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: Vaayu India Wind Power Project in Andhra Pradesh.
Version: 5.0
Date of completion of PDD: 22/05/2012

A.2. Description of the project activity:

Vaayu (India) Power Corporation Private Limited (VIPCPL) is developing 50.4 MW wind farm in the state of Andhra Pradesh in India. The project activity involves supply, erection, commissioning and operation of 63 machines of rated capacity 800 KW each. The machines are Enercon E-53 make. The project will generate 98.367 GWh of electricity per year which shall be supplied to the state electricity utility thereby contributing to reducing the energy demand supply gap in the state of Andhra Pradesh. The project activity will assist the sustainable growth of the region by providing clean and green electricity to the state electricity grid.

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 92,971 tCO_2e per year, by displacing an 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 an 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 the operation of Wind Energy Convertors (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.

Nature of Project

The Project harnesses renewable resources in the region, thereby displacing non-renewable natural resources and leading to sustainable economic and environmental benefits. Enercon (India) Limited ("Enercon") will be the equipment supplier and the operations and maintenance contractor for the Project. The Project is owned by VIPCPL. The generated electricity will be supplied to Electricity Distribution Company (DISCOM) under a long-term power purchase agreement (PPA).

Contribution to Sustainable Development

The National CDM Authority (NCDMA) 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

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

Mechanism (CDM) projects from India[2]. The contributions of this project activity towards these indicators are provided below:

1. **Social well being:**
   - The project activity will lead to the development of supporting infrastructure such as road network etc., in the wind park location, the access to which is also provided to the local population.
   - The project activity will lead 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 to increased energy security.
2. **Environmental well being:**
   - The project activity employs 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 and contributes 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 in the region
   - 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.

In addition to this, the project proponent will contribute 2% of the CDM revenue realized from the candidate CDM project for sustainable development including society / community development. PP is aware about the Indian DNA guideline on commitment of 2% of the CDM revenues towards sustainable development and a formal undertaking is being submitted separately.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*) (as applicable)**	**Kindly indicate if the Party involved wishes to be considered as project**

[2] http://envfor.nic.in/cdm/host_approval_criteria.htm

		participant (Yes/No)
India (Host)	Vaayu (India) Power Corporation Private 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:

A.4.1.1. Host Party(ies):

India

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

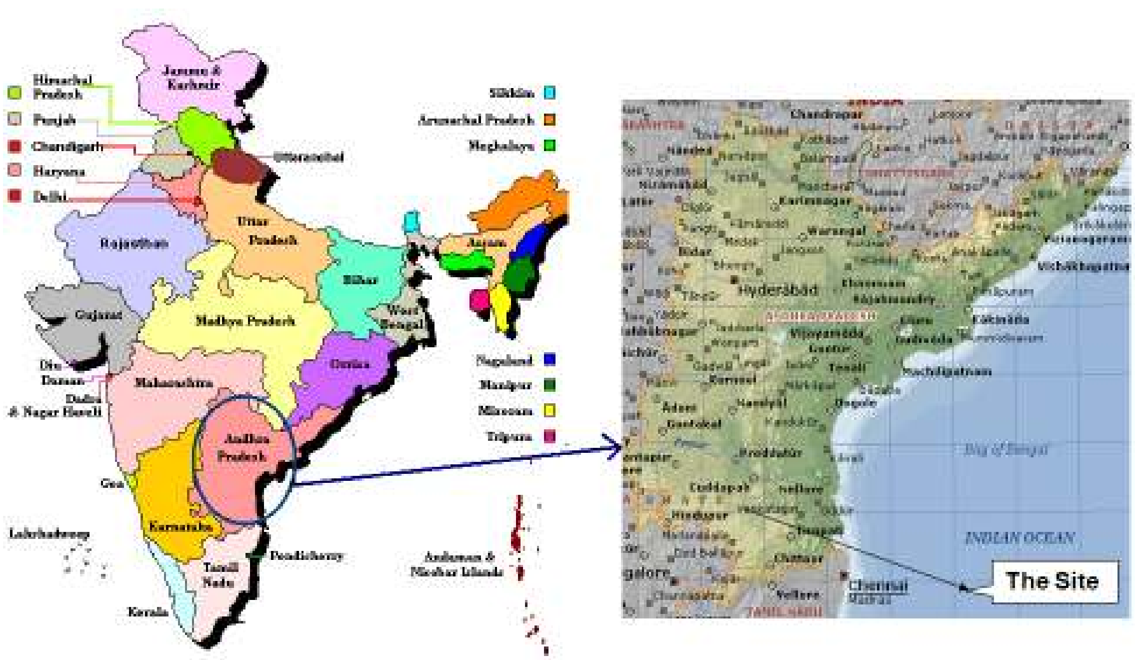
Southern Region/Andhra Pradesh State

A.4.1.3. City/Town/Community etc:

The project is spread across Petnikota, Tummalapenta, Itikyala, Abdullapuram, Chintalayapalli, Venkatampalli & Bhogasamudram villages in Kurnol district in Indian State of Andhra pradesh.

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

The project area extends between latitude 14^O 59’ 10.2” and 15^O 05’ 02.5’ North and longitude 77^O 59’ 15.7” and 78^O 05’ 18.3” East. Nearest railway station is at Tadipatri which is about 25 kms away from the site. Nearest airport is at Bangalore which is about 250 kms from the site. The longitude and latitude details are given in Appendix 1.



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

The project activity is considered under CDM category zero-emissions **'grid-connected electricity generation 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).**

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

The project activity involves 63-wind energy converters (WECs) of Enercon make (800 kW E-53) with internal electrical lines connecting the project activity with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV. The project activity can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The average life time of the WEC is around 20 years as per the industry standards; however the project activity is yet to be commissioned. 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 (India) Limited has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH and has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.

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:

The estimated emission reductions over the 10 year fixed crediting period would be 929,710 tCO_2e as per details on annual emission reductions provided below:

Years	Annual estimation of emission reductions in tonnes of CO_2e
*June 2011 to May 2012	92,971
June 2012 to May 2013	92,971
June 2013 to May 2014	92,971
June 2014 to May 2015	92,971
June 2015 to May 2016	92,971
June 2016 to May 2017	92,971
June 2017 to May 2018	92,971
June 2018 to May 2019	92,971
June 2019 to May 2020	92,971
June 2020 to May 2021	92,971
Total estimated reductions (tonnes of CO_2e)	929,710
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	92,971

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

A.4.5. Public funding of the project activity:

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:

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

Title: "Consolidated baseline methodology for grid-connected electricity generation from 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
- Tool for the demonstration and assessment of additionality – Version 5.2

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:

The project activity is wind based renewable energy source, zero GHG emission power project connected to the Andhra Pradesh state grid which in turn forms part of the Southern grid. The project activity 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 grid.

The approved consolidated baseline and monitoring methodology ACM0002 Version 11 is the relevant baseline and monitoring methodology and it is applicable because:

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.

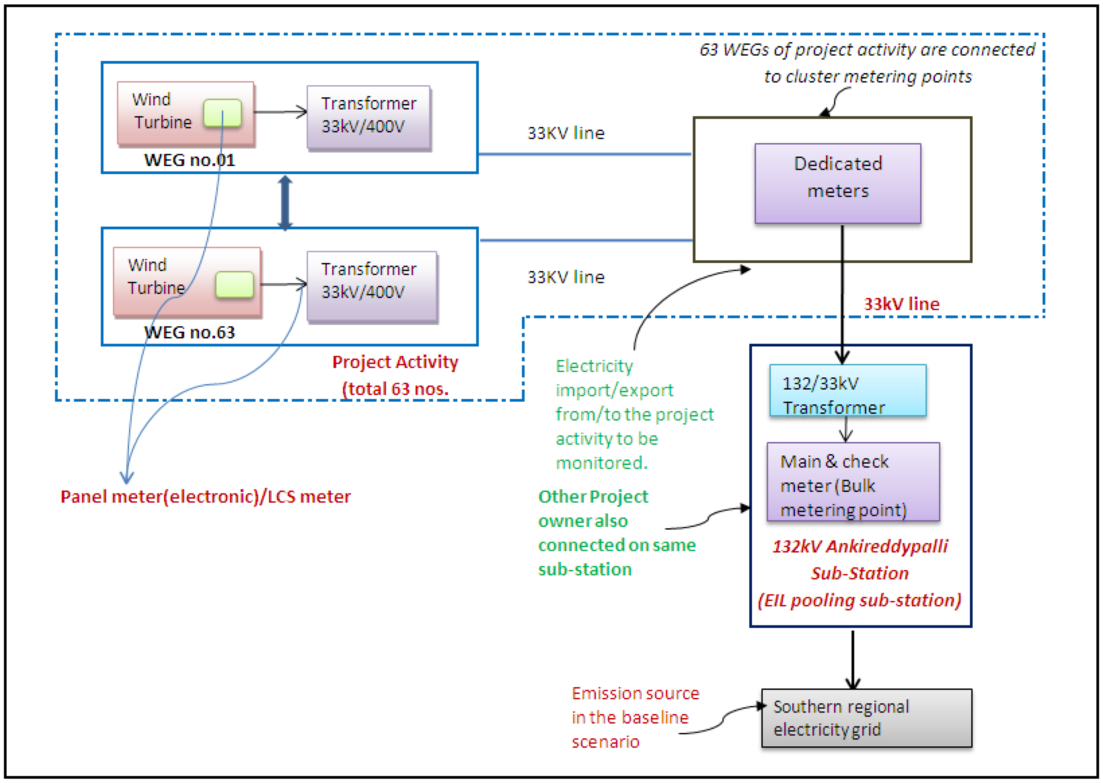
3.	In case of hydro power plants: • The project activity is implemented in an existing reservoir, with no change in the volume of reservoir. • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2. • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	This condition is not relevant, as the project activity is not the installation of a hydro power plant.
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 not 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 the 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

According to the applicable methodology, spatial extent of this project activity 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. Project activity is connected to 132kV Ankireddypalli sub-station developed by Enercon (India) Limited.

Schematic of project boundary:



Represents 1 unit of WEG (there are 63 such units in the project activity)

Represents project activity

Represents 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 GHG emission free electricity generation from renewable sources.
Following table indicates the sources and gases included in the project 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	CO_2	No	The project activity does not emit any emissions.
		CH_4	No	No methane generation is expected to be emitted.

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

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described below.

As the Project does not modify or retrofit an existing generation facility, the baseline scenario is the emissions generated by the operation of grid-connected power plants and by the addition of new generation sources. This is estimated by multiplying the Combined Margin with electricity delivered to the grid.

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

Andhra Pradesh state falls under Southern grid. The power sector in India including the Southern region largely comprises thermal power stations[4]; as can be seen from the table below[5]:

Sector	Hydro	Thermal				Nuclear	Renewable	Total
		Coal	Gas	Diesel	Total			
State	27055.76	42537.5	3672.12	602.61	46812.23	0.00	2247.68	76115.67

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

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

Central	8592.00	29620.00	6638.99	0.00	36258.99	4120.00	0.00	48970.99
Private	1230.00	5491.38	4565.50	597.14	10654.02	0.00	10994.73	22878.75
All India	36877.76	77648.88	14876.61	1199.75	93725.24	4120.00	13242.41	147965.41

It is evident from the above table that the installed capacity in India is predominantly thermal power plants; 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 5
$EF_{grid,BM,y}$ = Build Margin Emission Factor (tCO_2/MWh)	CEA Database for CO_2 emission factor, version 5
EFy – 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):

The project activity has been conceived as a CDM project since its inception. The project start date is 05 December 2009 and the PP has intimated UNFCCC and DNA about the project activity initiative within six months of the start date. The acknowledgement from UNFCCC and email to Indian DNA shall be provided to the DoE for verification.

The latest Additionality tool i.e. Tool for the demonstration and assessment of Additionality version 5.2 approved by CDM Executive Board is used to demonstrate project Additionality.

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

Define realistic and credible alternatives3 to the project activity(s) through the following Sub-steps:

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

As per ACM0002, the baseline alternative for the project activity is generation of equivalent amount of electricity by operation of grid-connected power plants and by addition of new generation sources. Accordingly, the realistic and credible alternatives to the project activity are:

(a) The Project is undertaken without registering it as a CDM activity.

(b) Equivalent amount of electricity being generated through operation of grid-connected power plants and addition of new generation sources

Outcome of Step 1a: Alternatives (a) and (b) above have been identified as realistic and credible alternative scenario(s) to the project activity

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

There are no legal and regulatory requirements that prevent Alternatives (a) and (b) from occurring.

Outcome of Step 1b: Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

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

In accordance with the additionality tool version 5.2, sub-step 2(a), *"If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III)."*

Since the project activity earns revenues from sale of generated electricity, option I can not be considered.

Further in accordance with paragraph 16 of the Guidance to Investment Analysis version 03.1, *"If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate"*

The baseline to the project activity is the electricity generated by grid connected power plants, represented by the combined margin emissions of the Southern grid. Therefore, the benchmark approach is appropriate.

The Project Proponent proposes to use **Option III – Benchmark Analysis** and the financial indicator is identified as *post-tax* equity 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 (Cost of 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 cost of Equity applicable to the project type has been considered as the benchmark to be compared against equity IRR.

The benchmark Cost of equity for the project is calculated as **16.84%**. Further details of the benchmark Cost of equity considered are presented in Appendix2 and beta snapshots have been added in Appendix3.

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

Key assumptions used for calculating post-tax Equity IRR are set out below:

Capacity of Machines in kW	800		Enercon Offer
Number of Machines	63		Enercon Offer
Project Capacity in MW	50.40		Enercon Offer
Expected project commissioning date	01-Apr-11		Enercon Offer
Project Cost per MW (INR. In Millions)	59.34		Calculated
Operations			
Plant Load Factor Base Case	22.28%		C-WET Report
Insurance Charges @ % of capital cost	0.12%		Normative
Operation & Maintanance Cost base year @ % of capital cost	1.30%		Enercon's offer
% of escalation per annum on O & M Charges	6.0%		Enercon's offer
Tariff			
Base year Tariff fixed for first 10yrs after commissioning -INRKwh	3.50		APERC tariff order 1st May 2009
Annual Escalation (INR/kWh per Year)	-		APERC tariff order dated 1st May 2009. As per tariff order the levelized tariff for period of 20 years is INR. 3.43 per unit. However commission has approved the fixed tariff of INR. 3.50 for the first ten years. From 11th yr onwards the tariff is negotiated. Conservatively PP has selected INR 3.50 per unit after the term of PPA
Tariff applicable after 10yrs of commissioning -(INR/kWh)	3.50		
Generation based incentive- (INR/kWh)	0.50		Generation based incentive are applicable to wind power projects at the rate of INR 0.50 per kWh with cap of INR. 6.2 Million per MW*
Project Cost	**INR Million**		
Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc.			
Total Project Cost	**2,990.61**		Enercon Offer

Means of Finance		**INR Million**	
Own Source	30%	897.18	Debt Equity Ratio for the power generation projects in India
Term Loan	70%	2,093.43	Debt Equity Ratio for the power generation projects in India
Total Source		2,990.61	
Terms of Loan			
Interest Rate	11.50%		PLR rate published by RBI dated 30 October 2009
Tenure	8	Years	Normative for power generation Sector India
Income Tax Depreciation Rate (Written Down Value basis)			
on Wind Energy Generators	15%		Income Tax Act
Book Depreciation Rate (Straight Line Method basis)			
On all assets	4.50%		Straight line Method Adopted
Book Depreciation up to (% of asset value)	90%		
Income Tax			
Income Tax rate	33.99%		Income Tax Act (Financial Year 2009-10)
Minimum Alternate Tax	17.00%		Income Tax Act (Financial Year 2009-10)
Working capital			
Receivables (no of days)	30		Billing Cycle
O & m expenses (no of days)	90		Enercon's Offer

*(source: http://www.mnre.gov.in/gbi-scheme.htm)

Debt Equity Ratio: This is the first investment by Vaayu (India) Power Corporation Private Limited and there are no existing debts in the company. Hence the debt equity ratio of 70:30 envisaged for the project activity as per detailed project report has been considered. In addition a sensitivity analysis on the debt equity ratio has been carried out to strengthen the investment analysis.

Interest rate: This is the first investment by Vaayu (India) Power Corporation Private Limited and there are no existing debts in the company. Therefore we have taken the Prime lending rate as interest rate for investment analysis form the data published by Reserve bank of India that is publically available.

Plant Load Factor: As per EB 48, annex 11, Plant load factor validated by independent third party source can be used for investment analysis. Plant load factor for the project activity is taken from Center for Wind Energy Testing (a Government of India Agency). The plant load factor for the project site as determined by CWET is 22.28%.

Salvage Value: The project is depreciated up to 90% of the project cost (except for land that is non depreciable item); therefore we have considered land cost and 10% of the remaining value as salvage in the cash flow for computing equity IRR.

The post tax equity IRR for the Project without CDM revenues is 5.05% i.e. less than the benchmark.

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

Sensitivity Analysis

The investment in wind power project shall be tested based on the following parameters:

- Capital Cost
- Tariff
- Plant Load Factor
- Debt Equity Ratio
- O&M cost

Capital Cost

In accordance with the investment guidance, the additionality for the project activity is demonstrated at the time of decision making. The project proponent has considered it appropriate to conduct the sensitivity at the variation of +/- 10% of the project cost.

	10% decrease in Capital Cost	Base Capital Cost	10% Increase In Capital Cost
Post tax Equity IRR	7.25%	5.05%	3.21%

The equity IRR crosses the benchmark (16.84%) after 37.5% reduction in base capital cost or at the capital cost of INR 1869.13 Million, which is not a realistic assumption.

Tariff

Andhra Pradesh state electricity commission in the tariff order dated 01May 2009 has fixed the tariff for the period of 10 years and decided to fix the Single Part tariff for the first ten years at INR3.50 per unit. As per the electricity act 2003 Section 61, the tariff should progressively reflect the cost of supply of electricity and return on investment only with an overall objective of reducing subsidies. The National tariff policy also determines tariff based on return on investment.

As per tariff order the levelized tariff for period of 20 years is INR 3.43 per unit. However commission has approved the tariff of INR. 3.50 for the first ten years which is higher than the levelized tariff of INR 3.43 per unit. Therefore it is very unlikely that the tariff of INR. 3.50 will be approved after 10th year assuming that the commission has provided a higher tariff for the first 10 years of operation.

Therefore conservatively we have considered INR 3.50 as base tariff after the term of PPA. However unrealistic but still we have conducted sensitivity at a variation of 10% over the base case.

Tariff beyond the term of PPA	10% decrease over base tariff after 10 years	Base tariff (INR. 3.50 after 10 years)	10% Increase over base tariff after 10 years
Post tax Project IRR	4.36%	5.05%	5.69%

Plant Load Factor

Plant Load Factor is the key variable encompassing variation in wind profile, variation in off-take (including grid availability) including machine downtime.

CWET Data: The PLF estimated by CWET (Center for Wind Energy Testing-Third party independent source for PLF) is 22.28% after adjustment of transmission loss. We have conducted sensitivity at a variation of 10% over the base case.

	PLF @ 20.52% (10% Decrease over PLF estimated by CWET)	PLF 22.28% (PLF by CWET)	PLF @ 25.08% (10% Increase over PLF estimated by CWET)
Post tax Equity IRR	3.14%	5.05%	6.91%

The sensitivity analysis clearly shows even with a higher PLF, the project is not able to generate sufficient returns. It can therefore be concluded that the project is financially not viable without CDM benefits.

The equity IRR crosses the benchmark at PLF of 37.03% which is not a reasonable assumption.

Debt Equity Ratio

The debt equity ratio envisaged for the project is 70:30, evident from the Detailed Project Report; the same has been considered for Investment Analysis. A sensitivity analysis of IRR to 10% variations in the debt-equity ratio is carried out in the table below:

	10% decrease over base case [68:32]	Base Debt Equity ratio [70:30]	10% Increase over base case [72:28]
Post tax Equity IRR	5.02%	5.05%	5.09%

It may also be noted that at 100% equity, the Equity IRR is 5.67%.

O&M Cost

The Sensitivity in O&M cost is conducted after taking to consideration +/-10% decrease in O&M Cost.

	10% decrease in	Base O&M Cost	10% Increase In

	O&M cost		O&M cost
Post tax Equity IRR	5.40%	5.05%	4.69%

However it is not reasonable to assume 0% O&M cost, the equity IRR at 0% O&M cost is 8.34% which below than the benchmark cost of equity.

Loan Tenure

The loan was envisaged for 8 years at the time of decision making. However actual loan sanction letter provides the loan for 12 years. Therefore we have conducted the sensitivity on loan tenure at 12 year. The equity IRR with loan tenure of 12 years is 4.19% which is less than the benchmark.

Outcome of Step 2: As can be seen, the equity 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 light of the above definition, all large scale wind projects, (greater than 15 MW) set up by a single project proponent in the state of Andhra Pradesh, have been analyzed.

There are total 186 number private wind farm developer in India who have invested in wind power projects and the list of these developers was sourced from website: Wind Power India (URL: - http://www.windpowerindia.com/statpriv.html). Out of total 186 number of private wind farm developers there are total 107 number of private wind farm developers who have developed wind power project totalling a capacity greater than 15 MW.

Further the data from Indian Wind Power Directory 9th edition published in year 2009 was used to sort out the number of private wind farm developers who have invested in the same region (Andhra Pradesh). Out the total number of 107 number of developers with project capacity >15 MW there is only one investor who has wind installations greater than 15 MW in the state of Andhra Pradesh. This project was installed in year 1999 and year 2000.The Central tariff regime issued by MNES was applicable to this project activity. The Wind power projects governed by MNES policy were provided with the tariff of INR. 2.25 per unit for the base year 1994-95 with a 5% annual escalation. The proposed project activity is commissioned under the tariff order issued by the commission dated 1-May-2009 which provides the tariff of INR. 3.50 per unit under long term PPA.

MNES regime was superseded by the state policy by the orders by the regulatory commission. As can be seen above, MNES regime is different regulatory and investment environment and hence cannot be compared to the proposed project activity which falls under the tariff order of electricity regulatory commission. Therefore the installation of 20 MW by RCI Power Limited is not similar and hence not comparable to our project activity.

The analysis above shows that there are no installations of wind projects with capacity of over 15 MW in the similar regulatory regime and investment climate. Therefore wind power projects are not a common practice in the state of Andhra Pradesh.

Sub-steps 4a is satisfied.

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

From sub-step 4a it is clear that similar activities are not widely observed or commonly carried out and that all similar projects have been undertaken only as CDM projects. Therefore Sub-step 4b is not applicable. Based on the above considerations, the project activity is considered to be additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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

$\mathbf{ER_y = BE_y - PE_y}$ **……………………………….. (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:

$\mathbf{BE_y = EG_{PJ,y} * EF_{grid,CM,y}}$ **…………………………….. (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 :

$\mathbf{EG_{PJ,y} = EG_{facility,y}}$ **………………………….. (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 proposed project activity is in the state of Andhra Pradesh 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 electricity systems:

The Indian electricity system is divided into two regional grids, viz. (1) Northern, Eastern, Western, North-Eastern and (2) Southern grid. Each grid covers several states. As the regional grids are interconnected, there is inter-state and inter-regional exchange. A small power exchange also takes place with neighboring countries like Bhutan and Nepal.

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 activity. As the project activity is connected to the Southern regional electricity grid, the Southern grid is the "project electricity system".

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 for calculating OM, 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 (option a) 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:

	2004-05	**2005-06**	**2006-07**	**2007-08**	**2008-09**

	2004-05	2005-06	2006-07	2007-08	2008-09
NEWNE	16.84%	18.0%	18.5%	19.0%	17.3%
South	21.61%	27.0%	28.3%	27.1%	22.8%
India	18.01%	20.1%	20.9%	21.0%	18.6%

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.

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 the net electricity generation, and a CO_2 emission factor of each power unit. (Option A), or
- Based 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 B)

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 A i.e. data on net electricity generation and CO_2 emission factor for each power unit, 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 net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$\mathbf{EF_{grid,OMsimple,y} = \Sigma\ (EG_{m,y}\ x\ EF_{EL,m,y})\ /\ \Sigma EG_{m,y}\ \ldots\ldots\ldots\ldots\ldots\ldots..\ (a)}$$

Where:

$EF_{grid,OMsimple,y}$	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 (tCO2/MWh)

m	All power units serving the grid in year y except low-cost / must-run power units
y	The relevant year as per the data vintage chosen in step 3

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

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

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	The relevant year as per the data vintage chosen in step 3

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

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

(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 participants 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:

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

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 4 (a) for the simple OM, using option A1 for *y* 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 *EFy* 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 $EFgrid,_{BM,y}$, then the *EFy* is given by:

$EF_y = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$ …………………………… (d)

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 945.15 tCO_2e/GWh.

Details of Baseline data:

Data of operating for the three financial years from 2006-07, 2007-08 and 2008-09 and Build Margin for 2008-09 has been obtained from -

The CO_2 Baseline Database for the Indian Power Sector
Ministry of Power: Central Electricity Authority (CEA)
Version 5
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

$PE_y = 0$ ………………………… (4)

Estimation of Leakage Emissions

As per ACM0002 Version 11, no leakage has been considered for the calculation of emission factor

$LE_y = 0$ ………………………….. (5)

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 5 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:	0.98756
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 5 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:	0.81792
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 5 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 $EF_{grid,OM}$ and 0.25 for $EF_{grid,BM}$ are applicable as per ACM0002. Combined Margin Emission Factor (EFy or $EF_{CM,y}$) — 0.94515 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:

Emission reductions from the project activity are equal to the baseline emissions as project emissions and leakage are nil.

Baseline emission factor (Combined Margin) (EFy)
= 0.94515 tCO_2e/MWh

Annual electricity supplied to the grid by the Project (EG_{PJ},y) is calculated as:
= 50.4 MW (Capacity) x 22.28% (PLF) x 8,760 (hours) MWh
= 98367.09 MWh

Annual Baseline Emissions Reduction: ERy = EFy * EG_{PJ},y
= 0.94515 tCO_2e/MWh x 98367.09 MWh
= 92,971 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)
*June 2011 to May 2012	0	92,971	0	92,971
June 2012 to May 2013	0	92,971	0	92,971
June 2013 to May 2014	0	92,971	0	92,971
June 2014 to May 2015	0	92,971	0	92,971

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)
June 2015 to May 2016	0	92,971	0	92,971
June 2016 to May 2017	0	92,971	0	92,971
June 2017 to May 2018	0	92,971	0	92,971
June 2018 to May 2019	0	92,971	0	92,971
June 2019 to May 2020	0	92,971	0	92,971
June 2020 to May 2021	0	92,971	0	92,971
Total (tonnes of CO_2e)	0	929,710	0	929,710

*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:	**$EG_{PJ,y}$**
Data unit:	MWh (Mega-watt hour)
Description:	Net electricity supplied to the grid by the Project activity.
Source of data to be used:	Calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Annual electricity supplied to the grid by the Project = 50.4 MW (Capacity) x 22.28%(PLF) x 8,760 (hours) MWh = 98367.09 MWh
Description of measurement methods and procedures to be applied:	• Metering system for the project activity consists of cluster metering system at 33kV. Each cluster point will have one main and one check meter (33kV metering point). All the clusters of the project activity will exclusively be connected to WEGs of the project activity i.e. there will be no WEGs of other project owners that are connected to these clusters. Summation of meter reading for all the clusters (connecting 63 machines) will provide total electricity generated by the project activity. • In addition to cluster meters there is one set of main & check meter at Enercon Pooling sub-station (132kV metering point/Bulk metering point) where all the WEGs of project activity and non-project activity are connected. • All main and check meters are two-way tri-vector meters capable of recording import and export of electricity and under the control of state electricity utility. • All main and check meters are of 0.2% of accuracy class. • The procedures for metering and meter reading will be as per the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. • Monthly Joint Meter Reading will be recorded at all the meters will be done

	by Discom utility in the presence of PP's representative (Enercon). • Joint meter reading recorded at cluster metering point indicates the values of export & import by the WEGs of project activity connected to 33 kV metering point. There will be individual Joint meter reading for individual cluster metering point. • Joint meter reading recorded at 132kV metering point at Enercon pooling sub-station indicates the values of export & import by the all the WEGs of project activity and WEGs of non-project activity connected to 132 kV metering point. • Net electricity supplied to the grid value is used in calculation of emission reduction of the project activity. Refer Annex – 4 for an illustration of the provisions for measurement methods. Detailed procedure calculating net electricity supplied to the grid is given in section B.7.2.
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by Discom/State utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. All the main meter and check meters are calibrated by state utility once in five years and records are available with PP. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be archived both in electronic and hard paper format for crediting period + 2 years.

Data / Parameter:	**$EG_{Export,y}$**
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity exported by project activity to grid after apportioning of transmission losses between 33kV metering point (Cluster meter) & 132kV metering point (Bulk metering point)
Source of data to be used:	Electricity exported by project activity will be calculated using the formula better described in section B.7.2.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Refer Annex – 4 and section B.7.2 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	Value of $EG_{Export,y}$ can be crosschecked from certified statement given by state utility showing cost of export and import. It may be noted that energy export by the project activity will be import by the grid from the project activity and therefore electricity export by the project activity is denoted as import by the grid in the certified statement by the state utility. QA/QC procedures will be as implemented by Discom/State utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly

	stated in the PDD. All the main meter and check meters are calibrated by state utility once in five years and records are available with PP. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be archived both in electronic and hard paper format for crediting period + 2 years.

Data / Parameter:	**EG*pe***
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity Export recorded at 33kV (JMR at 33kV metering point) cluster metering points connecting total 63 machines of the project activity.
Source of data to be used:	Electricity export to the grid as per the joint meter reading recorded at cluster metering points.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Electricity export to the grid will be recorded by the cluster meters (main and check) connecting 63 turbines at 33kV level. Refer Annex – 4 and B.7.2 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	Value of **EG*pe*** can be cross checked from transmission loss calculation sheet signed by the representatives of Enercon and Discom. QA/QC procedures will be as implemented by Discom/State utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD.
Any comment:	The data will be archived both in electronic and hard paper format for crediting period + 2 years.

Data / Parameter:	**EG*pi***
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity Import recorded at 33kV (JMR at 33kV metering point) cluster metering points connecting total 63 machines of the project activity.
Source of data to be used:	Electricity import from the grid as per the joint meter reading recorded at cluster metering point.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be	Electricity import from the grid will be recorded by cluster meters (main and check) connecting 63 turbines at 33kV level.

applied:	
QA/QC procedures to be applied:	Value of **EG*pi*** can be crosschecked from certified statement given by state utility showing cost of export and import. It may be noted that energy import by the project activity will be export by the grid to the project activity and therefore electricity import by the project activity is denoted as export by the grid in the certified statement by the state utility. QA/QC procedures will be as implemented by Discom/ State Utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be archived both in electronic and hard paper format for crediting period + 2 years.

Data / Parameter:	**EG*e***
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity Export recorded at 132 kV meters (main and check) at ENERCON pooling substation connecting machines of the project activity and machines commissioned by the other project developers.
Source of data to be used:	Electricity export to the grid as per the joint meter reading recorded at 132 KV of the ENERCON pooling substation (Bulk metering point).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Electricity export to the grid will be recorded by the meters at 132 kV (main and check) at the ENERCON pooling substation connecting machines of the project activity and machines commissioned by the other project developers. Refer Annex – 4 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	Value of **EG*e*** can be cross checked from transmission loss calculation sheet signed by the representatives of Enercon and Discom. QA/QC procedures will be implemented by Discom/state utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be archived both in electronic and hard paper format for crediting period + 2 years.

Data / Parameter:	**L*ep***
Data unit:	MWh (Mega-watt hour)
Description:	Total percentage of Transmission loss for export between the metering point at 33 kV metering points (sum of all the WEGs connected to Bulk metering point including non-project actitivty as well as project activity WEGs) and the metering point at 132 kV at the ENERCON pooling substation.
Source of data to be	Transmission Loss will directly applied from the joint meter reading for the

used:	project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This value is certified by the State utility and Enercon in the transmission loss calculation sheet. This value will be directly applied.
Description of measurement methods and procedures to be applied:	Transmission loss between metering point at 33kV and the metering point at 132kV at ENERCON substation is applied to the meter reading taken at meters connected at 33 KV for the project activity. ENERCON pooling Substation is connected to the machines of the project activity and the machines commissioned by the other project owners. Therefore transmission loss is applied to the project activity by the state utility as reflected in the JMR taken at 33kV level. 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. Refer Annex – 4 and Section B.7.2 for an illustration of the provisions for measurement methods.
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by Discom/ State utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. Refer Annex – 4 for an illustration of the provisions for QA/QC procedures.
Any comment:	The data will be archived both in electronic and hard paper format for crediting period + 2 years.

The data will be stored in hard format. Joint meter reading is taken in the presence of the persons representing Enercon [Operation and Maintenance Contractor]. The copies of the joint meter reading 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 methodology ACM0002 Version 11, “Consolidated 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.

Enercon (India) Limited is O&M contractor for the project activity. Enercon (India) Limited will be responsible for maintaining all the monitoring data on behalf of VIPCPL in respect of the project activity. Enercon (India) Limited has implemented the management structure for managing the monitored data.

This approved monitoring methodology requires monitoring of the following:

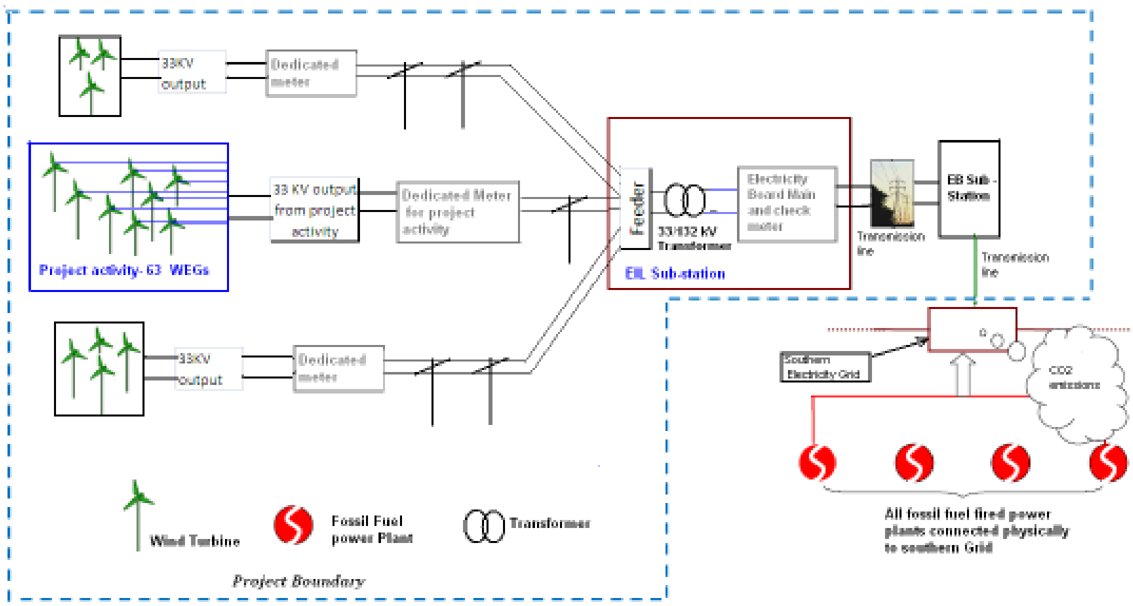
- Electricity generation from the project activity; and
- Operating margin emission factor and build margin emission factor of the grid, where *ex post* determination of grid emission factor has been chosen

Since the baseline methodology is based on ex ante determination of the baseline, the monitoring of operating margin emission factor and build margin emission factor is not required. Further, wind based electricity generation is not associated with any kind of leakages.

The Project is operated by Enercon and managed by the PP. The operational and maintenance contract for the project is with Enercon. Enercon is an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon 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.

Calculation of Net Electricity Supplied to the grid by project activity:

Layout of Metering arrangement for project activity is as follows:-



The PP will make clusters of WEGs at the project site for the purpose of metering. Each cluster will have main and the check meter. All the clusters of the project activity will exclusively be connected to WEGs of the project activity i.e. there will be no WEGs of other project owners that are connected to these clusters. From the above layout it is clear that the clusters meters (dedicated meters/ individual meters) of project activity and other customers are connected to the Enercon pooling sub-station at Ankireddy palli at bulk metering point at 132 kV. Since the main and check meters (bulk meter) at 132 kV metering point at the ENERCON pooling substation is connected to the machines of the project activity and the machines commissioned by the other project developers, therefore in order to determine the net electricity supplied to the grid at 132 kV at the ENERCON substation, the state utility apply the apportioning of transmission loss to the meter reading recorded at the 33 KV. The total % of transmission loss for export between 132kV metering point at Enercon sub-station and all the WEGs connected to sub-station is calculated by the state utility is endorsed / confirmed jointly by the representatives of Enercon and the state utility. The transmission loss applied to the project activity by the state utility is reflected in transmission loss calculation sheet signed by the representatives of Enercon and Discom. Net Electricity exported to the grid is calculated by applying transmission loss to the meter readings taken at 33 kV metering point of the project activity.

The procedure for calculation of the transmission loss is as follows:

Each project developer has dedicated individual metering system at 33kV. Energy export ($X_{Export, N}$) and import ($X_{Import, N}$) is recorded for the individual developers at 33 KV metering point; Where N is number of project developers connected to 132 kV metering point of the ENERCON substation

Total % of transmission losses for export (L*ep*) are calculated as per following formula:

$$Lep\,(\%) = \frac{\{(X_{Export,1} + X_{Export,2+}\; X_{Export,3+} \text{-------------}\; X_{Export,N}) - \mathbf{EGe}\}\ *100}{(X_{Export,1} + X_{Export,2+}\; X_{Export,3+} \text{--------}\; X_{Export,N})}$$

Where, EG*e* = Electricity export to the grid recorded at 132 kV (bulk meter) at the ENERCON pooling substation.

Value of L*ep* is calculated by state utility and would be sourced directly from the transmission loss calculation sheet.

Hence,

Electricity exported by project activity to grid after apportioning of transmission losses between 33kV metering point (Cluster meter) & 132kV metering point (Bulk meter)

$$\mathbf{EG_{export,\,y} \quad = \quad EG\mathit{pe} * (\ 1\text{-}\ L\mathit{ep}\ (\%))}$$

The Joint meter reading noted at 33 KV metering location contains the following data:-

1. Electricity Export
2. Electricity Import

In addition to the JMR at 33kV metering location for the project activity, the following documents will also be provided to the DoE for verification:

1. JMR at bulk meter at ENERCON substation
2. Transmission loss calculation endorsed / confirmed jointly by the representatives of Enercon and the state utility.
3. Certified statement of electricity export and import signed by Discom/State Utility.

The electricity export and import by the project activity can be cross checked cross checked from the certified statement of electricity export and import signed by Discom/State Utility. It may be noted that energy export by the project activity will be import by the grid from the project activity and therefore electricity export by the project activity is denoted as import by the grid in the certified statement by the state utility. Similarly, energy import by the project activity will be export by the grid to the project activity and therefore electricity import by the project activity is denoted as export by the grid in the certified statement by the state utility.

Net Electricity supplied to the Grid is calculated as:

$$\mathbf{EG_{PJ,y} \quad = \quad EG_{export,\,y} - EG\mathit{pi}}$$

The operational and maintenance contract for the project is with Enercon. Enercon is an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon 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.

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.

The meter readings are noted in the form of joint meter report and are signed jointly by the representatives of Enercon and the state utility.

The accuracy of monitoring parameter is ensured by adhering to the calibration and testing of the metering equipment once in five years. Enercon provides the daily generation report to the Project proponent. The project proponent also maintains the records of daily generation report and joint meter report.

Action plan for monitoring of 2% CER revenue contributed towards sustainable development:-

Vaayu (India) Wind Power Corporation Private Limited (VIPCPL) is committed to contribute a minimum of 2% of the CER revenue accrued every year for sustainable development activities for the local population.

VIPCPL will undertake an annual review process of the actual CERs accrued and the price transacted. On the basis of the actual price and exchange rate, VIPCPL will commit 2% of the revenue for sustainable development activities in the local areas.

As part of the annual review, VIPCPL will undertake informal discussions with the locals at the project site and commit the revenue towards society / community developmental activities in areas that are of most concern to the local population. These areas could include health, education, sanitation, skill development, infrastructure development, etc. The annual review process will detail the exact activities that would be undertaken using the 2% revenue and the detailed mode of implementation of the proposed activity.

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 WEGs, 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 staffs 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 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.

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

Date of completion: 31/05/2010

Name of responsible person/entity: Vaayu (India) Power Corporation Private 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:

05/12/2009, being the date of placement of purchase order for the wind energy generators.

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:

01/06/2011.

The project activity is expected to be registered by the 01/06/2011 hence crediting period will start from the date of registration with UNFCCC. It is hereby confirms that the crediting period will not commence prior to the date of registration.

C.2.2.2. Length:

10 years and 0 months

SECTION D. Environmental impacts

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

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[6] 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. Further MoEF published 2 other amended notification dated, 11th Oct 2007[7]& 01st December 2009[8] and these amendment doesn't provide any change in regulatory requirement for WIND power project related to EIA.

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:

The comments from local stakeholders were invited through a local stakeholder meeting conducted at Kurnol District in Andhra Pradesh on 27th February 2010. The meeting was presided over by Mr. P. Jyothi Basu (ENERCON), Mr. Himanshu Bhatnagar (ENERCON-CDM) and Mr. A. V. Bhargava (ENERCON).

E.2. Summary of the comments received:

The local stakeholder consultation meeting had representatives from the nearby villages and representatives of VIPCPL and Enercon (EPC and O&M contractor). Following stakeholders are identified for the project activity:

- Local community
- Village panchayat members
- Employees from wind farm developer (Enercon)
- Representatives from NEDCAP and TRANSCO.

The agenda of meeting was as follows:

1. Welcome address and introduction
2. Project profile
3. CDM, social issues and environmental issues
4. Suggestions and opinions
5. Queries from the stakeholders and response by respective authorized persons
6. Vote of thanks
7. Lunch

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

[7] http://www.fedmin.com/html/not-11-10-07.pdf

[8] http://mnre.gov.in/notification/env-notifn.pdf

The following queries were raised by the stakeholders:

1. Is there any effect on the cattle grazing near by the project after 4 to 5 years down the line from the commencement of project?
2. Will the machines installed create sound and disturb the surrounding?
3. Can the local people will get works relating to project.

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

The clarifications that were addressed 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) are listed in the table below:

S.No.	Villager Name	Question	Reply
1	Ramaiah	Is there any effect on the cattle grazing near by the project after 4 to 5 years down the line from the commencement of project?	There is no effect on the cattle grazing near by the project the sand down the line will not loss its sanctity as there is relation between the project and down line of cattle grazing.
2	Rameshwar Reddy	Will the machines installed create sound and disturb the surrounding?	Many companies have installed wind projects in several villages and no such problem has been faced. The sounds from the machines are negligible and carry no significance effect or have a major concern.
3	Rameshwar Reddy	Can the local people will get works relating to project.	Yes, there will be opportunities for the vicinity people of project by a proper selection process.

The meeting was very cordial and ended on a positive note. No adverse comments were received.

Annex 1
CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Vaayu (India) Power Corporation Private Limited
Street/P.O.Box:	Plot No. 33, Daman Patalia Road
Building:	
City:	Bhimpore
State/Region:	Daman (UT)
Postfix/ZIP:	396210
Country:	India
Telephone:	+91-260-2220624, 2220628
FAX:	+91-260-2221508
E-Mail:	yogesh.mehra@enerconindia.net
URL:	
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Mehra
Middle Name:	
First Name:	Yogesh
Department:	Corporate
Mobile:	+91-98200 40301
Direct FAX:	+91-260-2221508
Direct tel:	+91-22-22-6702 2832 extn. 7111
Personal E-Mail:	yogesh.mehra@enerconindia.net

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project activity does not involve any public funding from parties included in Annex 1.

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 are as follows:

Simple Operating Margin

	Southern Grid (tCO_2e/MWh)
Simple Operating Margin – 2006-07	0.99912
Simple Operating Margin – 2007-08	0.99062
Simple Operating Margin – 2008-09	0.97293
Average Operating Margin of last three years	0.98756

Build Margin

	Southern Grid (tCO_2e/MWh)
Build Margin- 2008-09	0.81792

Combined Margin Calculations

	Weights	Southern Grid (tCO_2e/MWh)
Operating Margin	0.75	0.98756
Build Margin	0.25	0.81792
Combined Margin		0.94515

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 and Monitoring Plan details: The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication shall be applicable as per the PPA (Power purchase agreement) with the State electricity board except or otherwise explicitly mentioned in the PDD.

Metering: The PP will make clusters of WEGs at the project site for the purpose of metering. Each cluster will have main and the check meter at 33 kV. All the clusters will exclusively be connected to WEGs of the project activity i.e. there will be no WEGs of other project owners that are connected to these clusters. Summation of meter reading for all the clusters (connecting 63 machines) will provide total electricity generated by the project activity.

The electricity supplied to the grid will be metered from main and check meters at 33kV that are connected to the 63 turbines of the project activity. The electricity export and import for the project activity will be taken from the summation of the joint meter readings noted from the cluster meters (dedicated meters) connecting 63 turbines of the project activity.

In addition to this there is one set of main and check meters at Ankireddypalli sub-station (Enercon pooling sub-station). Transmission loss between metering point at 33kV and the metering point at 132kV at Enercon substation is applied to the meter reading taken at meters connected at 33 KV for the project activity. Enercon Substation is connected to the machines of the project activity and the machines commissioned by the other project owners. Therefore transmission loss is applied to the project activity by the state utility as reflected in the JMR taken at 33kV level. The JMR is signed by the representatives of Enercon and the state utility. The procedure for calculation of transmission loss is better described in B.7.2

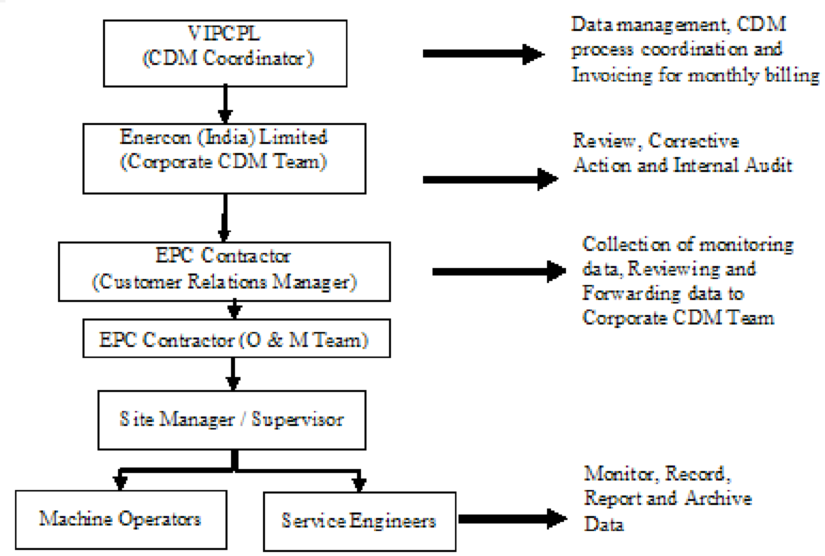
Metering Equipment: Metering equipment is electronic trivector meter of 0.2% accuracy class.

Meter Readings: The monthly meter reading is taken jointly by the parties (Enercon personals and personals of State utility) for every last month. At the conclusion of each meter reading an appointed representative of State Utility and Enercon sign a document indicating the number of Kilowatt-hours (kWh) indicated by the meter.

QA/QC Procedure: All the meters are calibrated/ tested once in five years. The calibration is done by the officials of the state utility. Copy of calibration/testing certificate will be kept as record by the PP and will be presented to the DoE during verification exercise.

The project proponent is Vaayu (India) Power Corporation Private Limited will be keeping and monitoring the data for electricity generation and calibration reports post project implementation. Enercon (India) Limited will be the O&M contractor who will be having the responsibility of activities such as maintaining electricity generation records, calibration records and maintenance of the WEGs (Wind Energy Generators).

The operational and management structure implemented for data monitoring is as follows:



Main and Check meter: In case the main meter(s) is found to operate outside the permissible limits, the main meter will be either replaced or calibrated immediately. Whenever a main meter goes defective, the consumption recorded by the Check meter will be referred.

If both the main meter and check meter are found to operate outside the permissible limits of error, both the meters shall be either replaced or calibrated immediately and consumption recorded by the main meter after applying full value of maximum permissible error will be referred.In case the date of registration or start date of the crediting period of the project does not match with the date of joint meter report, the apportioning for net electricity exported to the grid for first month will be done based upon the meter reading of the controller meter (also known as Local Control System (LCS) meter) located in the WEC tower and thereafter the readings from main meter will be referred.

The LCS meters do not require calibration as the energy readings of electricity generated at the LCS meter is cross verified by the energy calculated by inverting system installed in the WECs. In case there is any mismatch in the energy values recorded by the LCS meter and the energy values calculated by the inverting system; the machine will stop working and generate the error report. The operations and maintenance staff will calibrate the meter immediately and correction factor will be determined.

Appendix 1

LATITUDE AND LONGITUDE DETAILS

Sl. No.	WEG Location No.	Latitude			Longitude		
		DEG	MIN	SEC	DEG	MIN	SEC
1	1	14	59	10.3	78	5	17.5
2	2	14	59	17.7	78	5	16.5
3	3	14	59	24.7	78	5	14.9
4	4	14	59	30.0	78	5	14.0
5	5	14	59	39.0	78	5	16.5
6	6	14	59	46.6	78	5	18.3
7	7	14	59	51.8	78	5	0.7
8	8	14	59	58.2	78	4	59.8
9	9	15	0	1.3	78	4	44.5
10	10	14	59	37.2	78	5	1.8
11	11	14	59	43.6	78	4	51.9
12	12	14	59	47.5	78	4	42.5
13	13	14	59	52.5	78	4	37.0
14	14	14	59	52.5	78	4	21.6
15	15	14	59	57.8	78	4	16.3
16	16	15	0	3.2	78	4	11.2
17	17	15	0	9.5	78	4	4.4
18	21	15	0	18.2	78	4	45.5
19	22	15	0	25.6	78	4	39.3
20	23	15	0	30.1	78	4	22.0
21	24	15	0	42.0	78	3	52.3
22	25	15	0	33.2	78	3	42.2
23	26	15	0	39.6	78	3	38.6
24	27	15	0	47.0	78	3	35.2
25	28	15	0	51.2	78	3	29.4
26	29	15	0	57.0	78	3	25.6
27	30	15	1	25.9	78	4	50.2
28	31	15	1	32.1	78	4	47.3
29	32	15	1	36.5	78	4	39.4
30	33	15	1	41.9	78	4	39.2
31	34	15	1	43.5	78	4	53.8
32	35	15	1	38.1	78	4	55.4
33	43	15	2	58.6	78	2	57.9

34	43A	15	2	50.4	78	2	59.3
35	61	15	3	22.2	78	2	33.8
36	69	15	4	32.3	78	1	39.2
37	70	15	4	38.5	78	1	38.0
38	71	15	4	44.7	78	1	38.4
39	72	15	4	49.7	78	1	32.0
40	73	15	4	55.4	78	1	34.4
41	74	15	5	2.5	78	1	50.6
42	85	15	3	28.7	78	2	31.0
43	86	15	3	35.6	78	2	29.0
44	90	15	3	6.5	78	2	43.6
45	A1	15	4	32.6	78	2	26.8
46	A2	15	4	40.0	78	2	22.4
47	A3	15	4	28.1	78	2	42.3
48	A4	15	4	40.5	78	2	33.5
49	A5	15	4	54.0	78	2	17.2
50	A6	15	5	7.4	78	2	21.8
51	W1	15	2	37.0	77	59	16.0
52	W2	15	2	29.9	77	59	15.7
53	W3	15	2	24.2	77	59	18.6
54	W4	15	2	13.8	77	59	17.1
55	W5	15	2	5.9	77	59	20.8
56	W6	15	2	0.5	77	59	26.5
57	W7	15	1	49.3	77	59	36.4
58	W8	15	1	41.8	77	59	44.8
59	W9	15	1	36.5	77	59	50.5
60	W10	15	2	3.9	77	59	52.3
61	W11	15	2	10.8	77	59	56.7
62	W12	15	2	21.0	77	59	34.8
63	W13	15	1	55.4	77	59	29.9

Appendix 2

CALCULATION OF BENCHMARK COST OF EQUITY

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 world wide. 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 (paragraph 12) states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate

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 can not 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 can not 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.

Accordingly, the cost of equity applicable to the project type has been considered and calculation of cost of equity is described as follows:-

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.

[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

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, 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 rate is published by Reserve Bank of India dated Nov 11, 2009. Being conservative we PP used the average of 4 month risk free rate as mentioned below:-

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	Jun-09	Jul-09	Aug-09	Sep-09
Risk Free Rate	7.78%	7.79%	8.18%	8.16%
Average value	**7.98%**			

(Web-link: http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/27CT_BUNOV09.pdf)

The applicable risk free rate is 7.98%.

Market Risk Premium:

The most common approach for estimating the market 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 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran]. 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 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran].

In India, there is no power sector index available with long term data. The stock exchanges have only recently started publishing index for power sector comprising of companies in the power sector business and one such index available is BSE POWER index (http://www.bseindia.com/about/abindices/sectoralindices.asp), launched in November 2007 with index data available from January 2005. This index was not considered in benchmark determination, since only the less than 5 year data was available at the time of decision.

The research paper titled “equity risk premiums” by Dr. Damodaran (Page no [6] of “Equity Risk Premium”) states that the standard errors are large in case data used is for shorter duration (source: http://www1.worldbank.org/finance/assets/images/Equity_Risk_Premiums.pdf). Thus for calculation of

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

equity risk premiums, longer time periods are considered as appropriate. We have considered market data for four indices that have data available for more than 10 years (BSE Sensex, BSE 100, BSE 200 and BSE 500). The data for these four indices was analysed and minimum market return was used for computing benchmark. Furthermore the market return is adjusted for beta of power sector stocks used for determining cost of equity.

Market Return	BSE Sensex	BSE-100	BSE-200	BSE-500
Investment Decision Date	Nov-09	Nov-09	Nov-09	Nov-09
Data available	Oct-09	Oct-09	Oct-09	Oct-09
No of years of Index	30.60	26.60	20.59	10.75
Market return	**18.01%**	**18.09%**	**15.55%**	**18.39%**

Therefore the market risk premium has been calculated as the difference in compounded annual return between the BSE-200 (being conservative minimum value out of BSE-100, BSE-200, BSE-500 & Sensex has been choosen) and the risk free rate applicable at the time of investment decision. The detailed calculations are presented in the attached excel sheet.

The applicable market risk premium = 15.55%- 7.98%

= 7.58%.

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. However, there was only one wind energy company (BF Utility) listed on any stock exchange in India (both BSE- Bombay Stock Exchange and NSE-National Stock Exchange) in year. 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.

The Beta Value represents two types of risk:-

(1) Financial Risk

(2) Business Risk

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.).

Unlevered beta represents the companies that do not carry financial (leverage) risk which is not the case for our project activity. To account for such differences in leverage (debt equity gearing), beta values of reference companies shall be first unlevered and re-levered using the applicable debt equity mix for the project.

In case of our project, the debt equity ratio is 70:30 which is higher than the debt equity ratio of the power companies whose betas values are considered for computation of WACC. This means that re-levering will result in a higher beta value and higher benchmark cost of capital. Therefore use of raw Beta value is considered conservative.

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. Beta values of individual companies have been sourced from Bloomberg. The table below summarises the beta values:

Company Name	Beta
CESE	1.11
Energy Dev	1.19
Gujarat Industries	0.96
Reliance	1.57
Tata Power	1.03
Average	**1.17**

Source: Bloomberg, Beta snapshots are provided in Appendix 3.

The debt equity ratio of the companies considered for computing beta have lower debt equity ratio compared to project activity. Hence the use of raw beta values is conservative and is used for computing weighted average cost of capital.

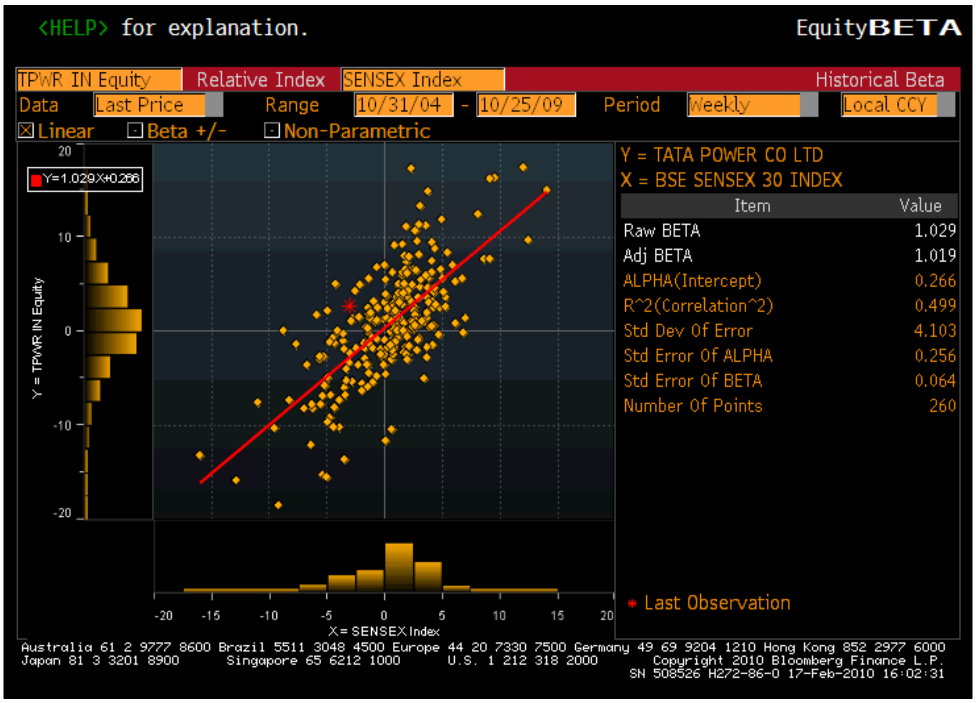
Calculation of Benchmark cost of equity:-

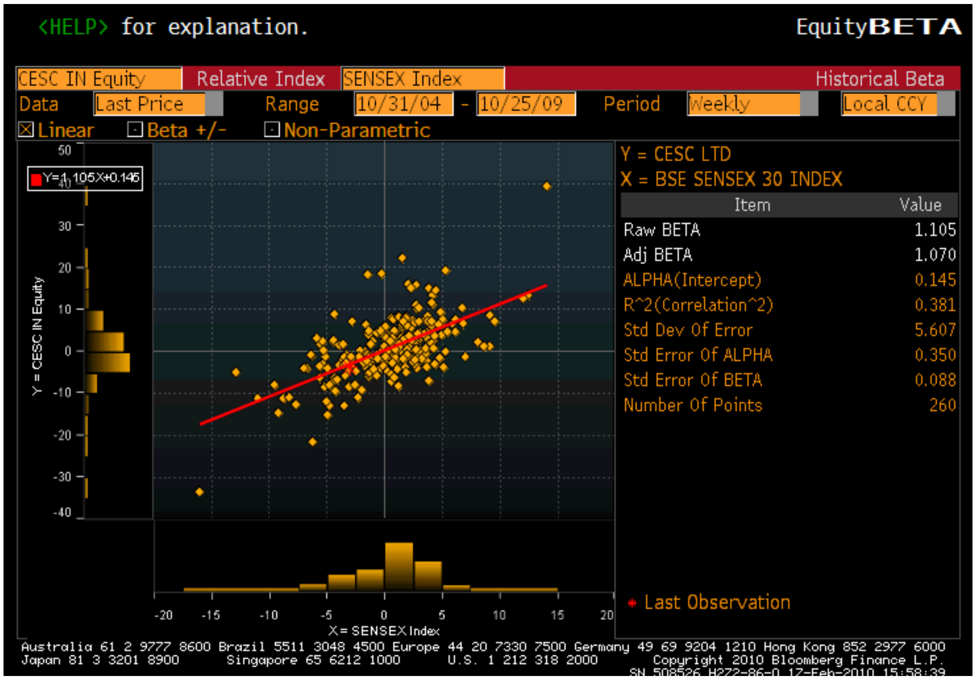
Ke = Rf + B x (Rm - Rf)]

Therefore, cost of equity benchmark, Ke = 7.98% + 1.17 * 7.58% = **16.84%**

Appendix 3

BETA SNAPSHOTS FROM BLOOMBERG

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EquityBETA
CESC IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
10/31/04
10/25/09
Period
Weekly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=1.105X+0.145
Y = CESC IN Equity
X = SENSEX Index
Y = CESC LTD
X = BSE SENSEX 30 INDEX
Item
Value
Raw BETA 1.105
Adj BETA 1.070
ALPHA(Intercept) 0.145
R^2(Correlation^2) 0.381
Std Dev Of Error 5.607
Std Error Of ALPHA 0.350
Std Error Of BETA 0.088
Number Of Points 260
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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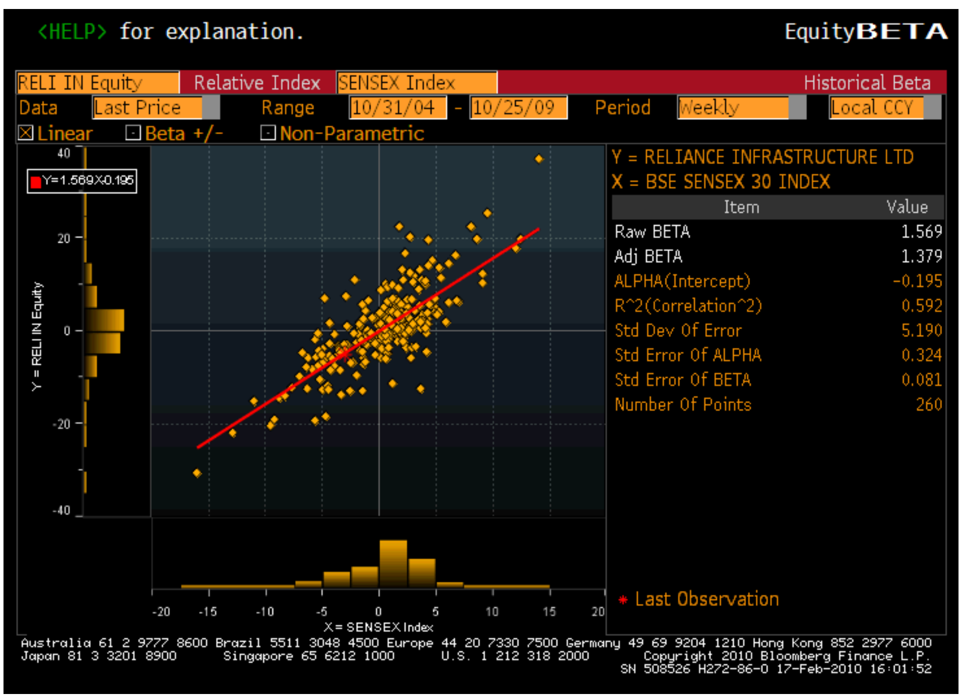
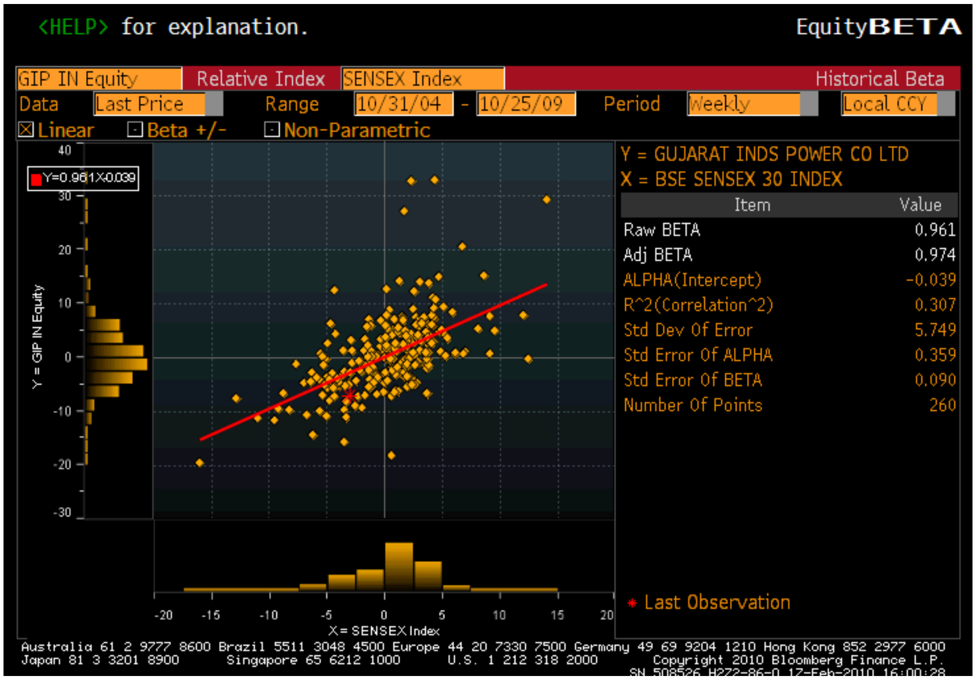
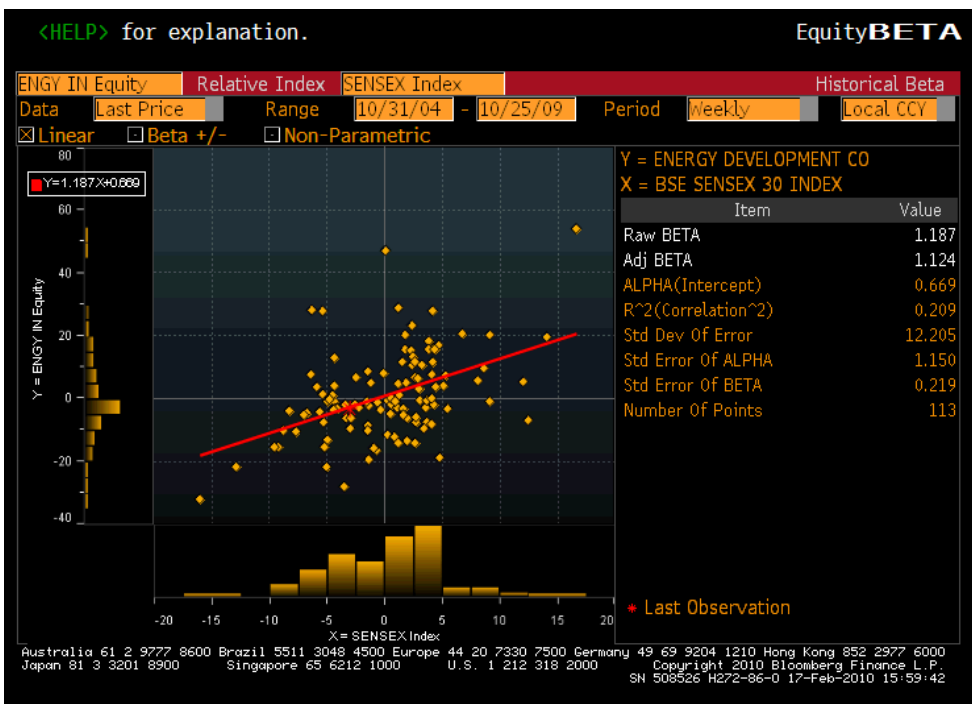

<HELP> for explanation.
EquityBETA
RELI IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
10/31/04
10/25/09
Period
Weekly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=1.569X-0.195
Y = RELI IN Equity
X = SENSEX Index
Y = RELIANCE INFRASTRUCTURE LTD
X = BSE SENSEX 30 INDEX
Item
Value
Raw BETA 1.569
Adj BETA 1.379
ALPHA(Intercept) -0.195
R^2(Correlation^2) 0.592
Std Dev Of Error 5.190
Std Error Of ALPHA 0.324
Std Error Of BETA 0.081
Number Of Points 260
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.
SN 508526 H272-86-0 17-Feb-2010 16:01:52


<HELP> for explanation.
EquityBETA
GIP IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
10/31/04
10/25/09
Period
Weekly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=0.961X-0.039
Y = GIP IN Equity
X = SENSEX Index
Y = GUJARAT INDS POWER CO LTD
X = BSE SENSEX 30 INDEX
Item
Value
Raw BETA 0.961
Adj BETA 0.974
ALPHA(Intercept) -0.039
R^2(Correlation^2) 0.307
Std Dev Of Error 5.749
Std Error Of ALPHA 0.359
Std Error Of BETA 0.090
Number Of Points 260
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.


<HELP> for explanation.
EquityBETA
ENGY IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
10/31/04
10/25/09
Period
Weekly
Local CCY
Linear
Beta +/-
Non-Parametric
Y=1.187X+0.669
Y = ENGY IN Equity
X = SENSEX Index
Y = ENERGY DEVELOPMENT CO
X = BSE SENSEX 30 INDEX
Item
Value
Raw BETA 1.187
Adj BETA 1.124
ALPHA(Intercept) 0.669
R^2(Correlation^2) 0.209
Std Dev Of Error 12.205
Std Error Of ALPHA 1.150
Std Error Of BETA 0.219
Number Of Points 113
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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