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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Title: GEI Wind Power Project in Karnataka, India
Version: 7.0
Date of completion of PDD: 25/02/2011

A.2. Description of the project activity:

>>
Objective of the Project

M/s Generacion Eolica India Limited ("GEI") is designed to construct 31.2 MW wind power project ("Project") in the state of Karnataka, India. The project activity is to install and operate 39 wind energy converters (WEC's), with each machine having a capacity of 800 kW. The objective of project activity is to develop, design, engineering, procure, finance, construct, operate and maintain the wind power project in the Indian state of Karnataka to provide reliable, renewable power to the Karnataka state electricity grid which is part of the Southern grid. The project activity will assist the sustainable growth of Karnataka state by providing clean and green electricity to the state electricity grid. The Project will lead to reduced greenhouse gas emissions because it displaces electricity from fossil fuel based electricity generation plants.

Purpose of the project activity:

The purpose of the project activity is to utilize renewable wind energy for generation of electricity. The project activity replaces anthropogenic emissions of greenhouse gases (GHG's) into the atmosphere, which is estimated to be approximately 64,095 tCO_2e per year, by displacing the equivalent amount of electricity generation through the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansions connected to the grid.

In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the Southern grid, which are/ will be predominantly based on fossil fuels[1]. Whereas the electricity generation from operation of WEC's is emission free. As per the applicable methodology the baseline scenario for the project activity is the grid based electricity system, which is also the pre-project scenario.

Contribution to Sustainable Development:

The National CDM Authority (NCDNA) which is the Designated National Authority (DNA) for the Government of India (GoI) in the Ministry of Environment and Forests (MoEF) has stipulated four indicators for sustainable development in the interim approval guidelines for Clean Development

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[1] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Mechanism (CDM) projects from India[2]. The contribution of this project activity towards in terms of these four indicators is provided below:

1. **Social well being:**

- ✓ The project activity has led to the development of supporting infrastructure such as road network etc., in the wind park location, which also provides access to the local population.
- ✓ The 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.
- ✓ Use of a renewable source of energy reduces the dependence on imported fossil fuels and associated price variation thereby leading increased energy security.

2. **Environmental well being:**

- ✓ The project activity involves use of renewable energy source for electricity generation instead of fossil fuel based electricity generation which would have emitted gaseous, liquid and/or solid effluents/wastes.
- ✓ 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.

3. **Economic well being:**

- ✓ The project activity requires temporary and permanent, skilled and semi-skilled manpower at the wind park; this will create additional employment opportunities.
- ✓ The generated electricity will be fed into the southern 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.

4. **Technological well being:**

- ✓ Increased interest in wind energy projects will further push R&D efforts by technology providers to develop more efficient and better machinery in future.

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)**

[2] http://cdmindia.nic.in/host approval criteria.htm

Government of India (Host)	M/s Generacion Eolica India Limited	No

The contact details of the entities are provided in Annex – 1.

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):

>>
The host party to the project activity is the Government of India.

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

>>
The Project is located in the State of Karnataka that forms part of the Southern regional electricity grid of India.

A.4.1.3. City/Town/Community etc:

>>
The Project is located at Harthi, Kurtakoti & Malasamudra villages in Gadag district of Karnataka state in India.

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

>>
The Project consists of 39 E-53 WECs of 800 kW each. The details of the physical location are as follows:

Sr.nos.	Loc.Nos.	No.of Machines	Commissioning Date	Village	Longitude	Latitude
1	170a	4	17/12/2007	Harthi	15°20'53"	75°34'29.2"
2	170			Harthi	15°20'59 "	75°34'27.5"
3	171			Harthi	15°21'5.8 "	75°34'26.1"
4	236			Harthi	15°21'14.3 "	75°34'38.8"
5	229	6	17/03/2008	Malasamudra	15°21'59.9 "	75°34'23"
6	181			Malasamudra	15°22'16.6"	75°33'57.8"
7	180			Malasamudra	15°22'10.4"	75°34'0.9"
8	163			Kurthkoti	15°22'8.3 "	75°33'44.8"
9	226			Malasamudra	15°22'19.2	75°34'13.5"

Sr.nos.	Loc.Nos.	No.of Machines	Commissioning Date	Village	Longitude	Latitude
					"	
10	230			Malasamudra	15°21'52.7"	75°34'23.9 "
11	173	8	25/06/2008	Harthi	15°21'19.4"	75°34'19.9"
12	231			Malasamudra	15°21'46.8"	75°34'27.7"
13	174			Harthi	15°21'31.5"	75°34'15.5"
14	233			Harthi	15°21'33.3"	75°34'30.6"
15	232			Harthi	15°21'39.6"	75°34'28.6"
16	234			Harthi	15°21'27.8"	75°34'33.5"
17	169A			Harthi	15°21'20"	75°34'3.7"
18	237			Harthi	15°21'8.1"	75°34'41.3"
19	168	10	7/7/2008	Kurthkoti	15°21'35.7"	75°33'56.8"
20	169			Harthi	15°21'29.5"	75°34'1.5"
21	235			Harthi	15°21'21.3"	75°34'39.2"
22	136			Harthi	15°20'26.5"	75°34'5.7"
23	137			Harthi	15°20'32.6"	75°34'4.6"
24	138			Harthi	15°20’39.9"	75°34'4.9"
25	139			Harthi	15°20'44.8"	75°33'57.3"
26	140			Harthi	15°20'50.9"	75°33'57.3"
27	141			Harthi	15°20'59.2"	75°33'56.9"
28	179			Malasamudra	15°22'3.6"	75°34'2.6"
29	228	4	11/9/2008	Malasamudra	15°22'6.2"	75°34'18.1"
30	172			Harthi	15°21'11"	75°34'22.3"
31	227			Malasamudra	15°22'15.2"	75°34'25.2"
32	239			Harthi	15°20'52.8"	75°34'41.2"
33	167	4	29/09/2008	Kurthkoti	15°21'42.8"	75°33'54.3"
34	176			Harthi	15°21'44.5"	75°34'9.5"
35	178			Kurthkoti	15°21'58.1"	75°34'5.6"
36	164			Kurthkoti	15°22'2.8"	75°33'48.1"
37	165	3	10/10/2008	Kurthkoti	15°21'55.3"	75°33'50.5"
38	166			Kurthkoti	15°21'49.3"	75°33'51.3"
39	177			Malasamudra	15°21'51.4"	75°34'8.1"
	Total:-	**39**				

. The site is located at a distance of 420 km from Bangalore by road. The nearest railway station is at Gadag. A location map is attached at Appendix – 1.

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

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The project activity is considered under CDM category zero-emissions **'grid-connected electricitygeneration from renewable sources'** that generates electricity in excess of 15 MW (limit for small scale project). 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), the project activity is grid connected renewable power generation hence Consolidated baseline and monitoring methodology for "Grid-connected electricity generation from renewable sources" (ACM 0002, Version 11) is applicable for the project activity.

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

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The Project activity involves 39 WECs of Enercon make (800 kW E-53) with internal electrical lines connecting the Project with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV at the Project site and further stepped up to 220 KV at the Receiving sub station at Nagavi village, Gadag in the close vicinity of the existing 220 KV DC line between Hubli and Lingapur by line in line out (LILO) of both 220 KV circuits, for the purpose of interconnection with the KPTCL/HESCOM grid at the sub-station of the KPTCL/HESCOM.

The Project can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The life time of the WEC is 20 years as provided by the equipment supplier. The other salient features of the state-of-art-technology are:

E 53 Specifications

Turbine model	Enercon E- 53
Rated power	800 KW
Rotor diameter	53 m
Hub height	75 m
Turbine Type	Gearless horizontal axis wind turbine with variable rotor speed
Power regulation	Independent electromechanical pitch system for each blade.
Cut in wind speed	2.5 *m/s*
Rated wind speed	12 *m/s*
Cut out Wind speed	28-34 m/s
Extreme Wind Speed	59.5 *m/s*
Rated rotational speed	32 rpm
Operating range rot. speed	12-29 rpm
Orientation	Upwind

No of Blades	3
Blade Material	Fibre Glass Epoxy reinforced with integral lightning protection
Gear box type	Gear less
Generator type	Synchronous generator
Braking	Aerodynamic
Output Voltage	400 V
Yaw System	Active yawing with 4 electric yaw drives with brake motor and friction bearing
Tower	74 m concrete

Enercon has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.
In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the Southern grid, which are/ will be predominantly based on fossil fuels[3], hence baseline scenario of the project activity is the grid based electricity system, which is also the pre-project scenario. Since the project activity involves power generation from wind, it does not involve any GHG emissions for generating electricity.

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

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The estimated emission reductions over the 10 year fixed crediting period would be 6,40,950 tCO_2e as per details on annual emission reductions provided below:

Years	Annual estimation of emission reductions in tonnes of CO_2e
*1st year	64,095
2nd year	64,095
3rd year	64,095
4th year	64,095
5th year	64,095
6th year	64,095
7th year	64,095

[3] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Years	Annual estimation of emission reductions in tonnes of CO_2e
8th year	64,095
9th year	64,095
10th year	64,095
Total estimated reductions (tonnes of CO_2e)	**6,40,950**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	64,095

*1st year begins from the date of registration, and each year extends for 12 months.

A.4.5. Public funding of the project activity:

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There is no public funding from Annex 1 countries and no diversion of Official Development Assistance (ODA) involved in the 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: Consolidated baseline and monitoring methodology for "Grid-connected electricity generation renewable sources"

Reference: Approved consolidated baseline methodology ACM0002 (Version 11, EB 52)

ACM0002 draws upon the following tools, which have been used in the PDD:

- Tool to calculate the emission factor for an electricity system – Version 02, EB 50
- Tool for the demonstration and assessment of additionality – Version 05.2, EB 39

Further information with regards to the methodology / tools can be obtained at http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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The Project is wind based renewable energy source, zero emission power project connected to the Karnataka state grid, which forms part of the Southern regional electricity grid. The Project will

displace fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in Southern regional electricity grid.

This methodology is applicable to grid-connected renewable power generation project activities under the following conditions:

Para No.	Applicability Conditions as per ACM 0002	Applicability to this Project Activity
1.	The project activity is the installation capacity addition, retrofit or replacement of a power plant/unit of one of the following types: • Hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir) • Wind power plant/unit, • Geothermal power plant/unit, • Solar power plant/unit, • Wave power plant/unit • Tidal power plant/unit.	The project activity is grid connected renewable power generation from wind.
2.	In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition project which use option 2: on the page 10 to calculate the parameter $EG_{PJ, y}$) : the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	This condition is not relevant, as the project activity does not involve capacity additions, retrofits or replacements.
3.	In case of hydro power plants: • The project activity is implemented in an existing reservoir, with no change in the volume of reservoir. • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2. • The project activity results in new	This condition is not relevant, as the project activity is not the installation of a hydro power plant.

	reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	
4.	The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	The project activity does not involve any of the given criteria hence methodology is applicable for the project activity.
5.	In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The project activity is a new wind power plant. Also no replacement, modification and retrofit measures are implemented here. Hence, this criterion is also not relevant to the project activity.

The description provided in table above shows that the project activity satisfies the applicable conditions of the methodology, ACM0002.

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

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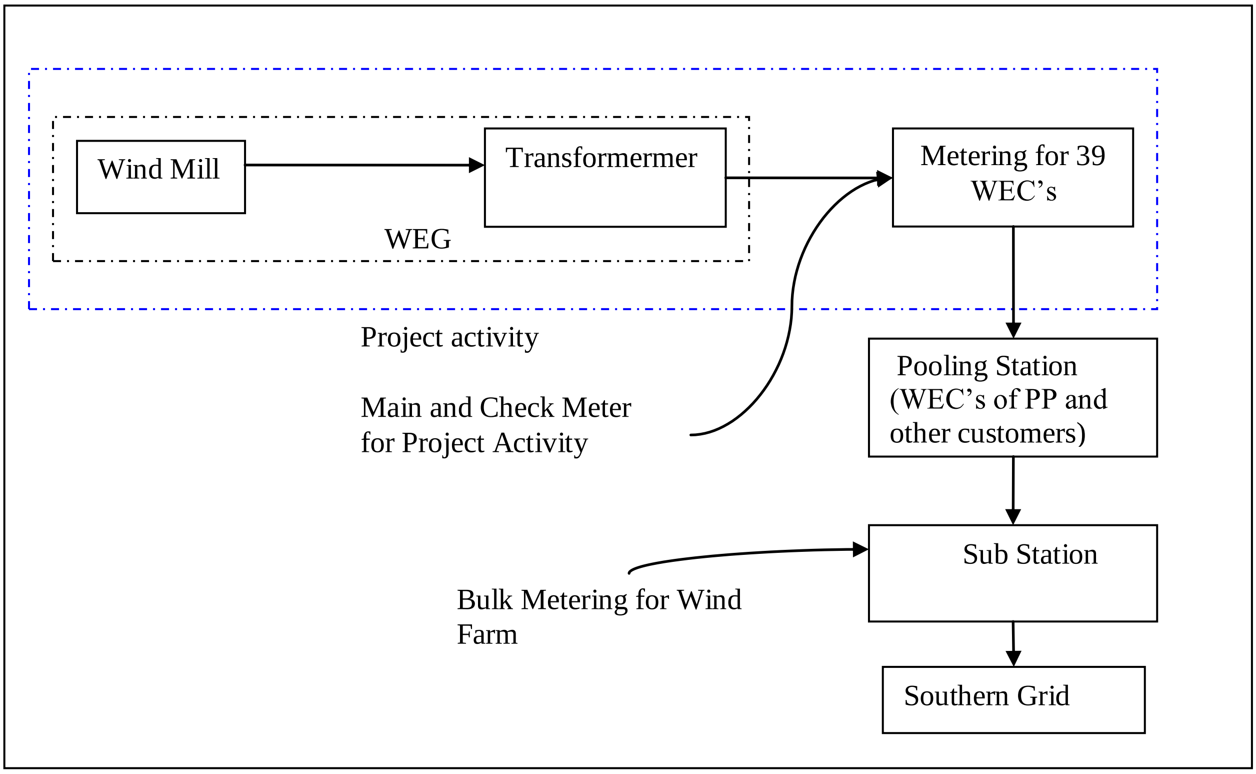
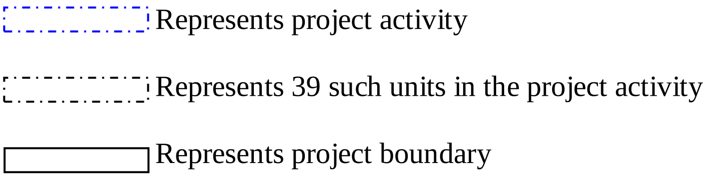
>>According to the applicable methodology, spatial extent of the project boundary includes the project site and all the power plants connected physically to the electricity system that the CDM power project is connected to. The project activity is connected to the network of state transmission utility which falls in Southern grid. Thus the project boundary includes all the power plants physically connected to the Southern grid.

Flow diagram of the project boundary:





The baseline study of southern grid shows that the main sources of GHG emissions in the baseline are CO_2 emissions from the conventional power generating systems, the other emissions are that of CH_4 and N_2O but both emissions were conservative and are excluded for simplification of the project. The project activity is the emission free electricity generation from renewable sources and hence emits no gases in the atmosphere.

Table B: Emission sources included in or excluded from the boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Grid-connected electricity generation	CO_2	Yes	In the baseline scenario the electricity would have been sourced from the Southern grid which in turn would be connected to fossil fuel fired power plants which emit CO_2.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.
Project Activity	Greenfield wind energy conversion system	CO_2	No	The project activity does not emit any emissions.
		CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.

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

>>

According to ACM0002 if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

The details of India grid system is described in the table below:

S.No.	Electricity Grid (Present)	Electricity Grid (Earlier)	Geographical Areas Covered
1.	NEWNE Grid	Northern	Chandigarh, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand
		Western	Chhattisgarh, Gujarat, Daman & Diu, Dadar & Nagar Haveli, Madhya Pradesh, Maharashtra, Goa
		Eastern	Bihar, Jharkhand, Orissa, West Bengal, Sikkim, Andaman-

			Nicobar
		North-Eastern	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura
2.	Southern Grid	Southern	Andhra Pradesh, Karnataka, Kerala, Tamilnadu, Pondicherry, Lakshadweep

Karnataka state falls under Southern grid. The power sector in India including the Southern region largely comprises thermal power stations[4], thermal power generation is GHG intensive and is a major source of CO_2 emissions.

In the absence of the project activity equivalent amount of electricity would have been generated from the existing grid connected power plants and planned capacity additions which are also largely fossil fuel based. Thus generation from the project displaces the electricity generated from existing and planned power plant capacities in the southern grid whose emission intensities are represented by the Combined Margin Emission Factor of the Southern Grid.

The baseline emissions and emission reductions from the project activity are estimated by multiplying the amount of electricity exported by the project activity to the Southern grid with the emission factor of the Southern grid calculated as the combined margin (CM) of the operating margin (OM) and build margin (BM) emission factors.

Variable	**Data Source**
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)	Records maintained by project proponents
Parameter	**Data Source**
$EF_{grid,OM,y}$ = Operating Margin Emission Factor (tCO_2/MWh)	CEA Database for CO_2 emission factor, version 4
$EF_{grid,BM,y}$ = Build Margin Emission Factor (tCO_2/MWh)	CEA Database for CO_2 emission factor, version 4
$EF_{grid,,CM,y}$ – Grid Emission Factor	Calculated as the weighted average of the operating margin and build margin

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): >>

CDM consideration: The offer for the project was submitted by the Enercon (WTG supplier) to the project proponent on 25 July 2006. The offer clearly stated that the proposed site will be located in the state of Karnataka. The project proponent passed the resolution dated 23 Aug 2006 at Tudela, Navarra, Spain to place the order on Enercon to freeze the price based on the detailed project report (DPR) dated 28 July 2006.

[4] http://www.cea.nic.in/

The supplier in its offer letter has proposed the site with generation of 1.785 Million units per machine based on which the decision to invest was taken in the board meeting dated 23 Aug 2006, in the board meeting CDM was seriously considered. PP advised Enercon to revise the DPR considering 45 Million as contingency capital to the capital cost provided by Enercon in its offer letter and present cost of financing that might have changed from the last DPR dated 28 July 2006. Enercon provided the revised DPR dated 01-Feb-2007 to the PP based on which PP took the decision dated 05-Feb-2007 at Tudela, Navarra, Spain to make an amendment to the purchase order placed on Enercon dated 15-Mar-2007.

Therefore the implementation work could only be started after placement of the amended purchase order dated 15-Mar-2007. As per EB 49, Annex 22, the chronology of events leading up to web-hosting of the PDD for global stakeholder consultation and the actions taken by the project proponent to secure CDM status of the project are presented below:

S.No.	Activity	Date
1	Board Resolution with serious consideration of CDM benefits and finalization of EPC Contractors	23-Aug-2006
2	Purchase Order	24 -Aug -2006
3	Revised DPR submitted by Enercon to GEI	01-Feb-2007
4	Board Resolution based on DPR dated 01 Feb 2007	5-Feb-2007
5	Purchase Order- Amendment	15-Mar-07
6	CDM Mandate	26-Mar-07
7	Loan Sanction Letter	5-Jul-07
8	Transfer of Capacity to GEI by nodal agency	1-Sep-07
9	PPA (Power Purchase Agreement)	22-Nov-07
10	Stakeholder Consultation	23-Nov-07
11	Commissioning of first WEC	17 December 2007
12	Loan Agreement	29-Jan-08
13	PDD Preparation	Jan-08 to Feb-08
14	HCA(Host Country Approval) Submission	10-Mar-08
15	HCA Meeting	25-Apr-08
16	EB Rejected the benchmark of CERC	17-Jun-08
17	Approach DoE (TUV-Nord)	16-Jul-08
18	Additionality tool version 5.2	16-May-08
19	DNA Approval	3-Oct-08
20	Commissioning of last WEC	10 October 2008
21	First wind power project to be registered with WACC in India	27-Oct-08
229	ACM0002 was revised to version 08	28-Nov-08
23	Revised PDD preparation based on version 08 of ACM0002	Nov-08 to Dec-08
24	ACM0002 was revised to version 09	13-Feb-09
25	Revised PDD preparation based on version	19-Feb-09

	09 of ACM0002	
26	Appointment of DoE	20-Feb-09
27	PDD Webhosting	04-Apr-09 to 03-May-09

As can be seen from the above, actions to secure CDM status for the project was initiated right at the start of the project, the CDM consultants were appointed on 26 March 2007 within 2 weeks of placing the amended purchase order on 15 March 2007. The PDD was prepared immediately after the execution of the PPA on 22 November 2007 and loan agreements on 29 January 2008 for the project. The PDD was submitted to DNA on 10 March 2008 and DNA approval for the project was completed on 3 October 2008 before commissioning of last WEC on 10 October 2008.

Efforts to secure CDM revenues were also initiated immediately after placement of the amended purchase order on 15 March 2007. The DOE for the project was approached before completion of the HCA. However the PDD had to undergo several rounds of revision on account of the new guidelines issued by the CDM EB and revisions to the applicable methodology ACM0002. For instance:

- The CERC benchmark used by Indian wind projects was deemed unacceptable by the EB in July 2008 and the clarity on applicable benchmark emerged only after October 2008, when a project (belonging to Enercon India, who are the CDM consultants for this project also) was registered.
- Similarly, the PDD was initially prepared on the basis of actual values of project parameters which were later changed to values applicable at the time of investment decision making after the Guidance on Investment Analysis was issued in August 2008.

As can be seen, the PP had initiated all possible efforts to ensure CDM registration of the project, however the process has been delayed because of external factors like Land clearances, DNA approvals, EB decisions and changes in the CDM procedures.

From above it can be seen that there is no gap that is more than two years between the two documented evidence. Therefore in accordance with EB 49, Annex 22, para 8 (a), the project proponent has taken continuing and real actions for securing CDM status for the project activity.

The latest Additionality tool i.e. Tool for the demonstration and assessment of additionality version 05.2 approved by CDM Executive Board in its 39th meeting is used to demonstrate project additionality.

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

Sub-step 1a. Define alternatives to the project activity:

In accordance alternative(s) available to the project participants or similar project developers include:

(a) The Project is not undertaken as a CDM project activity.

(b) Setting up of comparable utility scale fossil fuel fired (gas or coal), biomass or hydro power projects that supply to the Karnataka grid under a PPA.

(c) Continuation of the current situation

There are existing gas, coal and biomass projects in southern grid and hence these are alterative available to the project proponent. Therefore alternatives (a) and (b) are plausible alternatives to the project activity.

Continuation of the current situation means a situation where there is no project activity or other alternatives undertaken. This is not a plausible alternative because Karnataka had energy (MU) shortages of 0.7% and peak (MW) shortages of 9.8% in 2005-06 (Source: Southern Region Power Sector Profile, January 2007, Ministry of Power).

Given the power deficit situation in the state, it is not reasonable to assume that no other projects would be taken up in the absence of project activity. Hence the continuation of current situation is not a plausible alternative.

Outcome of step 1 a:

Alternatives a and b, as identified above are realistic and credible alternatives to the project activity.

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

Both alternative a and alternative b are in compliance with mandatory laws and regulations taking into account the enforcement in the region or country and EB decision on national and sectoral policies. Hence Alternative a and b as identified in the step 1 a, are realistic and credible alternatives to the project activity.

Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)

Step 2: Investment Analysis

Sub step 2(a) :

In accordance with sub-step 2(a), Simple cost analysis is not applicable as the project activity sells electricity to the utility and obtains economic benefits in the form of electricity tariffs. In accordance with the guideline on investment analysis where the project proponent has the option to invest or not to invest, benchmark analysis should be applied. Therefore investment comparison analysis (sub step 2b) is not applicable. Hence benchmark analysis is used for the project activity.

Sub step 2(b):

Option III – Benchmark Analysis:

In accordance with the guideline on investment analysis where the project proponent has the option to invest or not to invest, benchmark analysis should be applied.

The project participant proposes to use **Option III – Benchmark analysis** and the financial indicator that is identified is the post-tax project IRR.

The guidance to investment analysis issued in EB 51, Annex 58 (paragraph 12) states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for equity IRR.

The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that in cases where the project has more than one potential developer, the benchmark shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Accordingly, the weighted average cost of capital applicable to the project type has been considered as the benchmark.

The benchmark WACC for the project is **13.47**%. Further details of the benchmark considered and WACC calculations are presented in Annex 5.

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

The key assumptions used for calculating the post-tax project IRR are set out below:

Financial Assumptions

Owner:	M/s Generacion Eolica India Limited
Project:	31.2 MW GEI Wind Power Project
Location :	Karnataka

Assumptions	**Value**	**Reference**
Capacity of Machines in kW	800	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Number of Machines	39	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Project Capacity in MW	31.20	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Project Commissioning Date	31-Mar-08	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Project Cost per MW (Rs. In Millions)	49.8	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Operations		
Plant Load Factor	25.3%	C-WET Report (Third Party Report) dated 28 May 2007
Insurance Charges @ % of capital cost	0.18%	DPR dated 28 July 2006
Operation & Maintenance Cost base year @ % of capital cost	1.10%	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
% of escalation per annum on O & M Charges	5.0%	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Tariff		
Base year Tariff for 10 years - Rs./Kwh	3.40	KERC Order dated 18 Jan 2005
Annual Escalation up to 10 year (Rs./kWh per Year)	0.00	KERC Order dated 18 Jan 2005

Tariff applicable after 10 years (Rs/kWh)	Cost plus 16% return on equity	KERC Order dated 18 Jan 2005
Project Cost	Rs Million	
Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc.		
Total Project Cost	1,554.15	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Means of Finance		
Own Source (25%)	388.54	DPR dated 28 July 2006
Term Loan (75%)	1165.61	DPR dated 28 July 2006
Total Source	1,554.15	Enercon Offer dated 25 Jul 2006/DPR dated 28 July 2006
Terms of Loan		
Interest Rate	11.00%	RBI Lending rates at decision time
Tenure (Years)	10	KERC Order dated 18 Jan 2005
Income Tax Depreciation Rate (Written Down Value basis)		
on Wind Energy Generators	80%	Income Tax Act
On other Assets	10%	Income Tax Act
Book Depreciation Rate (Straight Line Method basis)		Income Tax Act
On all assets	4.50%	Straight line Depreciation method
Book Depreciation up to (% of asset value)	90%	KERC Order dated 18 Jan 2005
Income Tax		
Income Tax rate	33.66%	Income Tax Act
Minimum Alternate Tax	11.22%	Income Tax Act
Working capital		
Receivables (no of days)	30	Billing Cycle
O & m expenses (no of days)	120	Enercon Offer

Plant Load Factor: The guidance on PLF was issued by EB in meeting EB 48 held from 17-19 July 2009 where as PDD for the project activity was web-hosted on 04 April 2009. The estimated PLF given by the supplier is at WTG controller where as the tariff applicable to the project activity is applicable to the generation that is available at the sub-station. Therefore to arrive at the effective PLF at the substation, the PLF at WTG controller shall be subjected to adjustment in transmission loss, transformation loss at the transformer and grid availability. **In the web-hosted PDD, we have used the PLF from KERC order that is no longer applicable to the project activity as per EB 48 annex 11.**

The project proponent has used the effective PLF of 23.7% at the sub-station for evaluation of the project activity (that is derived after adjustment of Transmission loss of 5% and grid availability of 98% to the PLF provided by the supplier) as per its detailed project report.

Subsequently, the project proponent has got the plant load factor validated by C-WET (Centre for Wind Energy Testing; third party) for estimation of generation from the project activity. C-WET has reported that the following PLF values for the project site.

- Estimated PLF – 25.3%
- Min PLF – 22.7%
- Max PLF – 27.8%

Therefore, the investment analysis has been carried out considering the PLF values reported by C-WET. Clearly the effective PLF for the project activity estimated by C-WET is on the higher side compared to the plf value used in DPR and is therefore plf estimated by CWET is selected for evaluation of additionality. The estimated PLF is in accordance with the Annex 11 of EB 48 and hence we consider it appropriate to use the same for additionality.

Tariff beyond the term of PPA: We would like to submit that the tariff for our project is governed by a legally binding Power Purchase Agreement (PPA) signed between the project developer and the off-taker. The fixed tariff of Rs. 3.40 is applicable for the PPA tenure which is 10 years. For tariff beyond 10th year, the PPA states that [Source: Section on Rates and Charges of KERC tariff order dated 18 January 2005]:

"From 11th year onwards, from the date of signing of the agreement the corporation shall pay to the company for the energy delivered at the metering point at a rate based on operating costs and incentives to be agreed upon by mutual negotiations"

As can be seen, the PPA very clearly states that only "operating costs" and "incentives" to be agreed upon by mutual negotiation will determine the tariffs from 11th year to the 20th year. It can be noticed in the financial model that the tariffs from the 11th to 20th year have accordingly been considered – operating costs plus the 16% return on equity that KERC considers for setting wind power tariff. The reason why the tariff number comes down substantially after the 10th year is because the largest component of tariff being the debt service (principal repayment and interest payments) is over by the 10th year of operations and these have already been factored in while determining the regulated tariff for the first 10 years.

In fact KERC, while working out the tariff schedule for wind energy projects for the first 10 years, has noted that the reduction in tariff from year to year is mainly on account of repayment of debts and also that there are no running costs other than O&M costs which increases only marginally from year to year. Please refer Page 19 third line of KERC order dated 18th January 2005 which is

applicable to project activity. (Source: http://www.kerc.org/order2005/Order%20on%20NCE%20Tariff%20(FINAL).doc).

Therefore it is unrealistic to assume that the project will be able to obtain the same constant tariff beyond the PPA tenure.

However, we have carried out sensitivity analysis considering a reasonable escalation in tariff of 10% (as per EB Guidance para 17, Annex 58 of of EB 51). As can be seen, with reasonable variations in tariff the IRR remains below the benchmark. However, it is unrealistic to assume constant tariff for the period beyond the term of PPA, we have still presented the IRR based on constant tariff of INR 3.40 per kWh for the entire project life in the sensitivity for tariff.

The project IRR for the Project (without CDM revenues) is 9.35% which is less than the benchmark. The detail calculations of IRR are presented in a separate excel sheet.

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

Sensitivity Analysis

As per the investment guidelines only those parameters should be selected for the sensitivity analysis that constitute more than 20% of either total project costs or total project revenues, in this case only capital cost, tariff and PLF has such impact on the project cost and revenues hence these are selected for sensitivity analysis.

:

- Capital Cost
- Tariff
- Plant Load Factor

Capital Cost

In accordance with the investment guidance, the additionality for the project activity is demonstrated at the time of decision making. The supplier's offer was provided to the project proponent in June 2006 and the preliminary purchase order was placed in August 2006 to lock the price.

Capital Cost [In Million]	**1398.74 (-10% over base case)**	**1554.15 (Base case)**	**1709.57 (+10% over base case)**
Post tax Project IRR without CER revenues	11.11%	9.35%	7.90%

In accordance with the guidance on investment analysis, the project cost for the project activity is taken from the offer letter provided by the supplier. The project cost can also be cross checked from the purchase order. The project cost in the offer letter provided by Enercon is same as the project cost in the purchase order placed by the PP on Enercon.

However, as the actual data was not available to PP at the time of decision making, the robustness of the project cost was checked at the variation of +/-10% which is deemed appropriate as the negotiation in capital cost beyond 10% is not deemed reasonable.

Tariff

Tariff for the project is fixed for the first 10 year period and is not subject to any variations. Tariff for the next 10 years is determined based on tariff principles set by KERC in its order dated 18 January 2005 – Page 5. The calculated tariff from Year 10 to Year 20 based on the KERC tariff principle works out to Rs. 2.44/kWh. The calculations for this have been provided in the spreadsheet for Investment Analysis [Refer: Sheet "*Tariff beyond 10th Year*"].

At a 10 % escalation, the tariff for the period beyond the term of PPA works out to be INR 2.68/kWh. Any tariff increase beyond this rate is not realistic, however in order to be conservative we have carried out a sensitivity of the IRR by considering tariff of Rs.3.40 beyond the 10th year. The project IRR considering tariff of Rs. 3.40 per unit is 10.66% which is lower than the benchmark.

Plant Load Factor

Sensitivity analysis to the Plant Load Factor (the most critical assumption) has been carried out considering a plant load factor of 22.77% and 27.83%. Plant Load Factor is the key variable encompassing variation in wind profile, variation in off-take (including grid availability) including machine downtime. The post tax project IRRs at the stated PLFs are as follows:

PLF	**22.77%**(-10% OVER BASE CASE)	**25.3%(base case)**	**27.83%(+10% over base case)**
Post tax Project IRR without CER revenues	7.97%	9.35%	10.75%

The plant load factor estimated by C-WET (Center for Wind Energy Testing; the independent third party) has been considered for substantiating additionality. The independent third party has provided has probable minimum, average and maximum PLF values for the project site. The estimates for minimum, average and maximum values for plf provided by independent third party are 22.77%, 25.30% and 27.83% respectively. Therefore for sensitivity we have considered the estimates for minimum, average and maximum values for plf provided by independent third party.

Outcome of Step 2: As can be seen, the project IRR of the project activity remains well below the benchmark even under the sensitivity analysis. Therefore it can be concluded that the proposed CDM project activity is unlikely to be the most financially/economically attractive.

Step 3: Barrier analysis:

Not Opted for.

Step 4. Common practice analysis

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

The additionality tool version 5.2 describes 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.

In India tariff for the projects is approved by State Electricity Regulatory Commission (Karnataka Electricity Regulatory Commission in this case). Therefore geographical region for conducting common practice is restricted to state of Karnataka which is having similar investment climate and not extended to other states of India which are having different investment climate.

In light of the above definition, all large scale wind projects, (greater than 15 MW) set up by individual investors in the state of Karnataka, have been analysed. In India there 95[5] individual investors who have wind installations greater than 15 MW. Out of these there are 8[6] investors who have wind installations greater than 15 MW in the state of Karnataka. An analysis of these installations has been presented below.

Sl. No.	Name of Owner	Capacity in Karnataka (MW)[7]	CDM status
1	MSPL Limited	92.15	CDM project under 3 PDDs titled: 1) **"Emission free electricity generation at Harihar, Karnataka"** http://cdm.unfccc.int/UserManagement/FileStorage/Q7FCFG27XNUZ6IB32EM7CTVC7KZG6R and 2) **"8.35 MW wind power project at Guddarangavana Halli, Chitradurga, Karnataka in India"** http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf 3) **"125 MW Wind Power Project in Karnataka, India"** http://cdm.unfccc.int/UserManagement/FileStorage/6TU55OXGCAEHNZQV27694ATC31SOM3 All of MSPL's installations are under CDM or the voluntary carbon market as given in their website http://www.mspllimited.com/wind%20power.htm
2	Enercon Windfarms Hindustan P. Ltd.	68.8	CDM project under the PDD titled: **" Enercon Wind Farm (Hindustan) Ltd in Karnataka"** http://cdm.unfccc.int/UserManagement/FileStorage/4N3W9XGUHAIZYL0CJDFQRV6S17K5ET
3	Vijayanand Roadlines Ltd	42.5	CDM project under the PDD titled: **"42.5 MW Wind Power Project by VRL Logistics Ltd. In Karnataka State (India)"** http://cdm.unfccc.int/Projects/Validation/DB/5M0UJB3T8IVQ6OW8VMYEPCZ8WQBBGM/view.html

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[5] http://www.windpowerindia.com/statpriv.html

[6] The list of wind power investors was analysed using the Directory for Indian wind Power 2008 to identify the capacity of installations in each state for each investor.

[7] The capacity of each investor in Karnataka is taken from Directory for Indian Wind Power 2008

4	Ramgad Minerals & Mining Pvt. Ltd.	39.5	CDM project under 2 PDDs titled: 1) **"125 MW Wind Power Project in Karnataka, India"** http://cdm.unfccc.int/UserManagement/FileStorage/6TU55OXGCAEHNZQV27694ATC31SOM3 and 2) **"8.35 MW wind power project at Guddarangavana Halli, Chitradurga, Karnataka in India"** http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf
5	Nuziveedu Seeds Ltd	32.65	The company website states that the company's wind installations are under CDM. http://www.nuziveeduseeds.co.in/wind.html ; CDM project titled: 1) **"NSL 27.65 MW Wind Power Project in Karnataka, India"** http://cdm.unfccc.int/UserManagement/FileStorage/7MKGRE0K2J0D6O1WKHV6XTW67UCAD6 2) **"33MW Wind Power Project at Linganahalli and Rangayyanadurga"** http://cdm.unfccc.int/UserManagement/FileStorage/S2I3TPZ8NYWX5MH014UDJECF7Q9OGA
6	Enercon (Windfarm) India Ltd.	29.4	CDM project under 2 PDDs titled: 1) **"Bundled wind power project in Chitradurga (Karnataka in India) managed by Enercon (India) Ltd"** http://www.dnv.com/focus/climate_change/Upload/Enercon_Chitradurga_PDD-May2005.pdf and 2) **"Enercon Wind Farms in Karnataka Bundled Project-33 MW"** http://cdm.unfccc.int/UserManagement/FileStorage/QB4LN5D6YY0EZ9MDEUUCSB99HHER7R
7	VSL Mining Company (P) Ltd	19	CDM project under the PDD titled: **"VSL Wind Power project"** http://cdm.unfccc.int/UserManagement/FileStorage/1V5DW5ZJNU9BGYUL8N04SIF0NERRP4
8	Hindustan Zinc Limited	18.4	CDM project under the PDD titled: **"Wind power project by HZL in Karnataka"** http://cdm.unfccc.int/UserManagement/FileStorage/N9L0SY7CEOBTXFVGZQP5UH218WI6AJ

It can be seen that, without exception, all private investors in the state of Karnataka with installations greater than 15 MW have developed these projects as CDM projects.

The analysis presented in the table above, shows that there are no similar project activities without CDM and therefore non-CDM large scale wind energy investments is not a common practice in the region.

Sub-steps 4a is satisfied.
Sub-step 4b. Discuss any similar options that are occurring:

Sub-step 4a shows that there are no similar activities i.e large scale wind investments by a single investor in the and hence substep 4 (b) is not required.

The above additionality discussions show that wind power development is not a common practice in the state of Karnataka and the project activity is not financially attractive; hence the project activity is additional.

Sub-steps 4b is satisfied.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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According to the approved methodology ACM0002 (Version 11) Emission Reductions are calculated as:-

$$ER_y = BE_y - PE_y \text{ ……………………………….. (1)}$$

Where:

BE_y	Baseline Emissions in year *y* (t CO_2e/yr)
PE_y	Project Emissions in year *y* (t CO_2e/yr)

Estimation of Baseline Emissions:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y} \text{ …………………………….. (2)}$$

Where:
BE_y = Baseline emissions in year *y* (tCO_2/yr)

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

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO_2/MWh)

Since the project activity is the installation of a new grid connected renewable power plant the $EG_{PJ,y}$ is calculated as :

$EG_{PJ,y} = EG_{facility,y}$ ………………………….. (3)

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

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

The project activity is in the state of Karnataka which falls under Southern grid, baseline emission factor is calculated as combined margin, consisting of a combination of operating margin and build margin factors according to the procedures prescribed in the latest tool for calculating the emission factor for an electricity system. The steps of calculation are as follows:

STEP 1. Identifying the relevant electric power system

Historically, the Indian power system was divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covered several states (see Table). Since August 2006, however, all regional grids except the Southern Grid have been integrated and are operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids will be treated as a single grid and is being named as NEWNE grid in this document from FY 2007-08 onwards for the purpose of this CO_2 Baseline Database. The Southern grid has also been planned to be synchronously operated with rest of all Indian Grid by early 12th Plan (2012-2017). Presently Southern grid is connected with Western and Eastern grid through HVDC link and HVDC back to back systems.

Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets its demand with its own generation facilities and also with allocation from power plants owned by the Central Sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the Central Sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. The regional grid thus represents the largest electricity grid where power plants can be dispatched without significant constraints and thus, represents the “project electricity system” for the Project. As the Project is connected to the Southern regional electricity grid, the Southern grid is the “project electricity system”.

NEWNE Grid				**Southern Grid**
Northern	**Eastern**	**Western**	**North-Eastern**	**Southern**
Chandigarh	Bihar	Chhattisgard	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	**Karnataka**
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar and Nagar Haveli	Meghalaya	Tamil Nadu

Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Pondicherry
Punjab	Andaman-Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttarakhand				

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

Option I is opted for the project activity i.e. only grid power plants are included in the calculation.

STEP 3. Select a method to determine the operating margin (OM): According to the tool the calculation of the operating margin emission factor is based on one of the following methods:

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

Any of the four methods can be used. The simple adjusted OM and dispatch data analysis OM cannot be currently applied in India due to lack of necessary data, however the simple OM method can only be used if low cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

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

	2003-04	2004-05	2005-06	2006-07	2007-08
NEWNE	17.37%	16.84%	18.0%	18.5%	19.0%
South	16.18%	21.61%	27.0%	28.3%	27.1%
India	17.07%	18.01%	20.1%	20.9%	21.0%

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

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the Southern regional grid is less than 50 % of the total generation. Hence the Simple OM method can be used to calculate the Operating Margin Emission factor. The average operating margin method cannot be applied, as low cost/ must run resources in Southern grid constitute less than 50% of total grid generation.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation.
- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

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

STEP 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

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

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO_2 Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the “Tool to calculate the emission factor for an electricity system”. We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

The CEA database uses the option B i.e. data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit, to calculate the OM of the different regional grids.

The simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathbf{EF_{grid,OM,simple,y} = \Sigma\ (EG_{m,y}\ x\ EF_{EL,m,y})\ /\ \Sigma EG_{m,y}}$$

Where:

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

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

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

Where:

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

STEP 5. Identify the cohort of power units to be included in the build margin:

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

(a) The set of five power units that have been built most recently, or

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

Project Participant should use the set of power units that comprises the larger annual generation. Accordingly, the CEA database calculates the build margin as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation.

The build margin emission factor has been calculated ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period.

STEP 6. Calculate the build margin emission factor

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

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

Where:

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

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 3 (a) for the simple OM, using options B1 using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

STEP 7. Calculate the combined margin emissions factor

The Emission Factor $EF_{grid,CM,y}$ of the grid is represented as a combination of the Operating Margin (OM) and the Build Margin (BM). Considering the emission factors for these two margins as $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$,, then the $EF_{grid,CM,y}$ is given by:

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

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

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

According to ACM0002 the weights for OM and BM are 0.75 and 0.25 respectively.

Using the values for operating and build margin emission factor provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is 0.92694 tCO_2e/MWh.

Details of Baseline data:

Data of Operating Margin for the three financial years from 2005-06 to 2007-08 and Build Margin for year 2007-08 has been obtained from –

The CO_2 Baseline Database for the Indian Power Sector
Ministry of Power: Central Electricity Authority (CEA)
Version 4.0
Dated: October 2008
Key baseline information is reproduced in annex 3.
The detailed excel sheet is available at:
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Estimation of Project Emissions
The project activity involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 11, there will be no project emissions in the project activity (PEy = 0).

Estimation of Leakage Emissions
As per ACM0002 Version 11, no leakage has been considered for the calculation of emission factor (LEy = 0).

The details on OM, BM and CM estimates as provided by the CEA are shown in Annex-3.

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

>>

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2e/MWh
Description:	Operating Margin Emission Factor of Southern Regional Electricity Grid
Source of data used:	"CO_2 Baseline Database for Indian Power Sector" Version 04 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	0.998157
Justification of the choice of data or description of measurement methods and procedures actually applied :	Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with ACM0002.
Any Comment	The value is calculated on ex-ante basis and it will remain same throughout the crediting period.

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build Margin Emission Factor of Southern Regional Electricity Grid

Source of data used:	"CO_2 Baseline Database for Indian Power Sector" Version 4 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	0.71332
Justification of the choice of data or description of measurement methods and procedures actually applied :	Build Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with ACM0002.
Any Comment	The value is calculated on ex-ante basis and it will remain same throughout the crediting period.

Data / Parameter:	$EF_{grid,,CM,y}$
Data unit:	tCO_2e/MWh
Description:	Combined Margin Emission Factor of Southern Regional Electricity Grid
Source of data used:	The "CO_2 Baseline Database for Indian Power Sector" version 4 published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in
Value applied:	In case of wind power projects default weights of 0.75 for EF_{OM} and 0.25 for EF_{BM} are applicable as per ACM0002. Combined Margin Emission Factor (EFy or $EF_{CM,y}$) — 0.92694 Refer Annex – 3 for comprehensive calculation of Combined Margin Emission Factor.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Combined Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with CDM methodologies: ACM0002, and Tool to Calculate the emission Factor for an Electricity System.
Any Comment	The value is calculated on ex-ante basis and it will remain same throughout the crediting period.

B.6.3 Ex-ante calculation of emission reductions:

>>

Ex-ante calculation of emission reductions is equal to ex-ante calculation of baseline emissions as project emissions and leakage are nil.

Baseline emission factor (combined margin)
= 0.92694 tCO_2e/MWh

Annual electricity supplied to the grid by the Project
= 31.2 MW (Capacity) x 25.3% (PLF) x 8760 (hours) MWh
= 69147.936 MWh

Annual baseline emissions
= 0.92694 tCO_2e/MWh x 69147.936 MWh
= 64,095 tCO_2e

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

>>

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
*1st year	0	64,095	0	64,095
2nd year	0	64,095	0	64,095
3rd year	0	64,095	0	64,095
4th year	0	64,095	0	64,095
5th year	0	64,095	0	64,095
6th year	0	64,095	0	64,095
7th year	0	64,095	0	64,095
8th year	0	64,095	0	64,095
9th year	0	64,095	0	64,095
10th year	0	64,095	0	64,095
Total estimated reductions (tonnes of CO_2e)	**0**	**6,40,950**	**0**	**6,40,950**

*1st year begins from the date of registration, and each year extends for 12 months.

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

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	**EGy**

Data unit:	MWh (Mega-watt hour)
Description:	Net electricity supplied to the grid by the Project
Source of data to be used:	Electricity supplied to the grid as per the tariff invoices raised on KPTCL/HESCOM.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	69147.94
Description of measurement methods and procedures to be applied:	Electricity supplied to grid for the project activity will be calculated. Refer Annex – 4 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by KPTCL/HESCOM pursuant to the provisions of the power purchase agreement. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures. The meter will be tested for accuracy once in each year.
Any comment:	The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity whichever occurs later.

Data / Parameter:	**G*pe***
Data unit:	MWh (Mega-watt hour)
Description:	Electricity Export recorded at the meter(s) connected 39 machines of the project activity.
Source of data to be used:	Electricity export to the grid as per the joint meter report. Electricity export is assumed to be equivalent to EGy for estimation of emission reductions.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	69147.94 (This value will be taken from the JMR (Form B) and will be applied directly).
Description of measurement methods and procedures to be applied:	Electricity export to the grid will be recorded by the meter(s) connected to the 39 machines of the project activity feeding the pooling substation of Enercon. Refer Annex – 4 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility and the PP. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be stored in hard formula and values will be taken from JMR.

Data / Parameter:	**G*pi***

Data unit:	MWh (Mega-watt hour)
Description:	Electricity Import recorded at the meter(s) connected 39 machines of the project activity.
Source of data to be used:	Electricity import from the grid as per the joint meter report. The electricity import is assumed to be zero for estimation of emission reductions.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (This value will be taken from the JMR (Form B) and will be applied directly).
Description of measurement methods and procedures to be applied:	Electricity import from the grid will be recorded by the meter(s) connected to the 39 machines of the project activity feeding the pooling substation of Enercon. Refer Annex – 4 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility and the PP. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be stored in hard formula and values will be taken from JMR.

Data / Parameter:	**L*i***
Data unit:	MWh (Mega-watt hour)
Description:	Transmission loss between the metering point for the project activity feeding the pooling substation of Enercon and the metering point at EB Substation.
Source of data to be used:	Transmission Loss will directly applied from the joint meter report (Form B) for the project activity. The transmission loss is assumed to be zero for estimation of emission reductions.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (This value is certified by the State utility in the JMR (Form B). This value will be directly applied from the JMR (Form B)).
Description of measurement methods and procedures to be applied:	Transmission loss between metering point feeding the pooling substation of Enercon and the metering point at the EB Substation is applied to the meter reading taken at the feeder connecting 39 turbines of the project activity and feeding the pooling substation of Enercon. EB Substation is connected to the machines of the project activity and the machines commissioned by the other project developers. The project proponent does not have control over the data of the other project developers. Therefore the project developer has to rely upon the transmission loss applied to the project activity by the state utility as reflected in the JMR (Form B). The JMR is signed by the representatives of Enercon and the state utility. Refer Annex – 4 for an illustration of the provisions for measurement methods.

QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility and the PP. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be stored in hard formula and values will be taken from JMR.

The data will be stored in hard format. Joint meter report is taken in the presence of the persons representing Enercon [Operation and Maintenance Contractor]. The copies of the joint meter report will be presented to the validator during the verification exercise. The archive will be kept for the period up to two years after the completion of the crediting period.

B.7.2 Description of the monitoring plan:

>>

Approved monitoring methodology ACM0002 Version 11 Sectoral Scope: 1, "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", by CDM – Meth Panel is proposed to be used to monitor the emission reductions.

The reading will be taken by the representatives of Enercon and the State utility at the meter(s) for the project activity connecting 39 turbines at the project site and feeding the pooling substation. This reading is recorded in the form of JMR (Form B) and is signed by the representatives of Enercon and State Utility. The electricity export and import will be metered at this metering point. Transmission loss between metering point feeding the pooling substation and the metering point at the EB Substation is applied to the meter reading taken at the feeder connecting 39 turbines of the project activity and feeding the pooling substation.

Transmission loss given in the JMR will be directly applied to the meter readings taken at the metering point of the project activity and feeding to pooling substation of Enercon. Net Electricity exported to the grid is calculated by applying transmission loss to the meter reading taken at the metering point of the project activity connecting 39 turbines and feeding to pooling substation of Enercon.

The electricity supplied to the grid is apportioned based on transmission Loss. The Joint meter reading contains the following data:-

1. Electricity Export
2. Electricity Import
3. Transmission Loss (Between the metering point feeding the pooling substation and the EB substation)
4. Net Electricity supplied to the Grid [Electricity Export-Electricity Import-Transmission Loss]

Joint Meter reading is signed by the representatives of Enercon and the state utility. The meter readings (both export and import), transmission loss and net electricity exported to the grid are noted in the JMR. Hence all these values will be reproduced from the JMR at the time of verification. Please refer Annex 4 for details on calibration and QA/QC procedures.

Transmission loss for export is certified by the state utility in JMR:

L	:	$\sum Gpe - N$
$\sum Gpe$	:	Summation of electricity export data measured at all the feeders connected to pooling substation
N	:	Electricity export data measured at bulk meters at Enercon Substation
L	:	Total transmission loss
Li	:	$Gp * (L/\sum_j Gj)$

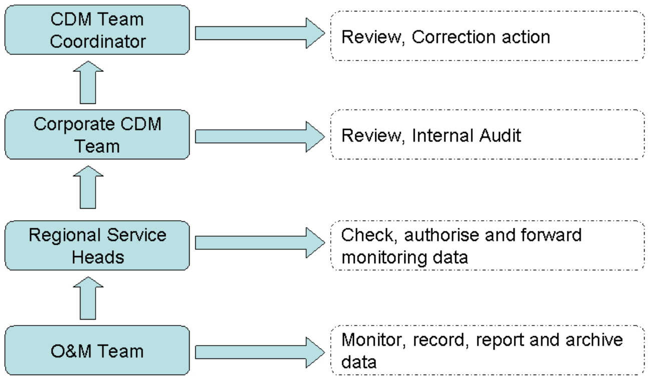
The Project is operated and managed by GEI.. The operational and maintenance contract for the project is with Enerconis an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon India Limited follows the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project.

The accuracy of monitoring parameter is ensured by adhering to the calibration and testing procedure. All the meters will be tested for accuracy once every year. The project will adhere to all the mandatory regulatory and statutory requirements at the state as well as national level. Enercon is Operation and Maintenance contractor for the project activity and provides the daily generation report to the project proponent. The project proponent also maintains the records of daily generation report and joint meter report.

Training and maintenance requirements:

Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the Wind Energy Converters (WECs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that Enercon's service staff is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. The Enercon Training Academy provides need-based training to meet the training requirements of Enercon projects. The needs are identified by Enercon based upon it's experience on different wind farm sides, Enercon's service department identifies the service needs and professional are trained accordingly in the training academy.
The training is contemporary, which results in imparting focused knowledge leading to value addition to the attitude and skills of all trainees. This ultimately leads to creativity in problem solving.

The operational and management structure implemented is as follows:



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)

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Date of completion: 20 March 2009

Name of responsible person/entity: **M/s. Generacion Eolica India Limited.** (Project Participant) . The details are given in Annex-1.

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:

>>

24/08/2006 being the date of placement of purchase order for the WEC's.

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

>>

20 years

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

The project proponent has selected the fixed crediting period for the project activity.

C.2.1. Renewable crediting period

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

>> Not Applicable.

C.2.1.2. Length of the first crediting period:

>> Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/04/2011, or date of project registration with UNFCCC.
.

C.2.2.2. Length:

>>
10 years and 0 months

SECTION D. Environmental impacts

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

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As per the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 27, 1994 and EIA Notification (S.O 1533) dated 14th September 2006, a list of activities that require undertaking environmental impact assessment studies[8] has been provided. EIA is not a regulatory requirement in India for wind energy projects and PP does not expect any adverse impacts of the proposed CDM project activity on the environment.

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

>>

The project activity 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 by the host party.

SECTION E. Stakeholders' comments

>>

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

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[8] http://envfor.nic.in/legis/eia/so1533.pdf

The comments from local stakeholders were invited through a local stakeholder meeting conducted in Gadag District on 23 November 2007. The personal invitations were sent to the local villagers 15 days prior to the meeting. Enercon India Limited on behalf of GEI identified local communities, farmers, officials of Gram Panchayat and O & M contractor Enercon as the most important stakeholders with an interest in the CDM activities. The local stakeholder consultation meeting had representatives from the nearby villages and representatives of Enercon. The minutes of the meeting are set out in Appendix 1.

E.2. Summary of the comments received:

>>

The queries/comments from local stakeholders during meeting in Gadag district included:

- Comment that there is a significant impact on the economic and social life in and around Gadag villages due to the wind power project.
- The nature of benefits that local stakeholders will get.
- Query on effect on rainfall due to wind turbine.
- Query on impact on crops.
- Query on impact on flora and fauna.

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

>>

The following responses have been provided by the representatives of Enercon (Enercon is authorized by the PP to execute all the activities in relation to CDM i.e. project registration and verification including local stakeholder consultation) in relation to the comments received from the local stakeholders during meeting in Gadag district:

- The benefits to the local stakeholders will be through employment opportunities provided by the project in construction work and for safeguarding the project asset. It will also lead to better road connectivity to nearby towns and villages.
- There is no relation between wind turbine and rainfall. Rain is natural phenomenon and is not affected.
-
- The noise level is within the limit prescribed by Central Pollution Control Board (CPCB). There is no damage to the crops since the wind turbine machines are running 50 meters above.
- There is no effect on flora and fauna because of project activity.
- No water draining or soil erosion occurs due to wind turbine.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**M/s. Generacion Eolica India Limited**
Street/P.O.Box:	3, Amrit Keshav Nayak Marg, Fort
Building:	12/13, Esplanade, 3rd Floor,
City:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 001
Country:	India
Telephone:	+91-9910021375
FAX:	+91-22-22072666
E-Mail:	avegagarwal@fersa.es
URL:	
Represented by:	Mr. Ignacio Moreno Hernandez
Title:	Director
Salutation:	Mr.
Last Name:	Hernandez
Middle Name:	Moreno
First Name:	Ignacio
Department:	
Mobile:	N.A
Direct FAX:	+34 933620405
Direct tel:	+34 932405306
Personal E-Mail:	imoreno@fersa.es

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project activity does not involve any public funding.

Annex 3

BASELINE INFORMATION

The Operating Margin data for the most recent three years and the Build Margin data for the Southern Region Electricity Grid as published in the CEA database Version 4 are as follows:

Simple Operating Margin

	tCO_2e/GWh
Simple Operating Margin – 2005-06	1005.67
Simple Operating Margin – 2006-07	999.12
Simple Operating Margin – 2007-08	990.62

Net Generation in Operating Margin (GWh)

	tCO_2e
Net Generation - 2005-06	100978
Net Generation - 2006-07	109116
Net Generation - 2007-08	114702

Simple Operating Margin = (1.0057×100978+.9991×109116+0.9906×114702) /Sum (100978+109116+114702)

= 998.157 tCO_2e/GWh

Build Margin

	tCO_2e/GWh
Build Margin- 2007-08	713.32

Combined Margin calculations

	Weights	tCO_2e/GWh
Operating Margin	0.75	998.157
Build Margin	0.25	713.32
Combined Margin		**926.94**

Detailed information on calculation of Operating Margin Emission Factor and Build Margin Emission Factor is available at www.cea.nic.in.

Annex 4

MONITORING INFORMATION

Metering: The electricity generated by the project is metered by the Parties (KPTCL/HESCOM, the Project Participant and Enercon) at the high voltage side of the step up transformer installed at the Project Site.

- **Metering Equipment:** Metering system for the project activity consists of main and one check meter. Both the meters are **two-way trivector meters of accuracy class 0.2 capable of recording import and export of electricity**. The metering equipment is calibrated annually.

- **Meter Readings:** The Net electricity supplied to the grid is recorded by taking a monthly Joint Meter Reading (JMR) in the presence of Parties (Officials from off-taking Utility (HESCOM) and Enercon). The Joint meter reading contains the value of energy imported and exported and the net export to the grid during the recording period. This Joint meter reading is certified by the Executive engineer of the off-taking utility and by Enercon Officials. These certified readings are then used by the off-taking Utility (HESCOM) to prepare the tariff invoices. Thus the net electricity supplied to the grid as mentioned in the JMR, canbe crosschecked with the value mentioned in the invoices.

- **Inspection of Energy Meters:** All main and check energy meters (export and import) and all associated instruments, transformers installed at the Project are of 0.2 accuracy class. Each meter is jointly inspected and sealed on behalf of the Parties and is not to be interfered with by either Party except in the presence of the other Party or its accredited representatives.

- **Meter Test Checking:** There is a separate check and main meter. The Main and Check Meters are close to each other and will be tested for accuracy with a standard meter by the KPTCL's testing Division. TheKPTCL will carry out the calibration, periodical testing, sealing and maintenance of meters. The KPTCL will provide a copy of the test reports.

  If during the meter test checking,

  - the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then the meter reading will be as per the main meter as usual. The check meter shall, however, be calibrated immediately.
  - the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible of error, then the meter reading for the month up to the date and time of such test shall be as per the check meter. There will be a revision in the meter reading for the period from the previous calibration test up to the current test based on the readings of the check meter. The main meter shall be calibrated immediately and meter reading for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
  - both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the main meters shall be immediately calibrated and the correction will be applied to the reading registered by the main meter to arrive the correct reading of energy supplied to the grid for the period up to the last test. If during any of the monthly meter readings, the variation between the main meter and the check meter is more

than the permissible limit for meters of 0.2 accuracy class, all the meters shall be re-tested and calibrated immediately and the correction will be applied to the reading registered by the main meter to arrive the correct reading of energy supplied to the grid for the period up to last test.

IN CASE OF THE FAILURES SUCH AS BURNING OF THE METERS THE METERS WILL BE IMMEDIATELY REPLACED AND IN CASE OF E ERRATIC DISPLAY OF THE METERED PARAMETERS AND WHEN THE ERROR FOUND IN TESTING THE METERS IS BEYOND THE PERMISSIBLE LIMIT OF ERROR, THE METER SHALL BE CALIBRATED IMMEDIATELY AND THE CORRECTION WILL BE APPLIED TO THE READING REGISTERED BY THE MAIN METER TO ARRIVE THE CORRECT READING OF ENERGY SUPPLIED TO THE GRID FOR THE PERIOD UP TO LAST TEST.

The daily records for parameters such as power generation, frequency and voltage of the individual machines are noted by the SCADA system. These records are maintained by Enercon India Limited (the O&M contractor) and the PP.

Calculation of Data to be monitored:

$EG_y = G_p - L_i$

EG_y : Net Electricity supplied to grid by the project activity

G_p : Generation of electricity by the project activity recorded at the feeder connected to 39 turbines of the project activity [export (G_{pe}) – 115%*Import (G_{pi})]

(source: Sample Joint Meter Reading for month of June 2010)

L_i : Transmission loss

Transmission loss is certified by the state utility in JMR:

L : $\sum_j G_j - N$

$\sum_j G_j$: Summation of electricity generation data measured at all the feeders connected to pooling substation (Export)

N : Electricity generation data measured at Substation from the feeders emanating from the pooling substation (Export)

L : Total transmission loss

Li : $G_p * (L / \sum_j G_j)$

Annex 5

Selection of Appropriate Benchmark:

In choosing an appropriate benchmark we have based our approach on the principles of financing and investment decision making that are well found in theory and practice of corporate financing worldwide. We have derived from text book on "Corporate Finance Theory and Practice" by Dr. Aswath Damodaran of Stern School of Business, New York University. Dr. Damodaran is one of the foremost authorities in the world in the field of Investment Analysis.

The guidance to investment analysis issued in EB 51 Annex 58 states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for equity IRR.

It is also worthwhile to note that the captioned project is a Greenfield wind power generation project that generates and supplies electricity to the state grid, therefore the project cannot have only one possible project developer. The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that in such cases (where the project has more than one potential developer) the benchmark cannot be based on internal cost of equity or WACC and shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Hence, we have not used company or project specific parameters for the calculation of the benchmark (such as company WACC, project and company specific interest rates, etc.).

Accordingly, the weighted average cost of capital applicable to the project type has been considered. Weighted average cost of capital (WACC) is calculated as weighted average cost of equity and cost of debt as illustrated below

WACC = [D/ (D+E)]*[Cost of Debt] + [E/ (D+E)]*[Cost of Equity]

Where,
D: Debt component
E: Equity Component

Cost of Debt:

Cost of debt is defined as the rate at which lenders agree to lend money to a project. The additionality tool and the guidance to investment analysis clarify that for projects that benchmark for project with more than one potential developer should not be based on project specific parameters but should represent the standard in the market. Accordingly, the bank prime lending prevailing at the time of project start date has been considered as the cost of debt. The prime lending rate at the time of project decision on 23 August 2006 was in the range of 10.75% to 11.25% [Source: Reserve Bank of India http://rbidocs.rbi.org.in/rdocs/Wss/PDFs/71184.pdf] therefore average lending rate of 11.00 % has been considered.

Interest costs are tax deductible, therefore in order to arrive at the post tax cost of debt, the cost of debt is multiplied with marginal tax rate. The marginal tax rate has been considered as 11.22%. For the financial year 2006-07. [http://exim.indiamart.com/budget-2006-07/]

Cost of Equity:

The expected return on equity has been determined using the Capital Asset Pricing Model (CAPM)[9]. The CAPM economic model is used worldwide to determine the required/expected return on equity based on potential risk of an investment. The CAPM framework is the Nobel award winning work of financial economist Dr. William Sharpe.

Ke = Rf + B x (Rm - Rf)
where:
Ke = Rate of return on equity capital;
Rf = Risk-free rate of return;
B = Beta;
Rm – Rf = Market risk premium;

Risk free rate:

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks, therefore the yeild rates are considered as risk free rates. Page 188 of text book on "Corporate Finance Theory and Practice" by Dr. Aswath Damodaran[10], Stern School of Business, New York University (attached as Appendix 3), describes that the yield rates are suitable indicators of risk free rates when the time horizon for the investment is long term.

Accordingly the risk free rate has been taken from yield rates available at the decision making date. This has been considered as it was in the year of investment (i.e in that year, the company had the alternative of this long term risk free investment). The data on yield rates is published by Reserve Bank of India. (RBI publication (2006-07) Web-link: http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/87456.pdf The applicable risk free rate is 7.47% (average of 7.08% to 7.85%).

Risk Premium:

The most common approach for estimating the risk premium is to base it on historical data, in the CAPM, the premium is estimated by looking at the difference between average return on stocks and risk free return. It is preferred to use long term premimums, i.e over a period of 25 years, since considering shorter time periods can lead to large standard errors because volatility in stock returns [page 190, 191, 196 Corporate Finance Theory and Practice, Dr. Aswath Damodaran. Attached as appendix 3]. It is also preferred to calculate the risk premium based on geometric mean of the returns since arithmetic mean overstates the risk premium. Geometric mean is defined as the compounded annual return over the same period [page 190, 191, 196, Corporate Finance Theory and Practice, Dr. Aswath Damodaran. Attached as appendix 3].

Therefore the risk premium has been calculated as the difference in compounded annual return bewteen the BSE-Sensex and the yield rate since the year of inception of BSE Sensex. The detailed calculations are presented in the attached excel sheet.

The applicable risk premium is 12.43%.

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[9] The Capital Asset Pricing Model (CAPM) was published in 1964 by William Sharpe, for his work on CAPM Sharpe received the Nobel Prize in 1990. http://www.investopedia.com/articles/06/CAPM.asp

[10] Dr. Damodaran, one of the foremost authorities in the world in the field of Investment Analysis

Beta:

Beta (B) indicates the sensitivity of the company to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. For companies that are not publicly listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is wind power generation; the approach therefore should be to base the beta for the project on the beta values of listed wind power generation companies in India. Therefore, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

Therefore, we have considered beta values of all electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. It is understood that risky businesses are likely to have higher cost of equity than safer businesses; projects in riskier businesses will have to cover these higher costs. Hence, investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks from significantly varying and unpredictable resource availability (e.g. wind), and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non conventional energy.

The applicable Beta value has been determined on the basis of the Beta values of all power generating companies in India which were listed on the stock exchange at the time of this investment.

The table below summarises the beta values:

Company Name	Beta
CESC Ltd.	1.503
Gujarat Industries	1.167
Neyveli lignite	1.073
Reliance Energy	0.873
Tata Power	1.279
Average	**1.18**

Source: Bloomberg, Beta snapshots has been provided as Appendix 04. The beta values are from 31 July 2001 to 30 June 2006.

Calculation of Benchmark WACC:

The WACC is the weighted average of the cost of equity and cost of debt used for financing. As per the additionality tool, standard parameters (and not project specific ones) are required to be used for arriving at the benchmark rate. In India, a debt to equity ratio of 70:30 is considered as the norm for financing wind power projects. Accordingly the WACC has been calculated based on a 70:30 debt to equity ratio.

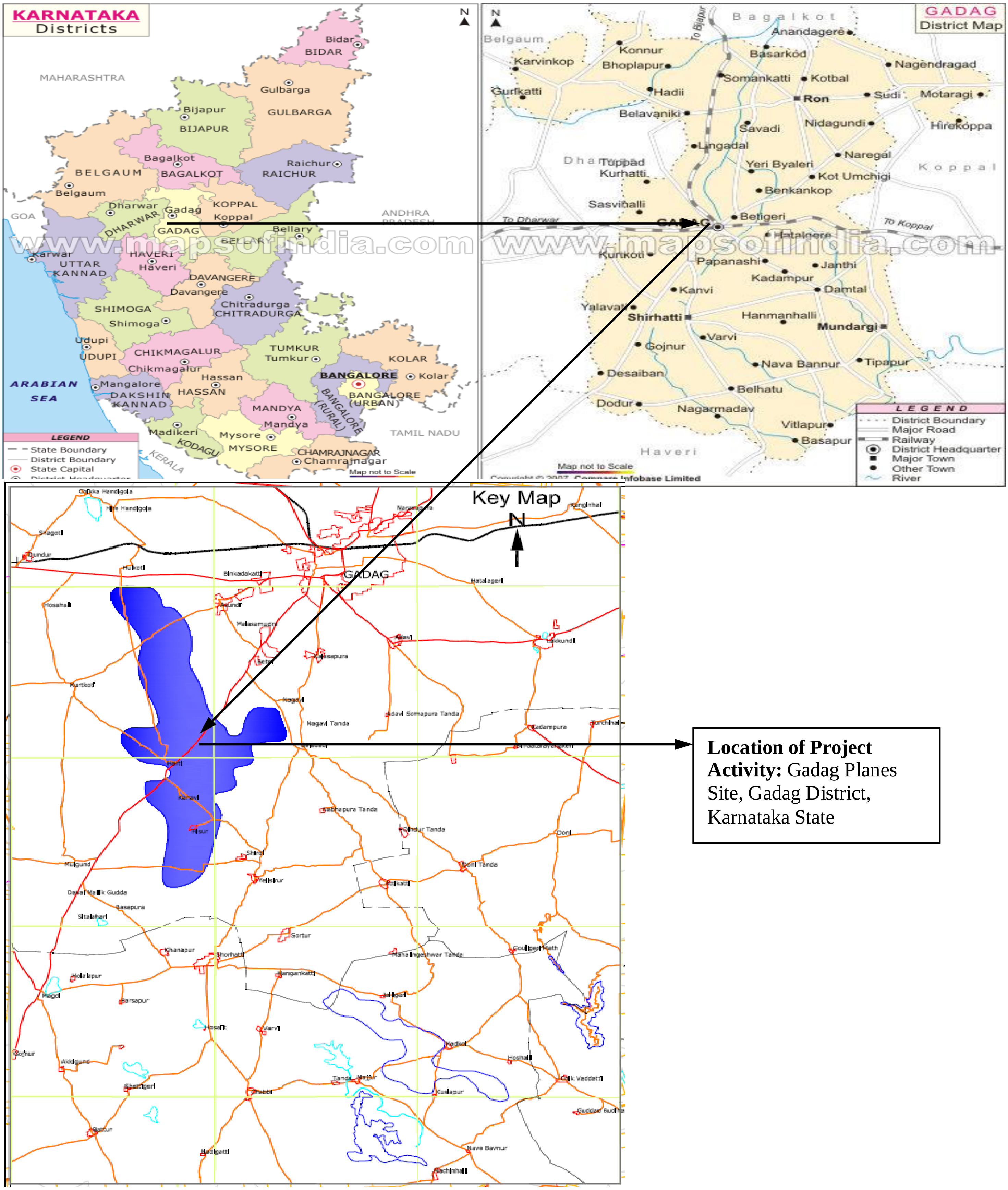
WACC = [D/ (D+E)]*[Cost of Debt] + [E/ (D+E)]*[Cost of Equity]

For calculation of WACC, a debt to equity ratio of 70:30 has been considered, as typical for the project type.

WACC = 70%* Cost of debt + 30%*[Rf + B x (Rm - Rf)]

Therefore, WACC = 70% * 11.00% * (1-11.22%) + 30% * (7.47% + 1.18* 12.43%) = **13.47%**

Appendix 1 – Location Map



Location of Project Activity: Gadag Planes Site, Gadag District, Karnataka State

Appendix 2 – Minutes of stakeholder consultation meeting

Public Stakeholder's Meeting of Clean Development Mechanism Project of M/s Generacion Eolica India Limited, at Site – Gadag Planes, Gadag District, Karnataka State.

Venue: Enercon Office - Gadag District, Karnataka State.

Date: 23rd November 2007

Members from Villages:

1. Sri. Gurusiddappa Honnappanavar
2. Sri. Mahantesh G. Patil

and 13 Village Members.

Members from Enercon (India) Limited

1. Sri. Basavaraj Patil
2. Sri. C.B.Poonacha
3. Sri. C. Ravidhara
4. Sri. Brij Mohan

Agenda of the Meeting:

1. Welcome Address
2. Introduction and Description about Wind Farms.
3. Project Profile
4. Suggestions and Opinions
5. Queries and Responses from the Stakeholders.
6. Vote of Thanks.

1. Welcome Address and Introduction:

Sri. M. Basavaraj Patil: On welcoming the Chairperson and the Chief Guest on the dais and welcoming the Stakeholders from villages of Harti, Kurthkoti and Malasamudra. Mr. Basavaraj Patil stated that Enercon is a Wind Energy Converter Company and it generates Green power. It is an eco friendly project and there is no harm to the nature by installing wind turbine. We have been establishing wind turbine all over India since last 12 years and it is helpful in reducing the power shortage to some extent. Greenhouse Gas emission level has increased in most of the developed countries and in order to balance it, UNFCCC has developed a Kyoto Protocol to promote the projects under Clean Development Mechanism. Power generated by conventional method viz. Coal and wood firing emits more gases into the nature resulting in Global Warming. Deforestation causing climatic change and projects like Wind Energy Converts are helping in combating such type of threats to the nature, he admitted. Mr. Patil also sought wholehearted co-operation of all the villagers, leaders in establishing such projects which also participate in curbing the power crisis and helps in developing the Nation. Such projects also helps in developing the villages and increases the employment opportunities, he claimed.

2. Project Profile:

Mr. Ravidhara: Enercon is the first company which has developed a synchronised generator and it has a capacity to generate power with low wind, he said. And he described how the Wind Mill generate electricity and supply to the grid. In India Tamil Nadu stands first in generating electricity by wind energy and tapped around 10000 MW capacity there, he quoted. In Karnataka also it is planned to develop wind farms to that extent. Wind farms are successfully running in Karnataka and it is a boon to our state, he said.

3. Address by Village Leaders:

President's Speech:

Sri. Gurusiddappa Honnappanavar:

Sri. Gurusiddappa Honnappanavar in his speech observed that all human beings after taking birth have to live rich. Enercon Company, by developing wind farms in our villages, is contributing in development of the Nation. By installing these type of projects the villages are developed economically and socially. Hence we have to support in installing and developing such wind farms in our villages. We have to come forward to lend our revenue lands to such companies and help in developing the villages. We have formed a committee and already given permission from our Panchayat to establish Wind Farms in our village. There will be a positive support from our Gram Panchayat for developing your windmill project, he assured.

Chief Guest:

Sri. Mahantesh Gouda Patil:

Sri Mahantesh Gouda Patil in his address quoted that Enercon is purchasing lands in our villages and installing wind turbines. It has helped our villagers economically. Usually in our country most of the villages have less revenue since there will not be any industries in villages and establishing such industries in villages will add much tax revenue to the villages and it helps in developing infrastructure of the villages. Hence we are thankful to GEI for developing windmills in our villages. Our support will always be there, he expressed. At the same time company also cooperate with the villagers while developing the project, he claimed.

4. Suggestions and Opinions:

Sri. Basavaraj Patil: In order to establish our wind farm villagers cooperation is very badly required. Without their support we cannot do any projects. Though the company is investing money, it cannot run the project against the villager's willingness. Hence we have to win the confidence of the villagers first to establish such wind farms. So, we humbly seek the fullest support from all the villagers and we do undertake many kinds of social services in the villages he said. Since the wind velocity is very good in these villages it is feasible to establish windmills here which helps in developing such economically backward areas.

5. Questionnaire by Villagers and Answers by the Company delegates:

i) There is a feeling among the villagers that by establishing wind farms rainfall will be reduced?

Ans. Installation of windmills will reduce the rainfall is dismissed as rumour.

ii) Due to more Wind velocity the clouds are scattering and driven away. Whether it is true?

Ans. No, It is false. Maximum height of WEC is 75-100 Mtrs. Whereas the height of the cloud is much higher.

iii) Any type of damages to crops by these machines?

Ans. No, there is no damage to the crops due to running of wind mills.

iv) By installing the wind mills how it affects the birds?

Ans. There is no harm to the birds due to wind turbine installations

Sri. Bhandi:

Mr. Bhandi (Teacher) has categorically informed that installation of windmills will reduce the rainfall is totally blind belief. Generating the power by best utilisation of such natural resources is scientific one and it helps in development of economy and employment opportunities.

Vote of Thanks:

Mr. C.B.Poonacha:

Sri C.B. Poonacha has offered thanks on behalf of the company to the delegates. He also extended special thanks to all the stakeholders who have made up their valuable time to attend this meeting.

Appendix 3

Appendix 3:References of text book on “Corporate Finance Theory and Practice”

- If no such securities exist in the market in which you are attempting to estimate a real riskless rate, it can be approximated by the long-term real growth rate of the economy. Thus, the real riskless rate in China may be set equal to 6% because that is what you expect the long-term real growth rate in the Chinese economy to be. It will be much lower (2–3%) for more mature, slower growth economies.

Risk Premium

The risk premium is a significant input in all the asset pricing models. In the following section, we begin by examining the fundamental determinants of risk premiums and then look at practical approaches to estimating these premiums.

What Is the Risk Premium Supposed to Measure? The risk premium measures the "extra return" that would be demanded by investors for shifting their money from a riskless investment to an average risk investment. It should be a function of how risk-averse investors are and how risky they perceive stocks (and other risky investments) to be, relative to a riskless investment. Because each investor in a market is likely to have a different assessment of an acceptable premium, the premium will be a weighted average of these individual premiums, where the weights will be based on the wealth the investor brings to the market. Investors with more wealth, like Warren Buffett, will therefore have their risk premiums weighted more than investors with less wealth.

***CQ 7.1:* Assume that stocks are the only risky assets and that you are offered two investment options. One is a riskless investment on which you can make 6.7%, and the other is a stock mutual fund. How much more than 6.7% would you need to be offered, on an expected basis, to pick the latter? Would you ever settle for less than 6.7%?**

Estimating Risk Premiums We look now at two ways to estimate the risk premium in the capital asset pricing model. One is to look at the past and estimate the premium earned by risky investments (stocks) over riskless investments (government bonds); this is called the **historical premium.** The other is to use the premium extracted by looking at how markets price risky assets today; this is called an **implied premium.**

Historical Risk Premiums. The most common approach to estimating the risk premium is to base it on historical data. In the arbitrage pricing model and multifactor models, the raw data on which the premiums are based are historical data on asset prices over very long time periods. In the CAPM, the premium is estimated by looking at the difference between average returns on stocks and average returns on riskless securities over an extended period of history.

In most cases, we follow these steps to find historical risk premiums. First, we define a time period for the estimation, which can range as far back as 1926 for U.S. data.[4] Then, we calculate the average returns on stocks and average returns on a riskless security over the period. Finally, we calculate the difference between the returns

[4] The most widely used database, from Ibbotson Associates, has returns going back to 1926. Jeremy Siegel at Wharton recently presented data going back to the early 1800s.

Page 191 of text book on "Corporate Finance Theory and Practice"

on stocks and the riskless return and use it as a risk premium to predict future returns. When we use historical premiums, we implicitly assume that the risk aversion of investors has not changed across time and that the relative riskiness of the risky portfolio (stocks) has not changed over time either.

In calculating the average returns over past periods, a measurement question arises: Should we use arithmetic or geometric averages to compute the risk premium? The arithmetic mean is the average of the annual returns for the period under consideration, whereas the geometric mean is the compounded annual return over the same period. The following example demonstrates the difference.

Year	*Price*	*Return*
0	\$50	
1	100	100%
2	60	–40%

The arithmetic average return over the two years is 30%, while the geometric average is only 9.54% ($1.2^{0.5} - 1 = 1.0954$). Those who use the arithmetic average premium argue that it is much more consistent with the framework[5] of the CAPM and a better predictor of the risk premium in the next period. The geometric mean is justified on the grounds that it takes into account compounding and that it is a better predictor of the average premium in the long term. There can be substantial differences in risk premiums based on the choices made at this stage, as illustrated in Table 7.1. The data in the table are based on historical data on stock, treasury bill, and treasury bond returns and provide estimates of historical risk premiums. As you can see, the historical premiums can vary widely depending on whether we go back to 1926, 1962, or 1981, whether we use T. Bills or T. Bonds as the riskless rate, and whether we use arithmetic or geometric average premiums.[6] Although it is impossible to prove one premium right and the others wrong, we are biased toward

- *Longer term premiums,* since stock returns are volatile and shorter time periods can provide premiums with large standard errors. For instance, the premium extracted from 25 years of data will have a standard error[7] of about 4 to 5%.
- *Long-term bond rates as riskless rates,* since our time horizons in corporate financial analysis tend to be long term, and we use the treasury bond rate as our riskless rate.
- *Geometric average premiums,* since arithmetic average premiums overstate the expected returns over long periods.[8] The geometric mean yields lower premium

[5] The CAPM is built on the premise of expected returns being averages and risk being measured with variance. Since the variance is estimated around the arithmetic average, and not the geometric average, it may seem logical to stay with arithmetic averages to estimate risk premiums.

[6] Booth (1999) examines both nominal and real equity risk premiums from 1871 to 1997. Although the nominal equity returns have changed over time, he concludes that the real equity return has been about 9% over this period. He suggests adding the expected inflation rate to this number to estimate the expected return on equity.

[7] Assuming that returns in individual years are independent, the standard error of a 25-year estimate can be calculated by dividing the annual standard deviation in stock prices in the United States (about 25%) by the square root of the number of years ($\sqrt{25} = 5$), yielding a standard error of 5% (25%/5) in the estimate.

[8] When we look at markets like the United States that have survived for 70 years without significant breaks, we are looking at the exception. To provide a contrast, consider the other stock markets in which one could have invested in 1926; many of these markets did not survive, and an investor would have lost much of his or her wealth.

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Betas

The second set of inputs that we need to put risk and return models into practice are the betas for investments. In the CAPM, the beta of an investment is the risk that the investment adds to a market portfolio. In the APM and multifactor model, the betas of the investment relative to each factor have to be measured. Three approaches are available for estimating these parameters. One is to use historical data on market prices for individual investments; the second is to estimate the betas from the fundamental characteristics of the investment; and the third is to use accounting data. We describe all three approaches in this section.

Historical Market Betas The conventional approach to estimating the beta of an investment is a regression of returns on the investment against returns on a market index. For firms that have been publicly traded for a length of time, it is relatively straightforward to estimate returns that an investor would have made by investing in the firm's stock each interval (such as a week or a month) over that period. In theory, these stock returns on the assets should be related to returns on a market portfolio, that is, a portfolio that includes all traded assets, to estimate the betas of the assets. In practice, we tend to use a stock index, such as the S&P 500, as a proxy for the market portfolio, and we estimate betas for stocks against the index.

The standard procedure for estimating betas is to regress stock returns (R_j) against market returns (R_m).

$$R_j = a + bR_m$$

where

a = Intercept from the regression

$$b = \text{Slope of the regression} = \frac{\text{Covariance}(R_j, R_m)}{\sigma^2_m}$$

The *slope* of the regression corresponds to the beta of the stock and measures the riskiness of the stock.

The *intercept* of the regression provides a simple measure of performance of the investment during the period of the regression, when returns are measured against the expected returns from the capital asset pricing model. To see why, consider the following rearrangement of the capital asset pricing model:

$$R_j = R_f + \beta(R_m - R_f)$$
$$= R_f(1-\beta) + \beta R_m$$

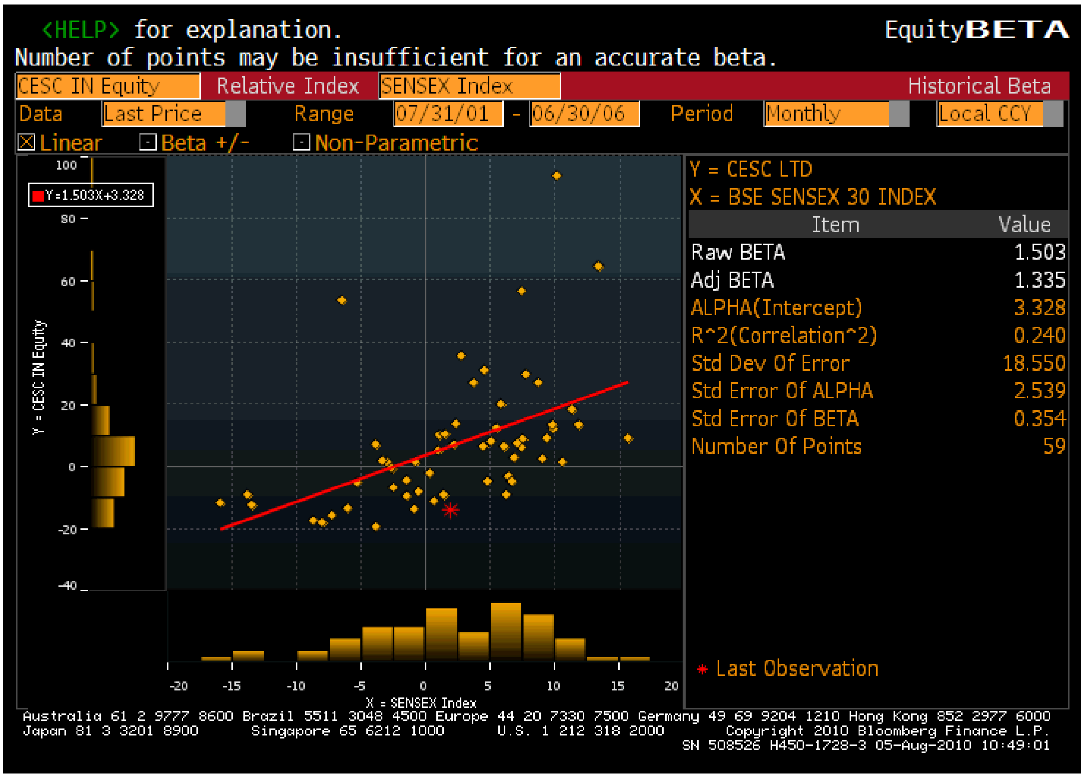
Compare this formulation of the return on an investment to the return equation from the regression:

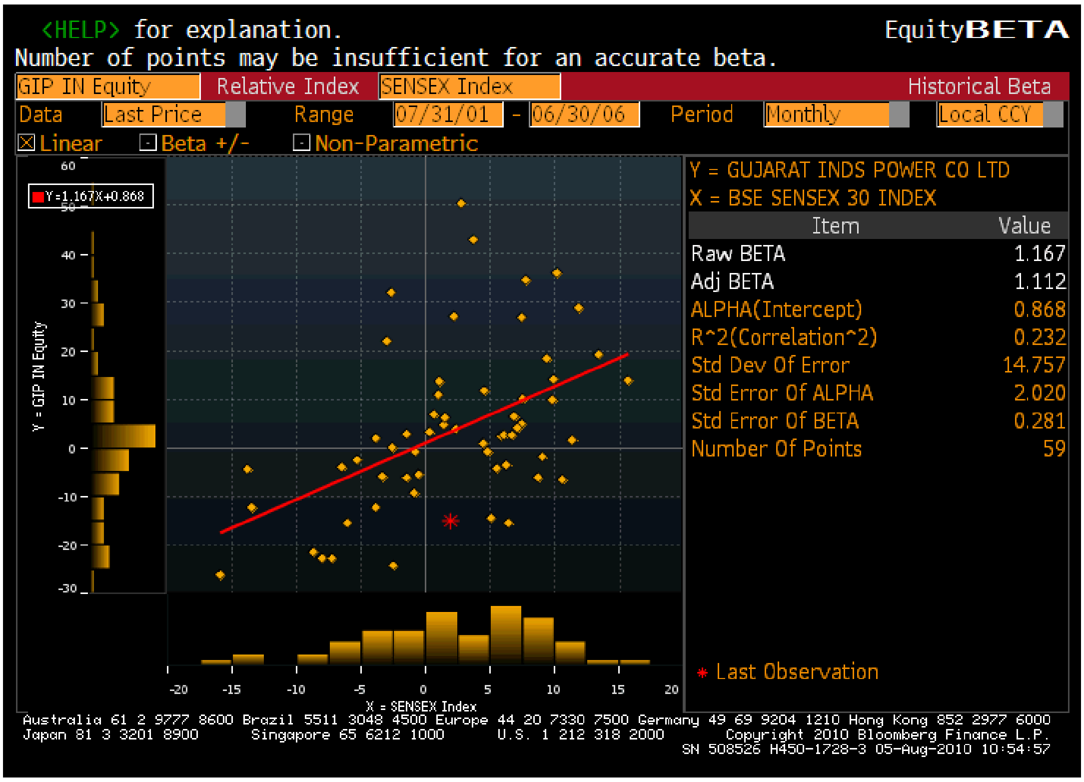
$$R_j = a + bR_m$$

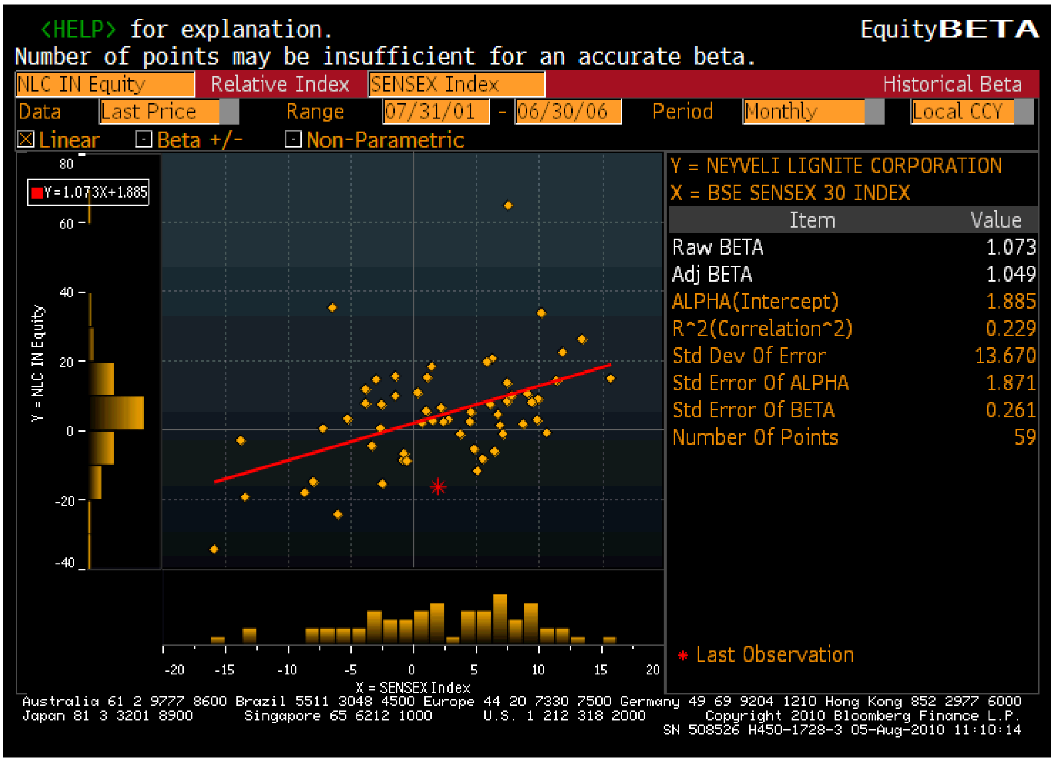
Thus, a comparison of the intercept (a) to $R_f(1-\beta)$ should provide a measure of the stock's performance, at least relative to the capital asset pricing model.[14] In summary, then:

[14] The regression is sometimes calculated using returns in excess of the riskless rate, for both the stock and the market. In that case, the intercept of the regression should be zero if the actual returns equal the expected returns from the CAPM, greater than zero if the stock does better than expected, and less than zero if it does worse than expected.

Appendix 4: Beta Snapshots






<HELP> for explanation.
EquityBETA
Number of points may be insufficient for an accurate beta.
NLC IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
07/31/01 - 06/30/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=1.073X+1.885
Y = NLC IN Equity
X = SENSEX Index
Y = NEYVELI LIGNITE CORPORATION
X = BSE SENSEX 30 INDEX
Item
Value
Raw BETA 1.073
Adj BETA 1.049
ALPHA(Intercept) 1.885
R^2(Correlation^2) 0.229
Std Dev Of Error 13.670
Std Error Of ALPHA 1.871
Std Error Of BETA 0.261
Number Of Points 59
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2010 Bloomberg Finance L.P.
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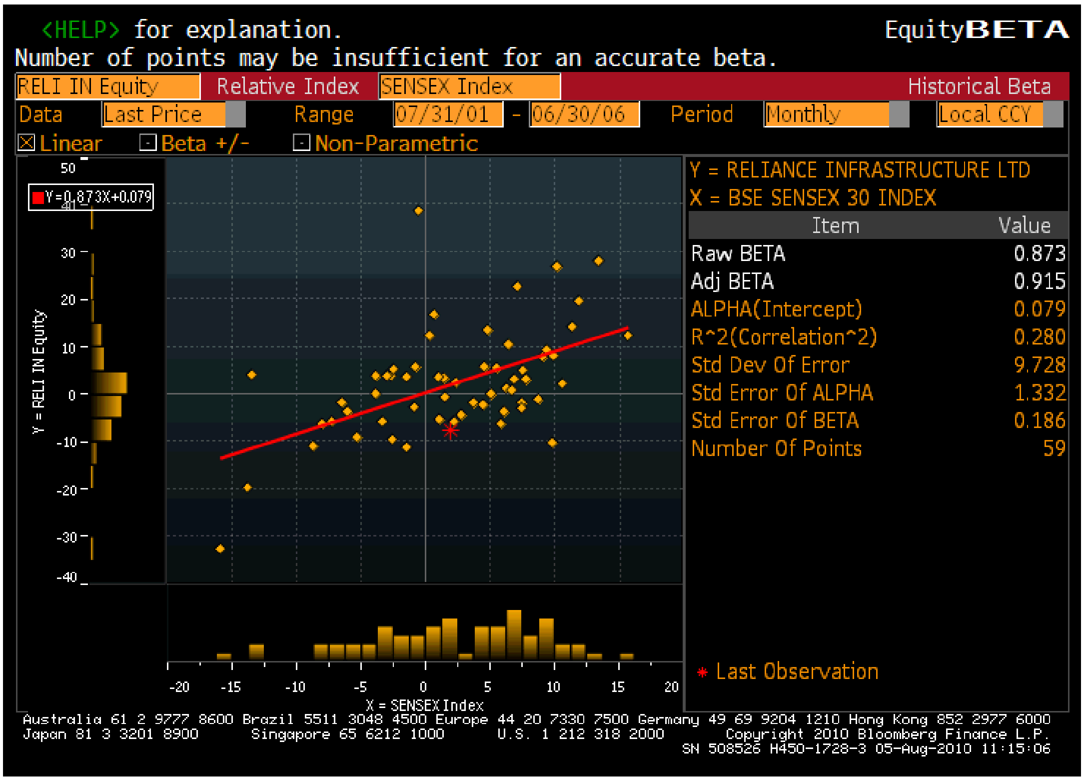
<HELP> for explanation.
EquityBETA
Number of points may be insufficient for an accurate beta.
RELI IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
07/31/01 - 06/30/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=0.873X+0.079
Y = RELI IN Equity
X = SENSEX Index
Y = RELIANCE INFRASTRUCTURE LTD
X = BSE SENSEX 30 INDEX
Item Value
Raw BETA 0.873
Adj BETA 0.915
ALPHA(Intercept) 0.079
R^2(Correlation^2) 0.280
Std Dev Of Error 9.728
Std Error Of ALPHA 1.332
Std Error Of BETA 0.186
Number Of Points 59
Last Observation
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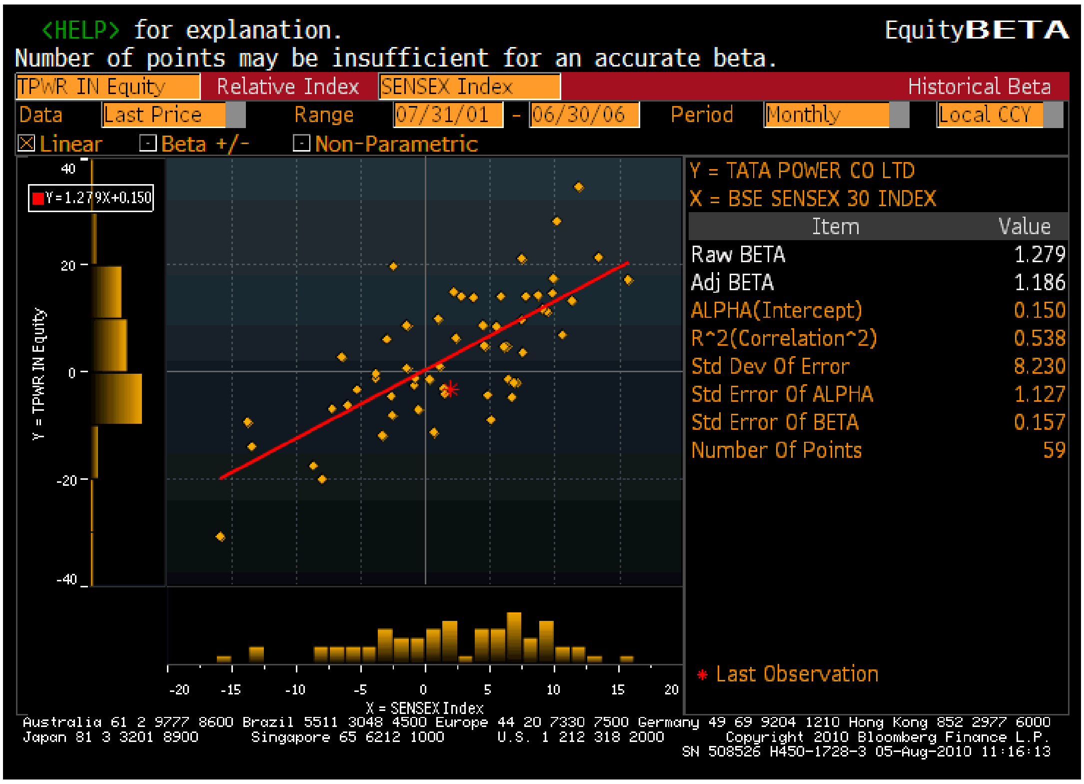
<HELP> for explanation.
EquityBETA
Number of points may be insufficient for an accurate beta.
TPWR IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
07/31/01 - 06/30/06
Period
Monthly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=1.279X+0.150
Y = TPWR IN Equity
X = SENSEX Index
Y = TATA POWER CO LTD
X = BSE SENSEX 30 INDEX
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R^2(Correlation^2) 0.538
Std Dev Of Error 8.230
Std Error Of ALPHA 1.127
Std Error Of BETA 0.157
Number Of Points 59
Last Observation
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2010 Bloomberg Finance L.P.
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