	52724.00	52428.00
Shortage (%)	6.20	8.20	9.70	11.50	11.40	12.00	11.70	8.20
Peak (MW)								
Requirement	7018.00	7554.00	7801.00	8005.00	8641.00	9820.00	10162.00	9783.00
Peak Met	5877.00	5962.00	6905.00	6700.00	7336.00	7204.00	7578.00	7610.00
Shortage (%)	16.30	21.10	11.50	16.30	15.10	26.60	25.40	22.10

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

The table depicts that the average requirement of power in Gujarat is much higher than the availability leading to consistent power shortages in the state for various years reaching to a maximum energy shortage of 12% 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 high energy shortages in the region and specifically the state of Gujarat, 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 have been defined in step 1 of 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): >>

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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 as per the additionality tool 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 111 WEGs of individual capacity 0.8 MW to generate electricity and export it to the western 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.

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 India, the power off-takes from the power plants is decided based on power plant and T&D availability and not on merit order basis, thus in absence of the wind power project, it is difficult to justify that equivalent amount of units would have been generated by coal based power plant (as a preferred substitute to the project). Thus, suitable grid mix has been selected as baseline option and therefore for calculation of baseline emissions.

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.).

Both 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.

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 selected baseline scenario which would have happened in the absence of the proposed project activity (as per ACM002).



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

1. Justify the benchmark in line with the cost of capital (deposit rate plus suitable risk premium) following the non-applicability of the GERC benchmark as per paragraph 40, EB 40.
2. 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. Alternate benchmarks applicable to the project activity – (included in Sub-step 2(b) Section B5 of the PDD)
2. Additional clarifications regarding common practice analysis (included in Sub-step 4 of the section B5 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 Gujarat state electricity utility, it will generate financial benefits in terms of revenues from the sale of electricity units. Thus simple cost analysis (option I) cannot be applied to the proposed CDM project activity.

Amongst the other two options – investment comparison analysis (option II) and benchmark analysis (option III), the benchmark analysis has been adopted 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

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 the first project activity being undertaken by HZL with a motive of being an independent wind power producer exporting the generated electricity from its wind farm to the regional electricity system. Since there is no precedence of a decision to invest in renewable energy based power generation, HZL consecutively sought an equity returns based benchmark applicable to independent power producers in the country implementing similar project activities.

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 14% benchmark based



on GERC prescribed values. 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;

β = 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:

The start date of the proposed project activity is 15th January 2007. 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 Bloomberg³.

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

³ Screenshots from Bloomberg terminal have been submitted to the DOE.

**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 sources⁴, 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 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 average⁵ 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 Sensex⁶ 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.

⁴ http://cea.nic.in/power_sec_reports/Executive_Summary/2008_07/27-33.pdf

⁵ 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:

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

⁶ <http://www.bseindia.com/histdata/hindices.asp>



Market Rate of Return (Rm) = $\left[\frac{\text{(BSE index at the time of start of project (December 2006))}}{\text{(BSE index at its start in 1979)}} \right]^{(1/\text{no. of years from 1979 till start of project})} - 1$

$$= \left[\frac{13,786.91}{100} \right]^{(1/27.75)} - 1$$

$$= 19.43\%$$

[Source for BSE Sensex Data: <http://www.bseindia.com/histdata/hindices.asp>]

Average risk free rate (Rf) = 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 = $\left[\frac{\text{(Compounded return for year 2005-06)}}{\text{Return for the year 1980-81}} \right]^{(1/\text{number of years from 1980-81 to 2005-06})} - 1$

$$= \left[\frac{1281^8}{100} \right]^{(1/26)} - 1$$

$$= 10.31\%$$

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

[Source for risk free rate is Reserve Bank of India:
<http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/80303.pdf>]

$$\text{Market Risk Premium} = 19.43\% - 10.31\% = 9.12\%$$

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

$$= 7.34\% + 1.02 \times 9.12\%$$

$$= 16.66\%$$

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 **16.66%**.

Benchmark 2

Deposit Rates increased by Market Risk Premium

In accordance with the guidance provided by EB to the request for review of Project activity, Benchmark has also been estimated using the Government **Deposit Rates** applicable at the time of start of the project activity. The average RBI deposit rate⁹ 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 (Rf) = The average risk free rate is calculated as the geometric mean of the compounded annual return.

⁷ The data for the interest rate on the central government securities is only available on a yearly basis from 1980-1981 till 2005-06. Further the data available for calculation of market return is available on a monthly basis from 1979-December 2006. Thus the number of years for calculation of market return and the average risk premium are different. However the implication on the final outcome of this difference is negligible.

⁸ Please refer WACC calculation excel file, Risk Free Rate worksheet for the basis of the value (represents compounded return as on 2005-06 of the government securities)

⁹ Refers to the deposit rates of 5 major public sector banks as at end-March



Geometric mean of compounded return for the year 2005-06 = $[\{(Compounded\ return\ for\ year\ 2005-06)/Return\ for\ the\ year\ 1978-79\} ^{(1/number\ of\ years\ from\ 1978-79\ to\ 2005-06)}]-1$

$$= [(1324.6/100) ^{(1/27^{10})}]-1$$

$$= 10.04\%$$

Refer the excel sheet of calculations for further details.

[Source for risk free rate is Reserve Bank of India:
<http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/87456.pdf>]

$$\text{Market Risk Premium} = 19.43\% - 10.04\% = 9.38\%$$

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

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

$$= (6.625 + 9.38 \times 1.02) \%$$

$$= 16.21 \%$$

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 **16.21%**.

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 Project 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 16.66%. However in accordance with the guidance provided by EB during the request for review, the deposit rates plus market risk premium i.e. benchmark (2) of 16.21% is chosen as the most suitable benchmark for comparison with the equity IRR of the project activity. It can be noted that project remains additional even with regard to the lowest value of the benchmark range i.e. 16%.

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

¹⁰ The data on a monthly basis is available for the calculation of market returns from the start of Sensex in 1979 till December 2006, hence the market returns have been calculated till December 2006. However the risk free rate of return is calculated based on the volume weighted annual average rate of return made available by the RBI. Since this data is not available on a monthly basis, the average risk free rate of return has been calculated till the year 2005-06 and hence there is a difference of 0.75 year in the two values. However the implication of this difference is negligible.



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The post tax equity 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 88.8 MW wind farm based on the following assumptions¹¹ 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	88.8 MW	Contract agreement between HZL and Enercon India Limited for Phase I - 38.4 MW and Phase II - 50.4 MW wind farms.
Number of WEGs	111	
Capacity of each WEG	800 kW	
Plant Load Factor	24.26 % (The PLF has been assumed based on the generation guarantee provided by the equipment supplier. This generation guarantee is established based on the prognosis carried out by the supplier for the proposed site. Further GERC in their order dated 11/08/2006 have considered a PLF of 23% for the computation of tariff. Thus the assumption of PLF for the proposed project is deemed to be conservative.)	
Guaranteed annual generation per WEG	17,00,000 kWh	Based on norms
Residual Value	5%	
Wheeling Losses	7% of gross generation	Assumed as appraised by the equipment supplier with respect to the losses on account of transmission to the grid interconnection point, fluctuations in grid availability, machine availability, transformation losses etc.
Annual Operation and Maintenance Cost	INR 4.48 Lakh per WEG with 5% escalation every year starting from the 2 nd year	Contract for O & M service between HZL and Enercon India Limited for phase I 38.4 MW and phase II – 50.4 MW.
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
GUVNL Tariff rate	INR 3.37 / kWh	PPA with GUVNL
Total Project Cost	INR 432.9 Crore	Contract agreement between HZL and Enercon

¹¹ The Investment analysis includes various benefits available to the project activity from the national and sectoral policies for promoting renewable energy generation in India such as accelerated depreciation, tax holidays etc.



		India Limited for Phase I - 38.4 MW and Phase II - 50.4 MW wind farms.
Means of finance	100% equity	Can be verified from the balance sheets of HZL
Income tax rate	33.66%	As per relevant Indian tax regulations/policies
Administration/Miscellaneous expenses	INR 2 Crore / year	Assumed as per norms
Western Regional grid emission factor	0.9011 tCO ₂ / MWh	CEA, CO ₂ Emission factor database, Version 02.

The post tax-equity IRR for the project activity was found to be 11.63% (*the workings to calculate IRR are attached as Enclosure*) which is lower than the **benchmark selected for the project.**

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 off-take (including grid availability) and machine downtimes.
2. O&M escalation rate

S. No.	Parameters	Variation	IRR	Comments
Project scenario (Base case)			11.63 %	--
1.	PLF of the wind farm – 24.26% in accordance with the generation guarantee provided by the Equipment supplier.	+ 10 %	13.87 %	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 at 100% grid availability (which is impractical/unattainable in the prevalent circumstances). Additionally the prevailing wind patterns and operating conditions cannot result in 10% increase in PLF at the site as even the electricity regulatory commission order states that the maximum CUF observed in Gujarat has reached only till 25.68% (at the best site which has already been exploited fully).
		+5 %	12.55 %	
		-5 %	10.35%	PLF may reduce due to change in wind patterns and any other unforeseen circumstances /vagaries in



		- 10 %	9.08 %	nature, resulting in very less IRR.
2	O & M escalation rate Current Rate – 5% per year	+ 10 %	11.27 %	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 %	11.48%	
		-5 %	11.76%	There is a little possibility that the O&M costs would decrease in the future.
		-10 %	11.85%	

The purpose of the sensitivity analysis is to demonstrate the sensitivity of the return on project due to uncertainty in plant load factor and O & M escalation rate. The risk on the first parameter remains outside the control of the project activity; it basically depends on wind pattern and the infrastructure facility of the off-taker. 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:

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

(a) Prevent the implementation of this type of proposed project activity; and

(b) 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%)¹² 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:

Barriers due to prevailing practice including institutional barriers

The electricity policy of the state of Gujarat limits the investor to either sell the generated electricity from wind power projects to DISCOMS or to put it to captive utilisation as third party sale is not allowed in the state. It has been observed that the new investments as well as the existing installation of WEGs, essentially depend on the public policy. For last 15 years, the frequent change in public policies is reflecting on the investment in the WEG installations in the state. A non-conductive, stagnant policy in the state brought the investments at a standstill leading to no (0 MW) installations in the state for four consecutive years (1998 – 2002)¹³. The description below highlights the changes in policy along with the investment made in WEG during that particular policy regime.

January 1993 – September 2001¹⁴:

Purchase of electricity at INR 1.75 /kWh (US\$ 0.039 /kWh) with wheeling charges of 2% of the energy generated by windmills and provision of banking for a period of 6 months. Electricity duty and demand cut to the extent of 30% of installed capacity of wind farm has been exempted along with 50% sales tax incentives. Additionally the generator was exempted from the electricity duty over the generated electricity. Prior to the first policy, the state had 16.1 MW of WEG installations. The first public policy for wind sector could attract investment, and the state enjoyed installation of 10.6 MW in 1993-94 followed by 37.7 MW in 1994-95 followed by 51.2 MW in the year 1995-96. The investors were looking forward to further improvement in tariff for this sector, but the public policy remained stagnant leading to reduction in investment, and an installation of 31.1 MW in 1996-97 and 20.1 in 1997-98. The manufacturer could not further attract the investors because of non-conductive policy and the amount of installations dropped to zero during rest of the policy period.

October 2001 – June 2002¹⁵:

Purchase of electricity at INR 2.25 /kWh (US\$ 0.05/kWh) with 1994-95 as base year with 5% escalation per annum for a period of 10 years from the date of commencement of generation of power. The purchase price after 10 years of commissioning of the project to be equal to the purchase price at the end of that year or as may be negotiated between the stakeholders. The wheeling charges doubled from 2% to 4% of the generated energy. A provision of banking for 12 months along with 3rd party sale was permitted. The policy was changed after a gap of 7 years, but the new policy couldn't meet the expectations of the investors, because of the less profitable nature of business as compared to available options for investment, hence for all practical

¹² 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

¹³ Refer Table 6.

¹⁴ Source: (a) Para (v)-(ix), pp. 2-3, Incentive Scheme for Wind Power Generation 1993, Govt. Resolution No. EDA-1092- M (I)-8(1)-E, dated 27.1.1993. (b) Para 6, page 4, Sales-tax incentive scheme for Wind Power Generation, 1993, Govt. Resolution No. EDA-1092-M (I)-8(2)-E, dated 27.1.1993.

¹⁵ Source: Para 3, 7, 8-9, pp. 1-3, Incentive scheme for energy generation through Renewable Sources-2001, Govt. Resolution No. REP-102000-502-B, dated 27.9.2001.



purposes, this policy was a total failure and not even a single installation of WEG took place during this regime.

June 2002 – August 2006¹⁶:

Purchase of electricity at INR 2.60 /kWh (US\$ 0.057 /kWh) with an increase of INR 0.05/ kWh per annum (US\$ 0.001 /kWh p.a.) for a period of 10 years and after 10th year, the rate to be negotiable. The wheeling charges were kept constant at 4%, whereas the banking period had been reduced from 12 months to 6 months. The permission for 3rd party sale of electricity not permitted. Payment of electricity duty and demand cut to the extent of 30% of the installed capacity of the wind farm had been exempted. Some relief to the investors were given with increase in tariff, but because of proactive action by manufacturers playing in the market, some investors were convinced to invest in the wind sector and again a marginal growth had been observed leading to 6.2 MW in 2002-03, 28.9 MW in 2003-04, 51.5 MW in 2004-05 and 84.6 MW in 2005-06.

August 2006 onwards:

Purchase of electricity at INR 3.37/kWh (US \$ 0.075 /kWh) fixed for entire project lifetime of 20 years. The wheeling charges are kept constant at 4% in accordance with the previous policy including the banking period of 6 months. The permission for 3rd party sale of electricity is still not allowed although it is allowed under Electricity Act 2003.

The following table illustrates the policy status of various states in India with wind power potential:

Table 5: Policy status of states in India

Items	Buy-back	Third party-sales	Penalty on kVARh consumption
Andhra Pradesh	Presently INR 3.37 w.e.f 01.04.2004 (frozen for 5 years)	Allowed as per Electricity Act 2003 subject to APERC Regulations	Reactive energy drawal @ 0.10p/unit.
Tamilnadu	INR 2.90/kwh (No Escalation)	Not Allowed	25 paise per kVARh if the ration of kVARh drawn to KWh exported is upto 10% and 50 paise per KVARh for more than 10%.
Karnataka	INR 3.40 / kwh without escalation for 10 years	Allowed to HT consumers	Penalty on kVARh consumption 0.40p/unit
Kerala	INR 3.14 for 20 years	Allowed as per Electricity Act 2003 subject to SERC Regulations	-
Uttar Pradesh	INR 2.25/kwh (5% esc. 95-96)	Allowed	-
West Bengal	To be decided on case to case basis	Not Allowed	-

¹⁶ Source: Para 5, 8-11, pp. 2-4, Wind Power Generation Policy-2002, Govt. Resolution No. EDA-10-2001-3054-B (Part-II) dated 20.6.2002.



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Gujarat	INR 2.60 /kWh with an increase of Rs 0.05/ kWh per annum (till 2006) Present INR 3.37/kwh (without any escalation for 20 yrs)	Not Allowed	Penalty on kVArh consumption - 10 paise per kVArh upto 10% & 25 paise per kVArh above 10%
Madhya Pradesh	INR 3.97 in 1st year, INR 3.80 in 2nd year, INR 3.63 in 3rd year, INR 3.46 in 4th year and INR 3.30 for 5th to 20th year	Allowed	27 paise per kVArh
Maharashtra	INR 3.50/kwh	Allowed	25 paise per KVarh
Rajasthan	INR 3.71/kWh (EHV) and INR 3.60/kWh (33/11kV) for Jodhpur, Barmer and Jaisalmer districts. INR 3.89/kWh (EHV) and INR 3.78/kWh (33/11kV) for the rest of the districts.	Allowed	4 paise per year w.e.f. 01/04/2006 with escalation of 5% per year

It is observed that power purchase price in the state of Gujarat from wind power was the lowest in comparison to all the other states with wind potential till the new policy which has recently come up in August 2006. The tariff according to the new policy has been fixed at Rs. 3.37/kWh which is still less than wind power tariff in states like Rajasthan, Madhya Pradesh, Maharashtra and Karnataka. It is to be emphasised here that out of the total installed capacity of wind electricity generators in the state of Gujarat, most of the private wind-farm owners are under the wheeling and banking agreement using the generated output from their WEGs for captive utilisation¹⁷. The electricity act 2003 allows third party sale, however the Gujarat Electricity Regulatory Commission (GERC) prohibits third party sale leaving investors to either sell the generated output to the utility at a low tariff or utilise it for captive consumption. As a result most of the investors in Gujarat have opted for captive consumption only.

The following table provides the year wise addition of wind power projects to the installed capacity (in MW) in the state of Gujarat:

Table 6: Year wise addition of wind power capacity in Gujarat (in MW)

Upto Mar 1992	1992 to 1993	1993 to 1994	1994 to 1995	1995 to 1996	1996 to 1997	1997 to 1998	1998 to 1999	1999 to 2000	2000 to 2001	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006	As On Apr 1, 2006
14.515	1.63	10.625	37.745	51.158	31.137	20.1	0	0	0	0	6.2	28.90	51.5	84.6	337.9

¹⁷ Page No. 21, GERC Order 11/08/2006



From the above table it is clear that after the year 1998, there was literally no investment by private entrepreneurs in Gujarat till the year 2002 due to unfavourable policy and huge losses faced by the erstwhile Gujarat state electricity board when all other states with wind power potential saw rise in the installed capacity e.g. Maharashtra, Tamil Nadu and Karnataka in the same period recorded a capacity addition of 372.34, 267.28 and 104.69 MW respectively.

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 GERC 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 is specified *ex ante* for the proposed project activity whereas in case of utility scale fossil fuel and hydro projects, these are usually by reference to cost-plus approach whereby the projects recover their full investment cost including a post-tax return on equity if they are able to reach specified level of plant availability. Thus the utility scale fossil fuel and hydro projects are ensured of equity returns from the first year of operation. This increases the investment risks in the project activity compared to investment in fossil-fuel or hydro power projects selling generated power to the grid.

As stated earlier, out of the total installed capacity in the state, most of the projects have been developed to use the generated power for captive consumption by the investors. The HZL wind farm is thus one of the very few projects in Gujarat developed for selling the generated output to the state electricity utility. Additionally a large scale investment of this nature has been the “**first of its kind**” in the state and it is the largest wind farm by Enercon India Limited to be commissioned in Gujarat¹⁸.

HZL is selling power to GUVNL through a 20 year Power Purchase Agreement (PPA) contract. As per the data available till 2002-03, erstwhile Gujarat Electricity Board (GEB) had been incurring heavy commercial losses since last one decade. The commercial loss (with subsidy) for erstwhile GEB (off-taker) in the year 2002-03 was INR 922 Crore¹⁹, in the year 2003-04 was Rs 1932 Crore and in the year 2004-05 it was Rs 1035 Crore²⁰. Although the situation has improved in the past few years, but the amount of losses are still huge. For their cash in-flows the project proponent is dependent on the payments from electricity utility against the sale of electricity to the grid and it is very likely that there could be problems with the cash inflows of project. However HZL signed a PPA with GUVNL only with the hope that CDM funding would help to off-set the anticipated losses.

Along with the above stated barriers, GERC in its order on 11/08/2006 has mandated the private investors to share 25% of the gross benefit from CDM with the respective distribution licensee which means that the anticipated revenue from CDM will also not be fully available to the project participant. There is a risk that the quantity of CDM revenue shared between the project proponents and DISCOM may increase in the future in view of CER sharing arrangement in other states e.g. Karnataka where there is 50:50 sharing of CDM revenue between the project proponents and the state electricity utility/DISCOM²¹.

¹⁸ Documentary evidence is available in the form of list of customers and the respective usage of generated power from Suzlon and Enercon, the two major supplier of wind turbines. Additionally the customer wise data is available in the Indian Wind Power Directory.

¹⁹ Power Finance Corporations on the performance of the State Power Utilities for the years 2000-01 to 2002-03

²⁰ State Power Sector- Performance Ratings – Final report submitted to Ministry of power, prepared by ICRA / CRISIL, June 2006.

²¹ Standard Draft Wind Mill PPA - KPTCL



To conclude the HZL project activity faces the following risks/barriers due to prevailing practice in the state of Gujarat:

- A non conducive stagnant power policy in the state. Lower wind power tariff in comparison to other states.
- Third party sale of electricity not allowed leaving the project proponent to either use the generated output for captive consumption or selling it to the state electricity utility.
- Single part tariff for wind power installations.
- First of its kind large scale project activity in the state conceived for selling the generated output to the grid.
- Risk in realisation of revenue from the cash stripped electricity board.
- Risk/uncertainty in the quantity of sharing of CDM revenues between the state electricity utility and the project proponents.

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 studies²².

The project proponent is undertaking a serious risk by venturing into a “**virgin**” site in the state of Gujarat²³, where no other developer has set strides in wind farm development. As the site in which the project activity is coming up has not been exploited by anyone till date, 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.

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 146965.21MW²⁴, whereas the installed capacity of wind till that time is only 7114.6 MW²⁵. Thus just 4.8% of the total generating capacity in India is through wind generation sources. Given that the gross potential for

²² Wind power: experiences and future directions - The proceedings of the Workshop held on 23 July 1999 in New Delhi, TERI

²³ Enercon has certified that the HZL project activity site is a virgin site, not exploited for wind power project activities before.

²⁴ http://www.cea.nic.in/power_sec_reports/Executive_Summary/2007_03/6.pdf

²⁵ Source - Ministry of New and Renewable Energy of India <http://www.windpowerindia.com/statstate.html>



wind power in India is 45195 MW²⁶, 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 Gujarat

Specifically analyzing the situation in the state of Gujarat, it is seen that against an assessed wind potential of 9675 MW, the state has installed wind capacity of 401.4 MW as of 31st December 2006 (Source: MNES data given below in the table). This shows that until 1st January 2007, the installed capacity of wind energy in Gujarat was only about 4.15 % 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 Gujarat since the promotional policy for wind was first introduced in 1994-95:

Year	Capacity Installed (MW)
Upto Mar 1992	14.515
1992 to 1993	1.63
1993 to 1994	10.625
1994 to 1995	37.745
1995 to 1996	51.158
1996 to 1997	31.137
1997 to 1998	20.1
1998 to 1999	0
1999 to 2000	0
2000 to 2001	0
2001 to 2002	0
2002 to 2003	6.2
2003 to 2004	28.90
2004 to 2005	51.5
2005 to 2006	84.6
As On December 31 st , 2007 ²⁷	401.4

Source: <http://www.windpowerindia.com/statyear.html>

From the above table it is clear that after the year 1998, there was literally no investment by private entrepreneurs in Gujarat till the year 2002 due to unfavourable policy and huge losses faced by the erstwhile Gujarat state electricity board when all other states with wind power potential saw rise in the installed capacity e.g. Maharashtra, Tamil Nadu and Karnataka in the same period recorded a capacity addition of 372.34, 267.28 and 104.69 MW respectively.

Wind Electricity generation in Gujarat

Another relevant common practice test is the amount of wind power generation as compared to the overall electricity generation availability for Gujarat. In the year 2005-06, the total power generated from all sources of power generation in Gujarat was 45070.44 Million Units²⁸ whereas the power generated from wind power projects was only 1613.04 Million Units²⁹ constituting only 3.6 % of the total power generated showing that wind energy generation is insignificant as compared to other power generation sources in Gujarat. Please

²⁶ Source – MNRE <http://www.windpowerindia.com/stateest.html>

²⁷ http://mnes.nic.in/annualreport/2006_2007_English/HTML/ch3_pg2.htm

²⁸ www.indiastat.com

²⁹ Indian Wind Power Directory 2006



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.

Further, most of the wind energy produced in Gujarat is utilized for captive consumption. For example, in 2004-05, out of the approximately 248 Million Units produced by wind farms in Gujarat, only 24 Million Units were purchased by GEB and its successor entities. The balance generation was for captive consumption³⁰. Thus there is dominance of captive wind power generation.

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 88.8 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 Gujarat for the sale of power to the grid.

The projects excluded from the definition of a similar scale project and the justification for the exclusions is provided below:

1. Captive wind power projects - A captive wind project is different from the project selling its generated output in the following ways:
 - a. A captive project is essentially implemented to meet the power requirements of an industry. Thus, there is a definite need for power which has to be secured from some sources. For meeting this requirement, the investor is likely to try and secure the cheapest and most attractive source of power. The investment will be justified only if the cost of generation through captive installation is lesser than the HT tariff offered by the grid to draw power. The baseline scenario will be different for such an investor and the risk undertaken by a captive investor will be different from an investor selling power to the grid.
2. Small scale wind power project activities bundled together from a large scale CDM project have not been considered for the analysis as the scale of these projects and the scale of investment is not comparable to the project activity under consideration.
3. CDM Project activities – Projects which are under the CDM pipeline have to be excluded as per the guidance provided by the tool for demonstration and assessment of additionality.
4. Project activities implemented post the start date of the project activity i.e. post 31st December 2006, since for common practice analysis as per the guidance, only those projects can be compared which are under operation prior to the start of the proposed project activity by HZL.

The wind projects of similar scale commissioned in state of Gujarat 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 and under operation in Gujarat available in the Indian wind Power Directory 2006. This data was further confirmed by the data obtained from two largest WEG suppliers in India i.e. Suzlon Energy Limited and Enercon India Limited. Further the data on private wind farm owners in India with an aggregate capacity of 15 MW and above in India as on 31st March 2007³¹ was also analysed for large scale private investment in Gujarat for comparison to HZL project activity. The list did not provide the States in which the projects have been implemented, thus publicly available sources were provided for the location of the specific project activities.

Following projects were excluded from the common practice analysis due to the reasons stated alongside:

³⁰ GETCO Tariff Order dated 6th May 2006

³¹ <http://www.windpowerindia.com/statpriv.html>



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Investor name	Size in Gujarat (MW)	Distinction/Reason for exclusion														
Gujarat NRE Coke	1.25+ 26.25 = 27.5	1. The project activity has also considered CDM and is currently in the CDM pipeline: ✓ Part of 22.3 MW Bundled grid connected Wind Power based electricity generation project in Gujarat http://cdm.unfccc.int/Projects/Validation/DB/OW17ZTWQUDGVXQGE059WCBOC9C6LIR/view.html ✓ Part of 26.25 MW wind electricity generation project of Gujarat NRE Coke Limited at Jamnagar and Kachchh http://cdm.unfccc.int/Projects/Validation/DB/2WHFROEPK85ARNQ1TVKJV4WC8ATMAB/view.html Since the project activity is under CDM, it has been excluded from common practice analysis.														
Gujarat Guardian Ltd.	31.6	a. The Project activity is considering carbon finance and has already received carbon benefits through the Voluntary VER route: http://www.carbonneutral.com/cnregistry/uploaded/Jamnagar%20Wind%20Power%20Projects%20PDDs.pdf 23.2 MW capacity is included under the webhosted VER PDD validated under the Voluntary Carbon standard. After deducting the project size of 23.2 MW from the total installed capacity of project proponent in Gujarat, only 8.4 MW capacity project is left which is less than 15 MW and hence cannot be compared to the HZL project. b. Further, the project is different from the proposed wind power project by HZL since it is a captive installation utilizing the generated output from its project for self utilization at its industry premises which is evident from the VER PDD above and verified from the equipment supplier Enercon India Limited Annexure - 5. c. Furthermore, the project activity has already applied for CDM benefits. Due to above reasons, the project is different and it has been excluded from common practice analysis.														
Patnaik Minerals Pvt. Ltd	30.2	The project is under CDM and part of Wind Power project by PMPL in Gujarat, District Jamnagar and Rajkot by M/s Patnaik Minerals Private Limited http://cdm.unfccc.int/Projects/Validation/DB/GQ56N39MLSZ9QDRL6RUF5YJSFDPD1U/view.html Since the project activity is under CDM, it has been excluded from common practice analysis.														
Indian Petrochemicals Co. Ltd	15.315	The project was commissioned phase-wise and got completed in March 1997, the regulatory environment then prevailing and the policies pursued were different from those existing at the time of the start of proposed project activity by HZL. <table><thead><tr><th>Capacity (MW)</th><th>Date of Commissioning</th></tr></thead><tbody><tr><td>2.25</td><td>Sep-96</td></tr><tr><td>5.625</td><td>Mar-96</td></tr><tr><td>2.7</td><td>Mar-97</td></tr><tr><td>2.8</td><td>Mar-96</td></tr><tr><td>0.54</td><td>Mar-96</td></tr><tr><td>1.4</td><td>Mar-97</td></tr></tbody></table> The differences in regulatory environment are as below: For IPCL Project –	Capacity (MW)	Date of Commissioning	2.25	Sep-96	5.625	Mar-96	2.7	Mar-97	2.8	Mar-96	0.54	Mar-96	1.4	Mar-97
Capacity (MW)	Date of Commissioning															
2.25	Sep-96															
5.625	Mar-96															
2.7	Mar-97															
2.8	Mar-96															
0.54	Mar-96															
1.4	Mar-97															



		The project was installed under the Incentive scheme for wind power generation 1993 which was applicable for the period from January 1993 – September 2001. The salient features of the scheme are: ✓ Purchase of electricity at INR 1.75 /kWh (US\$ 0.039 /kWh) with wheeling charges of 2% of the energy generated by windmills and provision of banking for a period of 6 months. Electricity duty and demand cut to the extent of 30% of installed capacity of wind farm has been exempted along with 50% sales tax incentives. Additionally the generator was exempted from the electricity duty over the generated electricity. [Source: (a) Para (v)-(ix), pp. 2-3, Incentive Scheme for Wind Power Generation 1993, Govt. Resolution No. EDA-1092- M (I)-8(1)-E, dated 27.1.1993. (b) Para 6, page 4, Sales-tax incentive scheme for Wind Power Generation, 1993, Govt. Resolution No. EDA-1092-M (I)-8(2)-E, dated 27.1.1993] For HZL Project – The project is installed under the Gujarat Electricity Regulatory Commission order dated 11th August 2006 - In the matter of Determination of price for procurement of power by the Distribution Licensees in Gujarat from Wind Energy Projects. The salient features of the order are: ✓ Purchase of electricity at INR 3.37/kWh (US \$ 0.075 /kWh) fixed for entire project lifetime of 20 years. The wheeling charges are kept constant at 4% in accordance with the previous policy including the banking period of 6 months. A brief description of the different regulatory environment is also provided on the following web-link: http://www.geda.org.in/wind/wind_power.htm Additionally, the project is a captive project as identified from the following web-link: http://sebidifar.nic.in/documents/IPCL/ar032002.pdf Page 21 of the document which clearly mentions that the electricity generated from the turbines is wheeled and utilized for internal consumption. Thus this project has been excluded from the common practice analysis.
Ratnamani Metals and tubes Limited	17.5	The project activity has been implemented in phases. The first phase of around 5 MW has been included under two bundled CDM project activities - 1. 22.3 MW Bundled grid connected Wind Power based electricity generation project in Gujarat and 2. 13.7 MW Bundled Grid-connected wind electricity generation in Jamnagar & Kachchh, Gujarat. 1. http://cdm.unfccc.int/UserManagement/FileStorage/X6RZB5RJQDTY6C6PF4A38DSNXH2FL4 2. http://cdm.unfccc.int/Projects/Validation/DB/HAZNBLU455HVN7QG44I3R7T5JWWLT/view.html Post these bundled projects the second phase consisting of 13.25 MW has been proposed as a separate CDM project activity implemented post January 2007 - 13.25 MW Wind Power Generation by RMTL, in Kutch, Gujarat. http://cdm.unfccc.int/Projects/Validation/DB/FQOM561A0WJL6VAG2NT568TNPCLZCG/view.html



		Thus, since the project activity is under CDM, it has been excluded from common practice analysis.
SREI Infrastructure	24.8	The project has been implemented in March 2007 and was not under operation at the start of the HZL project activity. Furthermore, the Annual Reports of the company for the year 2006-07 and 2007-08 specifically bear a mention of availing CDM benefits for its renewable energy projects. http://www.srei.com/srei_pdf/sreiannual/2006-07.pdf http://www.srei.com/srei_pdf/sreiannual/2007-08.pdf Thus since the project was not under operation at the time of start of the HZL project activity, it has been excluded from common practice analysis.
MSPL Ltd.	30	The Project is under CDM as part of the project activity - "30 MW wind power project at Surajbari, Gujarat in India" - http://cdm.unfccc.int/Projects/Validation/DB/L59OGCJY0XLZUC0W8M/MB84A2T4NKNX/view.html Further, according to the PDD the purchase orders for the project were placed on 19th December 2006 and hence the project was not under operation at the start of the HZL project activity. Since the project activity is under CDM, it has been excluded from common practice analysis.

Thus, after exclusion of the above project activities, 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 Gujarat at the time of start of the proposed project activity by HZL.**

From the above discussions the following can be concluded:

- ✓ Just **4.8%** of the total generating capacity in India is through wind.
- ✓ Installed capacity of wind in India is about **15%** of its potential.
- ✓ Until 31st December 2006, the installed capacity of wind energy in Gujarat was only about **4.15%** of its potential.
- ✓ Even after including CDM projects only **3.6%** of the total electricity generation in Gujarat is through wind energy sources.
- ✓ There are **no similar wind farm projects in Gujarat of 15 MW or more capacity** undertaken by public/private companies which can be comparable to the HZL project after exclusion of **CDM projects**.

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 selling the generate output to state grid are not present** in the state of Gujarat.



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:

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B.6.1. Explanation of methodological choices:

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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:

- Simple OM, or
- Simple adjusted OM, or
- Dispatch Data Analysis OM, or
- 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 Western 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 drawl 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 drawl from the regional

grid. There is no merit order dispatch prepared by the Western Regional Load Dispatch Center- it merely collates the drawl schedule of the SLDCs, which are restricted to ISGSs only. Further, the hourly drawl 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.

The percentage shares of generation from low cost/must run power plants for the 5 most recent years in the western grid is as follows:

2001-02	2002-03	2003-04	2004-05	2005-06
8.5%	8.2%	9.1%	8.8%	12.0%

(Reference: 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) = 9.3 %

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 $EF_{OM,y}$ 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 (Refer 2006 IPCC Guidelines for National Greenhouse Gas Inventories 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.

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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 ($EF_{BM,y}$):

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

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 conservativeness³². 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 western 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:	1.003
Justification of the choice of data or description of measurement methods	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 Operating Margin Method. Computed once during PDD finalization.

³² <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



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and procedures actually applied :	
Any comment:	The data will be archived for two years beyond the crediting period.

Data / Parameter:	EF_{BM,v}
Data unit:	tCO ₂ /MWh
Description:	Build Margin emission factor for western 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:	0.59
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 2006-07. 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:	The data will be archived for two years beyond the crediting period.

Data / Parameter:	EF_y
Data unit:	tCO ₂ /MWh
Description:	Combined Margin CO ₂ emission factor for western regional grid
Source of data used:	Estimated figure based on 75% of OM and 25% of BM values, CEA, Version 3.0.
Value applied:	0.9011 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:	The data will be archived for two years beyond the crediting period.

B.6.3 Ex-ante calculation of emission reductions:

>>

Installed Capacity (MW)
= 88.8 MW

Number of WEGs
= 111

Capacity of individual WEG (MW)
= 1.25 MW

PLF
= 24.26%

Number of days of operation
= 365

Total number of hours of operation in an year
= 365 x 24
= 8760



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Gross Generation of one WEG in an year (MWh)
= 1700 MWh

Gross Generation from 111 WEG in an year (MWh)
= (111 x 1700) MWh
= 188700 MWh

Net Losses @ 7% of gross generation (MWh)
= Losses due to machine consumption, transformer and transmission
= 7% of gross generation
= 13209

Net Generation from the project (MWh) - EG_y
= (Gross Generation – Net Losses)
= 188700 – 13209
= 175491 MWh

Baseline emission factor (Combined Margin) Western region grid (EF_y)

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

$$= [0.75 \times \{(1.013+1.004+0.9936)/3\} + (0.25 \times 0.59)]^{33}$$

$$= (0.75 \times 1.003) + (0.25 \times 0.59)$$

$$= 0.7526 + 0.1484$$

$$= \mathbf{0.9011 \text{ tCO}_2/\text{MWh}}$$

Baseline emissions (tCO₂)

$$BE_y = EG_y \times EF_y$$

$$= 175491 \times 0.9011$$

$$= 158,127$$

Project emissions (PE_y)

= 0

Leakages (L_y)

= 0

Emission reductions (tCO₂)

$$ER_y = BE_y - PE_y - L_y$$

$$= 158127 - 0 - 0$$

$$= 158127$$

Particulars	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Baseline emission factor (tCO ₂ /MWh)	0.901	0.901	0.901	0.901	0.901	0.901	0.901
Net Generation from the project (MWh)	175491	175491	175491	175491	175491	175491	175491
Baseline emissions (tCO ₂)	158,127	158,127	158,127	158,127	158,127	158,127	158,127
Project activity emissions (tCO ₂)	0	0	0	0	0	0	0
Leakage (tCO ₂)	0	0	0	0	0	0	0
Emission reductions	158,127	158,127	158,127	158,127	158,127	158,127	158,127

³³ CO₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 2.0.



(tCO ₂)							
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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	158,127	0	158,127
2009-10	0	158,127	0	158,127
2010-11	0	158,127	0	158,127
2011-12	0	158,127	0	158,127
2012-13	0	158,127	0	158,127
2013-14	0	158,127	0	158,127
2014-15	0	158,127	0	158,127
TOTAL	0	1,106,890	0	1,106,890

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
Description:	Net Quantity of Electricity exported to GUVNL facility
Source of data to be used:	Share certificate issued by GEDA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	175491.1 MWh/yr
Description of measurement methods and procedures to be applied:	Net electricity generated will be calculated from the readings of export and import indicated by the main meter connected to the incoming feeder of GUVNL. The procedures for metering will be as per the provisions of the power purchase agreement. 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 GETCO meter at the substation maintained by Enercon India Limited. Data monitoring takes place at the VCB metering yard and GETCO meter at the substation. The electricity metered at the GETCO 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 GETCO Main meter reading (net electricity exported to the grid) after deducting imports from the grid as mentioned in the share certificate issued by GEDA on monthly basis.
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, Export}
Data unit:	MWh
Description:	Quantity of Electricity exported to GUVNL facility
Source of data to be used:	Share certificate issued by GEDA monitored from the main GETCO meter
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 exported to GUVNL will be measured at the main meter connected to the incoming feeder of GUVNL. The procedures for metering will be as per the provisions of the power purchase agreement.
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 GUVNL
Source of data to be used:	Share certificate issued by GEDA monitored from the main GETCO meter
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 GUVNL will be measured at the main meter connected to the incoming feeder of GUVNL. The procedures for metering will be as per the provisions of the power purchase agreement.
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	Each WEG is equipped with an integrated electronic meter. These meters are connected to the Central Monitoring Station (CMS) of the entire wind farm



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and procedures to be applied:	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);

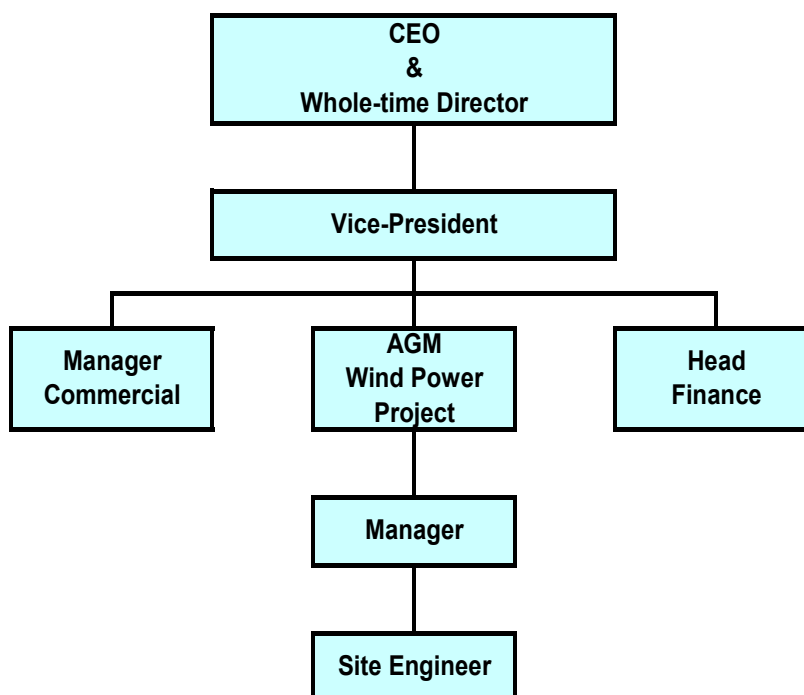
For the project activity to establish its creditable emission reduction, it has to record the actual electricity generation, which would displace equivalent units of electricity at the operating and build margin of the grid. Since the simple OM emission factor is calculated based on a 3 year average, 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. 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:



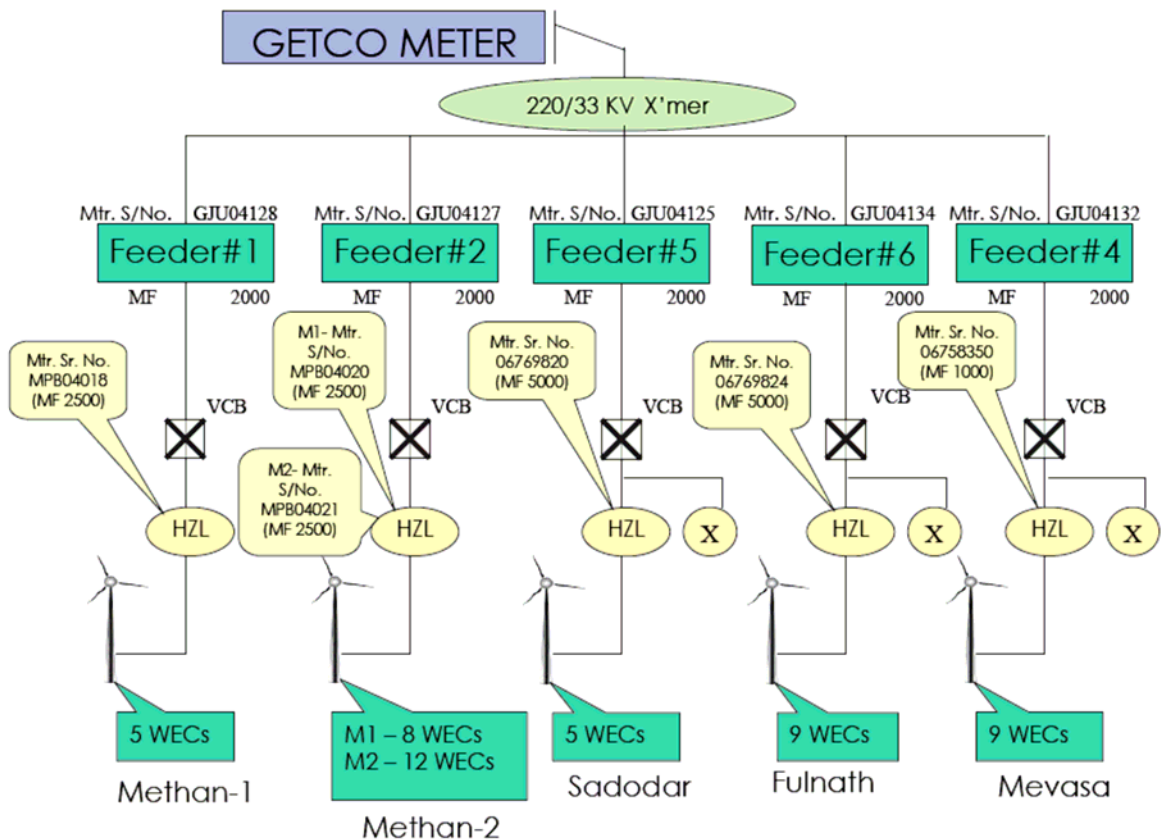
The O&M personnel are qualified engineers and are trained at the WEG manufacturing facility of Enercon India Limited at Daman for operating and ensuring best performance of the WEGs.

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 GUVNL.

Reading and correction of meters:

- a) As the WEGs are owned by more than one investor at the site, the ABT compliant meter at the pooling sub-station will be installed by GETCO on 33/220 KV side. A tri vector meter shall be installed in the VCB metering yard. At the end of the month, GEDA will give in respect of HZL, a statement of active energy injection and reactive energy drawal of their WEGs This statement will be the final measurement of the energy supplied to the GUVNL/DISCOM by the company for the preceding month for the purpose of payment.
- b) 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 GETCO meter at the substation maintained by Enercon India Limited. Data

monitoring takes place at the VCB metering yard and WEG (through the SCADA system). The electricity metered at the GETCO 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 GETCO Main meter reading (net electricity exported to the grid) after deducting imports from the grid as mentioned in the share certificate issued by GEDA on monthly basis. The following figure illustrates the metering arrangement for the HZL project activity. The figure is illustrative of the metering arrangement and does not depict total wind farm size.



- c) Whenever there is a major difference between the readings of the Main meter (GETCO meter) and the 33kV feeder at Enercon Sub station / VCB meter at wind farm end, the following steps shall be taken.
 - i. Checking of CT and PT connections
 - ii. Testing of accuracy of meters at site and at GETCO meter

If the difference exists even after such checking or testing, then the defective meter shall be replaced with a correct meter.
- d) In case of conspicuous failures like burning of meter and erratic display of metered parameters and when the error found in testing of meter is beyond the permissible limit of error provided in the relevant standard, the meter shall be immediately replaced with a correct meter.
- e) Sealing and maintenance of meters:
 - i. The GETCO meter shall be sealed in the presence of representatives of HZL / Enercon and GETCO.
 - ii. Any meter seal(s) shall be broken only by the GETCO representative in the presence of Enercon/HZLs representative whenever the main metering system or the 33kV metering system is to be inspected, tested, adjusted, repaired or replaced.



- iii. The GETCO meter at the substation will be calibrated once in a year . The calibration of the meters installed in an individual WEG will take place on yearly basis in accordance with Enercon's operation & maintenance manual which is consistently followed at all Enercon sites across the world.
- f) Records: Enercon will maintain an accurate and up-to-date operating log at the project site with records of:
 - i. 24 Hours logs of real and reactive power generation, frequency, transformer tap position, bus voltage(s), Main meter and other meter readings and any other data mutually agreed.
 - ii. Any unusual conditions found during operation/inspections
 - iii. All the records will be preserved for 2 years beyond the crediting period.
- g) The billing will be on monthly basis. Enercon/HZL shall raise invoice and submit to GUVNL for payment based on joint meter reading as certified by GEDA at the end of each month for the energy supplied
- h) Billing for the failure period:
 - i. In the event that any GETCO meter fails to register or upon being tested, is found not to be accurate within ± 0.2 class the energy injected in the grid, shall for the period be measured on the basis of the value registered by the corresponding meter at the feeder end.
 - ii. In the event that both GETCO meter and the corresponding meter at the feeder end fail to register, or upon being tested, be found not to be accurate within $\pm 0.2 / 0.5$ s the energy injected in the grid, shall for the period be adjusted by immediately restoring and recalibrating the GETCO meter and the corresponding meter at the feeder end / VCB meter and the correction applied to the consumption registered by the GETCO meter.
 - iii. The period referred to in the two points above is the actual period during which inaccurate measurements were made if such period can be determined or, if not readily determinable, the shorter of:
 - i. The period since the immediately preceding test of the relevant Main meter; or
 - ii. One hundred and eighty (180) days immediately preceding the test at which the relevant Main meter was determined to be defective or inaccurate.

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):

31/12/2008

Name of person/entity determining the baseline:

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:**

>>

15/01/2007

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**

>>

The project will use 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 barren and largely infertile. Prior to the project activity, most of the land in Jamnagar district 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.

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 upliftment 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 Samana site, district Jamnagar in the state of Gujarat. 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. Gujarat Energy Development Agency
4. Supplier of WEG
5. Operation and Maintenance staff of Enercon India Limited
6. Representatives of Non governmental organisation
7. Gujarat Urja Vikas Nigam Limited
8. Ministry of Environment and Forests

Local villagers and representatives of village governing body including NGOs

The varied sections of the local population, village panchayat / NGO & 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 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.

Gujarat Energy Development Agency (GEDA)

GEDA is the principal agency in Gujarat responsible for development of renewable energy sources in the state. HZL has obtained permission from GEDA for setting up the wind power project. GEDA is also responsible for transfer of wind farm from Enercon to HZL and at a later stage will be providing the commissioning certificate when all the WEGs are commissioned.

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.

Gujarat Urja Vikas Nigam Limited (GUVNL)

HZL has signed a power purchase agreement with GUVNL for selling the units generated from the project activity at a price fixed by the GUVNL/DISCOM 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 had submitted the Project Concept Note and Project Design Document to the MoEF for Host Country Approval which has been attained.

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Identified stakeholders were invited personally by HZL representatives with the help of Enercon personnel, a week ahead of the meeting.

E.2. Summary of the comments received:

>>

The project activity is environmentally benign and there are no 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. The stakeholders present in the meeting were Heads (Sarpanch) of village governing bodies (Gram Panchayats) accompanied by villagers belonging to villages in and around the wind farm project activity, representative of Non Government Organization (NGO) Aidete Action and also representatives of Enercon and Hindustan Zinc. The names of Sarpanches present in the meeting and who were appreciative of the project activity is furnished below:

1. Vallabh khoda, Dhundhoraji
2. Gaami Vital C, Wadali
3. Jasa bhai, Bhagadra
4. Magan bhai, Jamwadi
5. Arjun bhai, Motiwawadi
6. Ramji bhai, Hakkumathy saravania
7. Dosu bhai, Haripar /Mewasa
8. Nagin Bhai, Methan

There were no adverse comments by the local stakeholders. The issues and concerns raised by the stakeholders and the clarifications provided by HZL and Enercon India Limited are summarized below:

Queries raised by Participants	Clarifications by HZL
Will there be any adverse effect on the ground water level due to excavation work done for the WEC?	No. The depth of excavation done for civil foundation and Double pole structure earthing is not even more than 6 meters; there are no serious impacts due to this on the ground water level. No. The wind mills use wind as the resource to generate power and does not require water for its operation and hence there will be no effect on the ground water.
What kind of employment opportunities does this project offer to the local villagers?	Local villagers are given preference for the manpower requirement of construction work
Village roads near to the wind farm are getting damaged due to heavy vehicles and what is the corrective action planned?	Maintenance of roads at periodic intervals will be done by Enercon
What will be done with respect to improving Education and health needs of the nearby villages?	Social development is a continuous process and further steps would be taken up in this direction once the project is commissioned.
Does the temperature of the surroundings increase due to the wind mills?	No, the generation of electricity from Wind mills does not lead any emissions of greenhouse gases or thermal pollution during its operation.
Does the erection & commissioning activity of windmills lead to any impacts on cultivation?	No, there are no impacts on cultivation.
Does the rotation of wind mills have any effect on rainfall?	No, there is no impact on rainfall due to operation of windmills.



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

>>

No negative comments were raised by the local stakeholders, infact the sarpanches of various villages 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 Western 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**

The following table illustrates the WEG wise details of location:

Location Details for Samana, Gujarat Wind Power Project						
S.No.	Loc. No.	Latitude (N)	Longitude (E)	Taluka	Village Name	Land Survey No.
1	160	22°01'59.9"	70°14'36.2"	Jam-Jodhpur	Sadodar	410
2	161	22°02'06.9"	70°14'33.5"			410
3	162	22°02'13.1"	70°14'31.3"			410
4	163	22°02'18.9"	70°14'28.5"			410
5	164	22°03'08.8"	70°13'51.2"			410
6	165	22°03'02.1"	70°13'55.7"			410
7	166	22°02'57.1"	70°13'58.5"			410
8	167	22°02'49.9"	70°14'01.3"			410
9	174	22°02'01.5"	70°14'15.7"			410
10	175	22°01'56.4"	70°14'11.8"			410
11	176	22°01'50.6"	70°14'06.3"			410
12	205	22°03'03.0"	70°13'02.6"			410
13	209	22°02'17.3"	70°12'24.8"			410
14	210	22°02'09.6"	70°12'28.3"			410
15	216	22°01'11.4"	70°12'44.7"	Jam-Jodhpur	Methan	284
16	217	22°01'04.8"	70°12'42.7"			284
17	218	22°00'58.2"	70°12'43.5"			284
18	219	22°00'25.3"	70°12'36.8"			284
19	220	22°00'19.2"	70°12'41.0"			284
20	177	22°01'44.3"	70°14'05.8"			284
21	178	22°01'37.5"	70°14'04.2"			284
22	181	21°59'59.8"	70°13'49.8"			284
23	182	22°00'06.1"	70°13'41.2"			284
24	183	22°00'13.0"	70°13'34.0"			284
25	185	22°00'19.5"	70°13'27.9"			284
26	190	22°00'51.6"	70°13'16.8"			284
27	191	22°00'58.0"	70°13'11.6"			284
28	230	22°00'51.4"	70°11'26.4"			284
29	231	22°00'55.7"	70°11'25.5"			284
30	232	22°01'04.3"	70°11'26.9"			284
31	233	22°01'11.3"	70°11'29.7"			284
32	234	22°01'25.2"	70°11'32.4"			284
33	179	21°59'40.8"	70°14'06.7"	Jam-Jodhpur	Baghdara	441
34	180	21°59'46.5"	70°14'01.3"			441
35	184	22°00'06.3"	70°13'17.6"			441
36	186	22°00'25.2"	70°13'21.7"			441
37	187	22°00'32.9"	70°13'16.5"			441
38	188	22°00'37.7"	70°13'12.2"			441
39	901	22°00'14.5"	70°12'45.8"			441
40	142	22°01'01.5"	70°15'32.5"	Kalawad	Mevasa	137
41	143	22°00'56.2"	70°15'38.0"			137
42	144	22°00'49.7"	70°15'39.1"			137



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43	145	22°0' 43.0"	70°15'41.5"	Kalawad	Dhun-Dhoraji	137
44	147	22°00'40.1"	70°15'20.5"			137
45	149	22°00'59.1"	70°15'19.1"			137
46	150	22°00'48.5"	70°15'05.9"			137
47	151	22°00'56.5"	70°15'03.6"			137
48	902	22°01'01.3"	70°14'57.5"			137
49	133	22°03'55.8"	70°14'54.0"	Kalawad	Dhun-Dhoraji	220
50	134	22°04'03.7"	70°14'53.9"			220
51	135	22°04'09.5"	70°14'46.2"			220
52	136	22°04'15.9"	70°14'42.6"			220
53	137	22°04'23.2"	70°14'35.6"			220
54	139	22°04'13.6"	70°14'25.4"			220
55	140	22°04'07.3"	70°14'30.0"			220
56	141	22°04'01.3"	70°14'36.4"			220
57	157	22°01'27.8"	70°14'20.5"	Jam-Jodhpur	Methan	284
58	158	22°01'34.0"	70°14'24.3"			284
59	159	22°01'38.7"	70°14'24.7"			284
60	192	22°01'35.4"	70°13'18.1"			284
61	193	22°01'43.7"	70°13'17.4"			284
62	194	22°01'50.5"	70°13'16.6"			284
63	212	22°01'39.2"	70°12'18.3"			284
64	213	22°01'32.4"	70°12'20.2"			284
65	214	22°01'24.1"	70°12'25.3"			284
66	215	22°01'17.9"	70°12'28.4"			284
67	168	22°02'41.8"	70°14'04.3"	Jam-Jodhpur	Sadodar	410
68	169	22°02'35.2"	70°14'03.5"			410
69	170	22°02'29.8"	70°14'06.2"			410
70	195	22°01'57.7"	70°13'21.5"			410
71	196	22°02'04.6"	70°13'20.5"			410
72	197	22°02'12.1"	70°13'18.0"			410
73	206	22°03'10.3"	70°13'06.1"			410
74	207	22°02'30.2"	70°12'20.4"			410
75	208	22°02'23.7"	70°12'21.4"			410
76	235	22°04'10.1"	70°11'28.4"			410
77	236	22°04'17.3"	70°11'24.2"			410
78	237	22°04'23.1"	70°11'18.4"			410
79	238	22°04'27.5"	70°11'12.8"			410
80	240	22°04'33.1"	70°10'25.9"	Jam-Jodhpur	Narmana	20 and 190
81	241	22°04'27.3"	70°10'27.4"			20 and 190
82	243	22°04'14.1"	70°10'21.2"			20 and 190
83	244	22°04'06.2"	70°10'14.7"			20 and 190
84	245	22°04'28.8"	70°10'11.2"			20 and 190
85	246	22°04'39.0"	70°10'13.0"			20 and 190
86	247	22°04'33.7"	70°09'53.9"			20 and 190
87	248	22°04'26.9"	70°09'38.4"			20 and 190
88	249	22°04'20.6"	70°09'37.0"			20 and 190
89	250	22°04'13.9"	70°09'35.6"			20 and 190
90	251	22°04'07.5"	70°09'35.6"			20 and 190
91	257	22°04'41.4"	70°08'44.9"			20 and 190
92	258	22°04'47.1"	70°08'47.8"			20 and 190
93	259	22°04'53.7"	70°08'45.6"			20 and 190



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94	260	22°05'05.0"	70°08'48.0"			20 and 190
95	261	22°05'09.4"	70°08'46.0"			20 and 190
96	266	22°04'58.3"	70°06'06.6"	Jam-Jodhpur	Laloi	139
97	268	22°05'18.7"	70°05'55.0"			139
98	269	22°05'14.6"	70°06'10.7"			139
99	270	22°05'22.4"	70°06'07.9"			139
100	271	22°05'41.6"	70°06'01.4"			139
101	32	22°08'29.2"	70°18'55.7"	Kalawad	Jamwadi	164
102	33	22°08'37.1"	70°18'56.9"			164
103	34	22°08'43.5"	70°18'54.3"			164
104	41	22°08'21.4"	70°17'53.3"			164
105	42	22°08'15.2"	70°18'04.0"			164
106	44	22°07'37.9"	70°17'56.1"			164
107	45	22°07'32.0"	70°17'55.6"			164
108	46	22°07'27.4"	70°17'56.9"			164
109	47	22°07'52.7"	70°17'40.7"			164
110	48	22°07'58.2"	70°17'34.6"			164
111	49	22°08'04.0"	70°17'23.5"			164



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
DISCOM	Distribution Company
EF	Emission factor
EIA	Environment Impact Assessment
EIL	Enercon India Limited
EPC	Engineering, Procurement, Construction
ER	Emission Reductions
GEB	Gujarat Electricity Board
GEDA	Gujarat Electricity Development Agency
GERC	Gujarat Electricity Regulatory Commission
GETCO	Gujarat Electricity Transmission Company
GHG	Green House Gas
GUVNL	Gujarat Urja Vikas Nigam Limited
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
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
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
RLDC	Regional Load Dispatch Centre
RPC	Regional Power Committees
RPM	Rotations per minute
SLDC	State Load Dispatch Centers
T&D	Transmission and Distribution



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tCO₂e	Tonnes of Carbon Dioxide Equivalent
UNFCCC	United Nation Framework Convention of Climate Change
WEC	Wind Energy Converter
WEG	Wind Electric Generator
WREB	Western Region Electricity Board
