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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Title: Vaayu India Wind Power Project in Tamilnadu.
Version: 4.0
Date of completion of PDD: 15/03/2011

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 Tamilnadu 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 109.625 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 Tamilnadu. 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 103,612 tCO_2e per year, by displacing the equivalent amount of electricity generation through the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansions connected to the grid.

In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the Southern grid, which are/ will be predominantly based on fossil fuels[1]. Whereas the electricity generation from operation of 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 Tamilnadu Electricity Board (TNEB) 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/reports/monthly/executive_rep/feb11/8.pdf

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)	Private and/or public	Kindly indicate if the Party

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

indicates a host Party)	entity(ies) project participants (*) (as applicable)	involved wishes to be considered as project 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.:

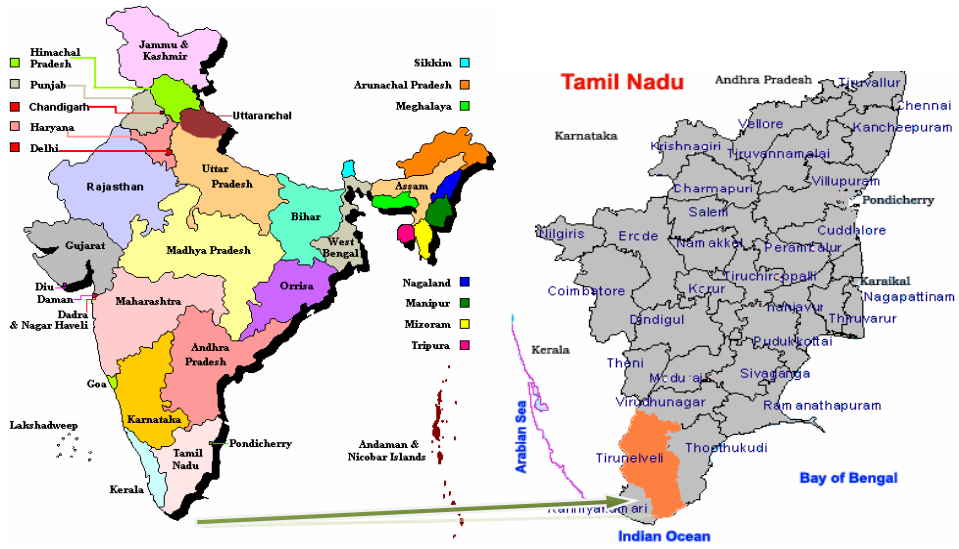
Southern Region/Tamilnadu State

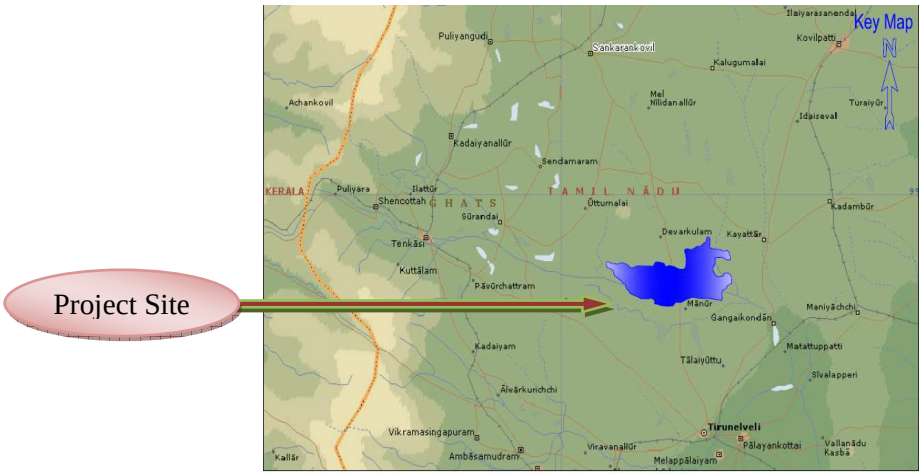
A.4.1.3. City/Town/Community etc:

The project is spread across Vagaikulam, Kuruchikulam, Ettankulam, Kalakudi, Muthammalpuram, Ukkirankottai villages in Tirunelveli district in Indian State of Tamilnadu.

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 8^{O} 52' 12.368" and 8^{O} 56' 6.770" North and longitude 77^{O} 35' 0.824" and 77^{O} 37' 9.822" East.Tirunelveli railway station is about 25 kms away from the site. Nearest airport is at Tuticorin about 70 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 has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured.

In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the Southern grid, which are/ will be predominantly based on fossil fuels[3], hence baseline scenario of the project activity is the grid based electricity system, which is also the pre-project scenario. Since the project activity involves power generation from wind, it does not involve any GHG emissions for generating electricity.

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

The estimated emission reductions over the 10 year fixed crediting period would be 1,036,120 tCO_2e as per details on annual emission reductions provided below:

Years	Annual estimation of emission reductions in tonnes of CO_2e
*July 2011 to June 2012	103,612
July 2012 to June 2013	103,612
July 2013 to June 2014	103,612
July 2014 to June 2015	103,612
July 2015 to June 2016	103,612
July 2016 to June 2017	103,612
July 2017 to June 2018	103,612
July 2018 to June 2019	103,612
July 2019 to June 2020	103,612
July 2020 to June 2021	103,612
Total estimated reductions	**1,036,120**

[3] http://www.cea.nic.in/reports/monthly/executive_rep/feb11/8.pdf

(tonnes of CO_2e)	
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**103,612**

*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:

Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated baseline methodology ACM0002 (Version 12.1.0, EB 58)

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 Tamilnadu 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 12.1.0 is the relevant baseline and monitoring methodology and it is applicable because:

Para No.	Applicability Conditions as per ACM0002	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:	The project activity is grid connected renewable power generation from wind.

	• 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.	
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	The project activity does not involve any of the given criteria hence methodology is applicable for the project activity.

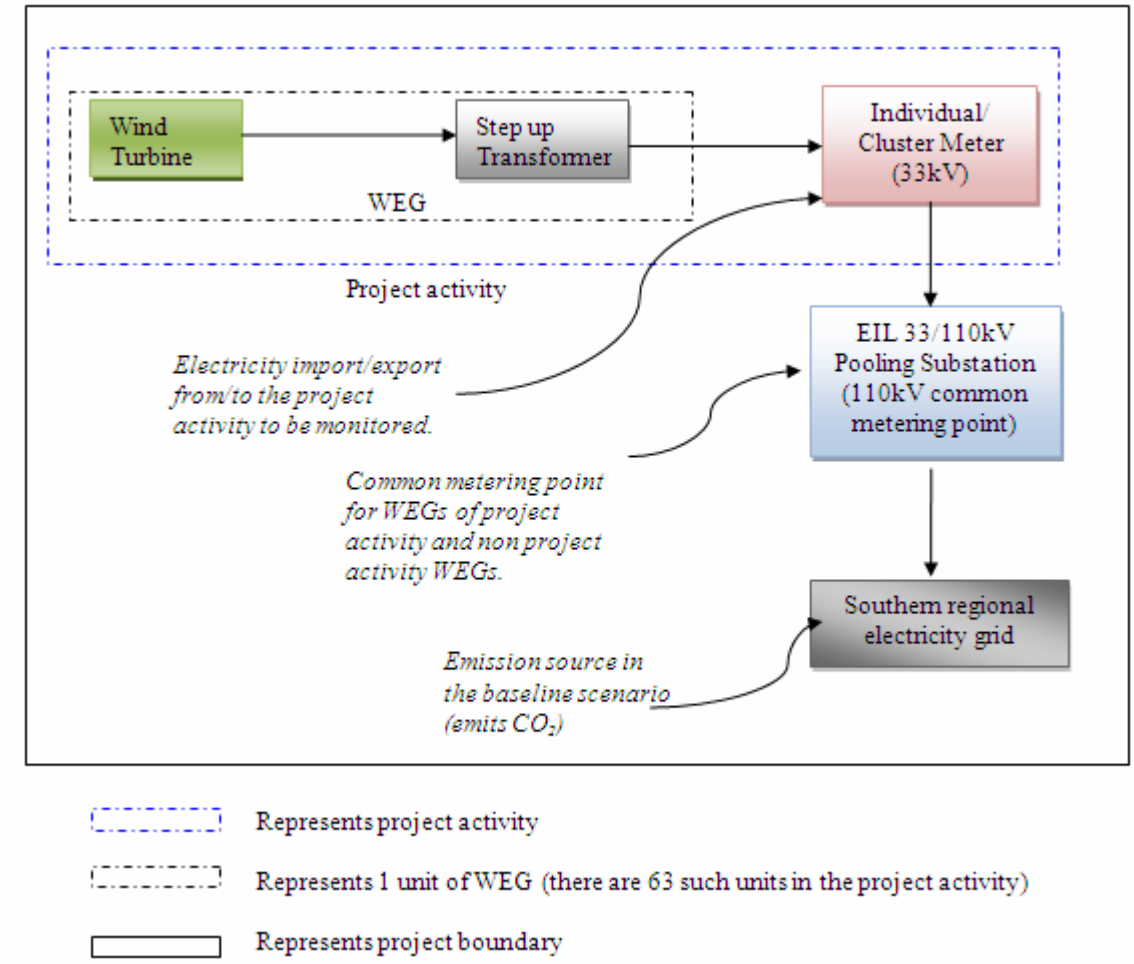
	reservoirs where the power density of the power plant is less than 4 W/m^2.	
5.	In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the 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 110kV Pillayarkulam sub-station developed by Enercon (India) Limited.

Flow diagram of the project boundary:



The baseline study of Southern grid shows that the main sources of GHG emissions in the baseline are CO_2 emissions from the conventional power generating systems, the other emissions are that of CH_4 and N_2O but both emissions were conservative and are excluded for simplification of the project. The project activity is 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.
Pri	Greenfield	CO_2	No	The project activity does not emit any emissions.

	wind energy conversion system	CH_4	No	No methane generation is expected to be emitted.
		N_2O	No	No nitrous oxide generation is expected to be emitted.

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

According to ACM0002, 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

Tamilnadu 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]:

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

[5] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

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
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
$EF_{grid,CM,y}$ – Grid Emission Factor	Calculated as the weighted average of the operating margin and build margin

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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

The project activity generates revenue by selling electricity to TNEB, thus simple cost analysis (option I) cannot be applied to the proposed CDM project activity.

The alternative to the project activity is continuation of current situation, i.e. no project activity and equivalent amount of energy would have been produced by the grid electricity system. This alternative will not require capital investment; hence investment comparison analysis (option II) cannot be applied.

In this case the benchmark analysis (option III) is most appropriate.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:

Assumptions for Financial Model			
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	24.83%		C-WET Report
Transformation loss and Transmission Loss up to metering point	0.0%		
Effective PLF	24.83%		Calculated
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 for 20 years - INR./Kwh	3.39		TNERC Order
Generatiuon Based Tariff- 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 (web link: http://www.mnre.gov.in/gbi-scheme.htm)
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	10	Years	Normative for power generation Sector India
Income Tax Depreciation Rate (Written Down Value basis)			
on Wind Energy Generators	80%		Income Tax Act www.fastfacts.co.in/resources/DepIncomeTax.rtf
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
Minimum Alternate Tax	17.00%		Income Tax Act
Working capital			
Receivables (no of days)	30		Billing Cycle
O & M expenses (no of days)	90		Enercon's Offer

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 24.83%.

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 6.23 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	8.78%	6.23%	4.14%

The equity IRR crosses the benchmark at capital cost variation of 31.5% which is not realistic.

Tariff

Tamilnadu state electricity commission has fixed the tariff for the period of 20 years (Lifetime) for the wind power projects. The control period for the tariff order dated 20 Mar 2009 is specified as two years and hence the applicable order will extend to 30 Mar 2011. The tariff for the entire life of the project activity is fixed a INR 3.39 per kWh as per current tariff order in force and all the projects that are commissioned up to 30 Mar 2011 will be provided the tariff approved by the commission in its order dated 30 Mar 2009. Therefore it is not appropriate to conduct sensitivity on tariff.

The equity IRR crosses the benchmark at the tariff of INR 5.15 per kWh that is at 52% increase in base tariff of INR 3.39 per kWh which is not a reasonable assumption.

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 24.83%. We have conducted sensitivity at a variation of 10% over the base case.

	PLF @ 22.35% (10% Decrease over PLF estimated by CWET)	PLF 24.83% (PLF by CWET)	PLF @ 27.31% (10% Increase over PLF estimated by CWET)
Post tax Equity IRR	4.06%	6.23%	8.39%

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 37.42% 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	6.26%	6.23%	6.20%

It may also be noted that at 100% equity, the Equity IRR is 6.51%.

O&M Cost

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

	10% decrease in O&M cost	Base O&M Cost	10% Increase In O&M cost
Post tax Equity IRR	6.60%	6.23%	5.86%

The project does not cross the benchmark even at 100% variation in O&M cost.

Loan Tenure

At the time of investment decision the loan repayment period was assumed as 10 years for the project activity. The loan repayment period of 10 years is accepted norm for power sector projects and is envisaged by Central Electricity Regulatory Commission and State Electricity Regulatory Commission. However, in actual the PP was able to secure loan from IDFC for period of 12 years. To capture the deviation, the sensitivity analysis at loan tenure of 12 years has been done; the equity IRR for 12 years loan tenure is 5.91% 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:

Analysis of similar projects within comparable regulatory regime and investment climate:

Over the years there have been two different regulatory / investment regimes in the state of Tamil Nadu for wind power projects.

Regime 1 – Central regime (MNES policy)

- Projects installed prior to September 2001
- Wind power projects were governed by MNES policy with tariff set at INR. 2.25 per unit for the base year 1994-95 with a 5% annual escalation, wheeling and banking charges of 2%, etc.

Regime 2 – State regime (TNEB and TNERC policies / orders)

- Projects installed after September 2001
- Wind power projects were governed by (a) TNEB order of 2001 with fixed tariff of INR. 2.70 per unit, wheeling and banking charged of 5%, etc. (b) TNERC order of 2006 with fixed tariff of INR. 2.9 per unit, etc.

The different tariffs under regime 1 and regime 2 are presented below:

Electricity tariff (INR/kWh)	2006 -07	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	2012 -13	2013 -14	2014 -15	2015 -16	Averag e
REGIME 1											
MNES Policy[6]	3.60	3.72	3.83	3.94	4.05	4.17	4.28	4.39	4.50	4.62	4.11
REGIME 2											
TNEB order 2001[7]	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
TNERC Order 2006[8]	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90

Wind projects prior to September 2001 were governed by the MNES policy. However this regime was superseded by the state policy and post September 2001 all project fell into the state regime (regime 2). As can be seen above, Regime 1 projects are of a different regulatory and investment environment and hence cannot be compared to the proposed project activity which falls under the Regime 2.

The candidate CDM project activity is a large scale project and hence an analysis of all private wind farm owners with an installed capacity of 15 MW or above, in the state of Tamil Nadu, under the Regime 2 i.e. after September 2001, has been presented below (Details of all the investors for the common practice analysis have been sourced from the Indian Wind Power Directory 9th edition published in year 2009.)

Name of Investor[9]	Total Capacity MW in the	CDM[11]	Web-links and Explanation

[6] INR.2.25 for 1994-95 and 5% annual escalation thereafter

[7] INR.2.70 for 2001 fixed for next 10 years

[8] INR. 2.90 for 2006, fixed for next 10 years

[9] The data on private wind farm owners with greater than 15 MW installed capacity has been taken from http://www.windpowerindia.com/index.php?option=com_content&view=article&id=21&Itemid=26 .

	Regime 2[10]		
Madras Cement Ltd.	**142.350**	**Yes**	Installations under the 3 CDM PDDs titled 1) "41.6 MW grid connected electricity generation project by Madras Cements Limited in Tamil Nadu." http://cdm.unfccc.int/Projects/Validation/DB/AOLO0C51SE7IUL19FP3B27HORLRSK0/view.html 2) 46.2 MW wind energy project in Tamilnadu, India. http://cdm.unfccc.int/Projects/Validation/DB/OB98HGOB9W6DUNN60IUBED9VHZRTUQ/view.html 3) 74 MW wind energy project in Tamilnadu, India. http://cdm.unfccc.int/Projects/Validation/DB/BHX0TQO6T2FMQNF1A59AGMX7X5E4DD/view.html
Simran wind power project	**51.600**	**Yes**	Installations under 2 PDDs 1) Grid connected wind energy project in Tamil Nadu by Simran Wind Project Private Ltd. http://cdm.unfccc.int/Projects/Validation/DB/IVRFOXG4PHX66FTOIH9AHHP55OHR4L/view.html 2) 33.9 MW bundled wind power project in states of Karnataka and Tamil Nadu. This is a VCS project.
Super wind power project	**36.000**	**Yes**	PDD titled "Grid connected wind energy project in Tamil Nadu by Super Wind project private ltd" http://cdm.unfccc.int/Projects/DB/DNV-CUK1280379317.22/view
DLF Home developers	**34.500**	**Yes**	PDD titled "Wind Power based electricity generation project in India by DLF Home Developers Limited" http://cdm.unfccc.int/Projects/DB/BVQI1270985563.08/view
Soundararaja Mills Ltd.	**33.850**	**Yes**	Installations are under the CDM PDDs titled 1) 10.005 MW captive grid connected wind power project by the members of IWPA at Coimbatore. http://cdm.unfccc.int/Projects/Validation/DB/LO3RUNJBAVPC94GWP0N3IPQZM866Y0/view.html 2) 40.68 MW grid connected electricity generation project by Indian Wind Power Association at Tirunelveli in Tamil Nadu. http://cdm.unfccc.int/Projects/Validation/DB/1VD4I971NMFAB70C0LGFR01GV4RI4H/view.html 3) Bundled Wind power project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (TASMA-II)

[10] The capacity of installations under the Regime 2, i.e. commissioned after September 2001 and before the project start date, in the state of Tamil Nadu, has been sourced from the Directory of Indian Windpower 2009.

[11] The CDM status of the projects has been taken from the CDM pipeline, in http://cdm.unfccc.int, MoEF site and other publicly available sources.

			http://cdm.unfccc.int/Projects/Validation/DB/4R4NBZ8HU31NRZMNQAMH37GJN07926/view.html 4) 21.00 MW grid connected electricity generation project by Indian Wind Power Association at Tirunelveli in Tamil Nadu. http://cdm.unfccc.int/Projects/Validation/DB/471EKHW7NC9S7MHCK3H8Y9DLP08GYA/view.html
KPR Mill Pvt. Ltd.	**32.250**	**Yes**	The installations are under two CDM PDDs 1) 19.27 MW Grid connected wind electricity generation project by KPR Mills in Tamil Nadu. http://cdm.unfccc.int/Projects/Validation/DB/KBAXDG75UAPOH4J4P20YB2AIQKM36G/view.html 2) 19.8 MW grid connected Wind farm project by KPR Mill Private Limited, Tamil Nadu, India http://cdm.unfccc.int/Projects/Validation/DB/AB7TO0OZGUKE6HYPB4TWCP5536AGVF/view.html
Grace Infrastructure (P) Ltd.	**31.000**	**Yes**	Installations under CDM PDD titled "31 MW Wind energy project in, India by Grace Infrastructure Pvt Ltd" http://cdm.unfccc.int/Projects/Validation/DB/VLQQA5G0DHYVVJPOIUAALLK00RALY1/view.html
Vishal Export Overseas Ltd	**29.275**	**Yes**	All the installations were envisaged to be CDM projects as reported publicly http://www.projectsmonitor.com/detailnews.asp?newsid=9284
Shanmugavel Group	**25.500**	**Yes**	The installations are under the PDD titled "Bundled Wind power project in Tamilnadu, India co-ordinated by the TamilNadu Spinning Mills Association (TASMA)" http://cdm.unfccc.int/UserManagement/FileStorage/AE2042RXII12SBXNF29XDKVT2BCEWG
Best & Co.	**25.000**	**Yes**	The installations are all under the CDM PDD titled "Bundled Wind power project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (TASMA-II)" http://cdm.unfccc.int/UserManagement/FileStorage/6QDL0CJW95NYIX8U14H3STGKAF2BEV
Bannari Amman Spinning Mills Ltd.	**23.400**	**Yes**	The installations are under the CDM PDDs titled 1) "STL Wind Power Project" http://www.dnv.com/focus/climate_change/Upload/Version%202%20-%20PDD%20%20Sept%2005.pdf 2) Eco Friendly Electricity Export to Grid http://cdm.unfccc.int/Projects/Validation/DB/6SWAELBL6JQ0FHJOHCFAPRY4B5IBZ0/view.html 3) Bannari Amman Spinning Mills Wind Power Project managed by Enercon (India) Ltd. https://cdm.unfccc.int/Projects/Validation/DB/FYPAQ52NJB35JZRDUIC0GVD36E6S33/view.html

Lakshmi Machine Works Ltd	**23.000**	**Yes**	Installations under PDD titled "27.95 MW wind energy project in Coimbatore district in Tamilnadu, India." http://cdm.unfccc.int/UserManagement/FileStorage/7LXZLFECVXR5YBOJ5TH8J6XNHIPOCN
Premier Fine Yarns Pvt. Ltd.	**22.850**	**Yes**	The installations are under the PDD "Grid connected renewable electricity generation project by M/s. Premier Mills Pvt Ltd in Tamilnadu, India" http://cdm.unfccc.int/Projects/Validation/DB/J0J2B6K3O92EEUAFD3OGYLE03TNZ7I/view.html 2) "Bundled wind power project in Tamil Nadu managed by Enercon India Limited-II". This is a VCS project. https://climatefriendly.com/skins/files/file/pdf/project_page/Tamil_Nadu_Wind_Project_Verification_Report.pdf?PHPSESSID=l52vii0nmj23rchhaao4aofkd2
Sapthagiri Distilleries	**21.000**	**Yes**	The installations are under CDM project titled "53.75 MW Bundled wind Power project in Tamil Nadu and Karnataka by KBD Group, India" http://cdm.unfccc.int/Projects/Validation/DB/ZSGOS9T3629EQQBKKJ8S3S5KQCSRP9/view.html
TCS Textiles Ltd.	**20.750**	**Yes**	The installations are under the PDD titled 1) "Bundled Wind power project in Tamilnadu, India co-ordinated by the TamilNadu Spinning Mills Association (TASMA)" http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view 2) "19.80 MW bundled wind energy project in Tirunelveli and Coimbatore districts in Tamilnadu, India" http://cdm.unfccc.int/Projects/Validation/DB/QCDOZFYAQ1NMKR2SATF56PMJNH0TIU/view.html
Loyal Textile Mills Ltd	**20.450**	**Yes**	The installations are under the PDD titled "22.25 MW Captive Wind Power Project in Tamil Nadu" http://cdm.unfccc.int/Projects/Validation/DB/ED7XENPZW06ZNTMVUOXKGQXEGZMUZV/view.html
Ashok Leyland Fin. Ltd	**20.025**	**Yes**	The installations are in the CDM PDD titled "56.25 MW bundled wind energy project in Tirunelveli and Coimbatore districts in Tamilnadu, India." http://cdm.unfccc.int/Projects/Validation/DB/37X42BG16GG63VK5L84D6WZ0UM8YGG/view.html
Arvind A Traders	**19.350**	**Yes**	The installations are under the PDDs titled 1) "16.45 MW bundled grid connected renewable energy project in Tamil Nadu, India" http://cdm.unfccc.int/Projects/Validation/DB/ABFMBRFUS8RHP90TSOL3MQ2K4PLTM5/view.html 2) 37.6 MW Bundled Wind Power Project in Nagercoil, Tamilnadu http://cdm.unfccc.int/filestorage/1/M/N/1MNSGD49QZYL4ZR8QOU54A8M3WU4XA/India%20PDD.pdf?t=MDV8MTMwMjA2NTk0Ny40NA==|gcNPNhJlqyOTtYxHwEhSirUP-MQ=

Muthoot Fincorp Ltd.	**18.750**	**Yes**	Installations are under the CDM PDDs 1) Wind based bundled renewable energy project, Tamilnadu, India. http://cdm.unfccc.int/Projects/Validation/DB/NL768PUSVEEJJWKRMJ52W0F1GGT8A2/view.html 2) Emissions free electricity generation using wind energy http://cdm.unfccc.int/Projects/Validation/DB/0KHOIO3K9P0Z86DVCHDOHQ7XBZH58S/view.html 3) 23.75MW grid connected electricity generation project at Tirunelveli in Tamil Nadu. http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/512/PDD%2023.75MW%20grid%20connected%20electricity%20generation%20project%20at%20Tirunelveli%20in%20Tamil%20Nadu..pdf
CPCL	**17.600**	**Yes**	Installations are under PDD titled "17.6 MW captive grid connected electricity generation from wind energy project by Chennai Petroleum Corporation Limited." http://cdm.unfccc.int/Projects/DB/BVQI1257245548.54/view
Suzlon Infrastructure Limited	**17.500**	**Yes**	The installations are under the PDDs 1) "16.25 MW grid connected electricity generation project at Coimbatore in Tamil Nadu" http://cdm.unfccc.int/Projects/Validation/DB/X1W2URT6QDN2GVGATM1WN7EXSFH89N/view.html 2) "38.75 MW grid connected electricity generation project at Tirunelveli in Tamil Nadu" http://cdm.unfccc.int/Projects/Validation/DB/01HFZ32O165S7S2CESB81LQ0C46PYL/view.html 3) "23.75MW grid connected electricity generation project at Tirunelveli in Tamil Nadu" http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/512/PDD%2023.75MW%20grid%20connected%20electricity%20generation%20project%20at%20Tirunelveli%20in%20Tamil%20Nadu..pdf
Premier Spg & Wvg Mills Pvt. Ltd	**16.250**	**Yes**	The installations are under the PDD "Grid connected renewable electricity generation project by M/s. Premier Mills Pvt Ltd in Tamilnadu, India" http://cdm.unfccc.int/Projects/Validation/DB/J0J2B6K3O92EEUAFD3OGYLE03TNZ7I/view.html 2) “Bundled wind power project in Tamil Nadu managed by Enercon India Limited-II”. This is a VCS project. https://climatefriendly.com/skins/files/file/pdf/project_page/Tamil_Nadu_Wind_Project_Verification_Report.pdf?PHPSESSID=l52vii0nmj23rchhaao4aofkd2
Rasi Seeds (P) Ltd.	**16.250**	**Yes**	The installations arel under the CDM PDDs titled 1) "Bundled Wind power project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (TASMA-II)" http://cdm.unfccc.int/Projects/Validation/DB/F6GT20QKMW3G6AOEUUNKK0UD2RG3F3/view.html 2) "Bundled Wind power project in Tamilnadu, India co-ordinated

			by the TamilNadu Spinning Mills Association (TASMA)" http://cdm.unfccc.int/UserManagement/FileStorage/AE2042RXII12SBXNF29XDKVT2BCEWG
Ambika Cotton Mills Ltd.	**15.400**	**Yes**	The installations are under CDM PDDs 1) Bundled Wind power project in Tamilnadu, India co-ordinated by the Tamil Nadu Spinning Mills Association (TASMA) http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view 2) Bundled Wind power project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (TASMA-II) http://cdm.unfccc.int/Projects/Validation/DB/4R4NBZ8HU31NRZMNQAMH37GJN07926/view.html
Jayajyoti & Co. Ltd	**15.000**	**Yes**	The installations are under the PDD titled "Bundled Wind power project in Tamilnadu, India co-ordinated by the TamilNadu Spinning Mills Association (TASMA)" http://cdm.unfccc.int/UserManagement/FileStorage/AE2042RXII12SBXNF29XDKVT2BCEWG

It can be seen all private wind farm installations, in the similar regulatory and investment climate as that of the project activity and with capacity of over 15 MW in the state of Tamil Nadu, are CDM projects.

The analysis presented in the table above, shows that almost all similar project activities (except Simran wind power project, Premier Fine Yarns Pvt. Ltd. & Premier Spg & Wvg Mills Pvt. Ltd which under VCS projects and available carbon credits) are CDM projects, i.e. and non-CDM large scale wind energy investments is not a common practise in the region.

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 12.1.0) Emission Reductions are calculated as:-

$ER_y = BE_y – PE_y$ …….. (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:

$$\mathbf{BE_{y} = EG_{PJ,y} * EF_{grid,CM,y}} \quad \text{..... (2)}$$

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

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

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

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

$$\mathbf{EG_{PJ,y} = EG_{facility,y}} \quad \text{..... (3)}$$

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 Tamilnadu 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**
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:

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

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:

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

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:

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

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

$$\mathbf{EF}y = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (d)$$

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/reports/planning/cdm_co2/cdm_co2.htm

Estimation of Project Emissions

The project activity involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 12.1.0, there will be no project emissions in the project activity

$PE_y = 0$ …… (4)

Estimation of Leakage Emissions

As per ACM0002 Version 12.1.0, 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:	***EFy*** or $EF_{grid,CM,y}$
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_{OM} and 0.25 for EF_{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 (EGy) is calculated as:
= 50.4 MW (Capacity) x 24.83% (PLF) x 8,760 (hours) MWh
= 109,625.44 MWh

Annual Baseline Emissions Reduction: ERy = EFy * EGy
= 0.94515 tCO_2e/MWh x 109625.44 MWh
= 103,612 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)
*July 2011 to June 2012	0	103,612	0	103,612
July 2012 to June 2013	0	103,612	0	103,612
July 2013 to June 2014	0	103,612	0	103,612
July 2014 to June 2015	0	103,612	0	103,612
July 2015 to June 2016	0	103,612	0	103,612
July 2016 to June 2017	0	103,612	0	103,612
July 2017 to June 2018	0	103,612	0	103,612
July 2018 to June 2019	0	103,612	0	103,612
July 2019 to June 2020	0	103,612	0	103,612
July 2020 to June 2021	0	103,612	0	103,612
Total (tonnes of CO_2e)	0	1,036,120	0	1,036,120

*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 Exported to the grid by the project
Source of data to be	Monthly billing records which is given by Tamilnadu Electricity Board (TNEB)/

used:	Tirunelveli Electricity Distribution Circle, Tirunelveli).
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 Activity = 50.4 MW (Capacity) x 24.83% (PLF) x 8760 (hours) MWh = 109625.44 MWh
Description of measurement methods and procedures to be applied:	• Metering system for the project activity consists of clusters of individual metering points at 33kV (one main meter) at project site for the project activity. Summation of meter reading for all the clusters (connecting 63 machines) will provide total electricity generated by the project activity after adjustment of transmission loss. • In addition the 33kV metering points there is one set of main & check meter at Enercon Pooling sub-station (110kV metering point/Bulk metering point) where all the WEGs of the wind farm including machines of the project activity and other project developers 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 TNEB in the presence of PP's representative (Enercon). • Joint meter reading recorded at 33kV 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 points. • Joint meter reading recorded at 110kV metering point at Enercon pooling sub-station indicates the values of export & import by the all the WEGs of project activity and WEGs of other project developers connected to 110 kV metering point. 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 annually 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 recorded at 33kV metering points (Cluster meter)
Source of data to be used:	Monthly billing records which is given by Tamilnadu Electricity Board (TNEB)/ Tirnunelveli Electricity Distribution Circle, Tirunelveli).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This value will be directly applied.
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 invoice raised on TNEB or state electricity board. QA/QC procedures will be as implemented by Discom/State utility (TNEB) pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. All the main meter installed at 33kV metering point at project site are calibrated by state utility annually 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:	**$EG_{Import,y}$**
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity imported by project activity to grid recorded at 33kV metering point (Cluster meter)
Source of data to be used:	Monthly billing records which is given by Tamilnadu Electricity Board (TNEB)/ Tirnunelveli Electricity Distribution Circle, Tirunelveli).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This value will be directly applied.
Description of measurement methods	Refer Annex – 4 and section B.7.2 for an illustration of the provisions for measurement methods.

and procedures to be applied:	
QA/QC procedures to be applied:	Value of $EG_{Import,y}$ can be crosschecked from invoice raised on TNEB or state electricity board. QA/QC procedures will be as implemented by Discom/State utility (TNEB) pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. All the main meter installed at 33kV metering point at project site are calibrated by state utility annually 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:	**T_E**
Data unit:	MWh (Mega-watt hour)
Description:	Line loss between the metering point at 33 kV metering points of project activity and the metering point at 110 kV at the ENERCON pooling substation.
Source of data to be used:	Monthly billing records which is given by Tamilnadu Electricity Board (TNEB)/ Tirnunelveli Electricity Distribution Circle, Tirunelveli).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This value will be directly applied.
Description of measurement methods and procedures to be applied:	Line loss between metering point at 33kV and the metering point at 110kV 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 Line loss is applied to the project activity by the state utility as reflected in the Monthly billing records taken at 33kV level. The line loss calculation is done by TNEB which is a state utility and is directly used for adjusting the net export recorded at 33kV metering clusters. 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 T_E can be crosschecked from invoice raised on TNEB or state electricity board. QA/QC procedures will be as implemented by Discom/State utility (TNEB) 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.

B.7.2 Description of the monitoring plan:

Approved monitoring methodology ACM0002 Version 12.1.0, "Consolidated baseline monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", by CDM - Meth Panel is proposed to be used to monitor the emission reductions.

Enercon (India) Limited is O&M contractor for the project activity. Enercon (India) Limited will be responsible for the 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:

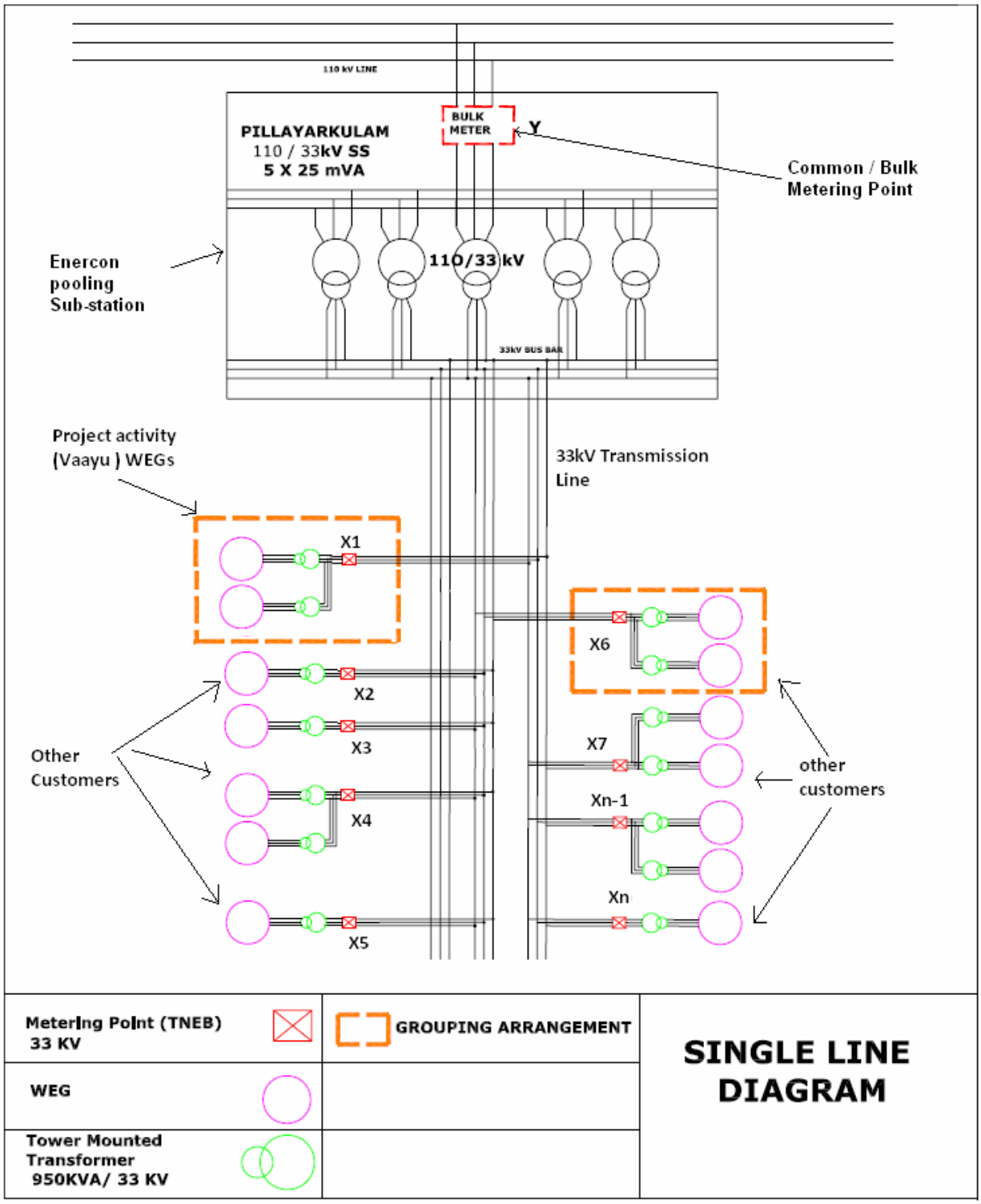
- Electricity generation from the project activity; and
- Operating margin emission factor and build margin emission factor of the grid, where *ex post* determination of grid emission factor has been chosen

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. Hence, the sole parameter for monitoring is the electricity generated by the project and supplied to the grid.

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:

Single Line diagram of Metering arrangement for project activity is shown in below picture:-



From the above line diagram it is clear that the machines of the project activity and other project developers at the wind farm have individual metering points at 33kV at the project site. Further PP will

make clusters of WEGs at the project site for the purpose of metering. Each cluster will have a main meter. The WTGs of the project activity will be connected to individual dedicated cluster meters.

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 Pillayarkulam at bulk metering point at 110 kV. There is one main and one check meter at the Enercon substation. Since the main and check meters (bulk meter) at 110 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 110 kV at the ENERCON substation, the state utility apply Line loss to the meter reading recorded at the 33 KV.

The total % of Line loss from WEGs (33kV metering point) to Enercon substation (110kV metering point) is calculated by the state utility. Net Electricity supplied to the grid by project activity is calculated by applying Line loss to the meter readings taken at 33 kV metering point of the project activity.

The procedure for calculation of the percentage Line loss is set-out below:

$$Z = \frac{(X1+X2+X3+X4+.....Xn) - Y}{(X1+X2+X3+X4+.....Xn)} \times 100\%$$

Where,

Z = *Percentage Line loss incurred in Line between the meters located at 33 kV metering point (including the machines of the project activity and other project developers) and the meters located at 110kV metering point (bulk meter: main and check) at high voltage side of receiving sub-station. Refer above picture for schematic of the flow diagram.*

(X1+X2+X3+X4+…..Xn) = *Summation of meter readings (Export- Import) at 33 kV metering points for all the project developers connected to receiving substation (including the machines of the project activity and other project developers)*

Xi = Net Export (Export – Import) Reading (Xi) noted at energy meter installed at 33kV metering point where i vary from 1 to n which represents the meters connected to project activity and other project developers. X1, X2, X3,…Xn are the meters that are installed at 33kV metering point (including the machines of the project activity and other project developers) and further connected to the receiving substation at 110 kV by internally connected lines. Refer above picture for schematic of the flow diagram.

Y = *Net Export (Export-Import) Reading at bulk meter installed at high voltage side of transformer of the receiving sub-station at 110 kV connecting machines of the project activity and other project developers. Refer above picture for schematic of the flow diagram.*

Therefore Line Loss for the project activity (between 33kV & 110kV metering point) is calculated as follows:-

Line Loss (T_E) = Percentage Line Loss * Net Export recorded at 33kV metering point of project activity

$$T_E = Z \times (EG_{Export,y} - EG_{Import,y})$$

Therefore Net Energy Supplied to Grid (or net generation) after adjustment of Line loss is calculated as below:-

$$EG_{PJ,y} = EG_{Export,y} - EG_{Import,y} - T_E$$

The monthly statement showing the Energy Generated by the project activity as provided and duly signed by TNEB/Tirunelveli Electricity Distribution Circle, Tirunelveli) contains the following data:-

1. Electricity Export (EGexport)
2. Electricity Import (EGimport)
3. Line Loss (T_E) between 33 kV metering point and 110 kV metering point at Enercon substation
4. Net Generation to the Grid [EGexport-EGimport-T_E]

The Electricity Export, Electricity Import, Line Loss and net electricity supplied (Net Generation) to the grid, can be cross checked from the invoices raised on the state utility for supply of net electricity supplied to the grid.

The accuracy of monitoring parameter is ensured by adhering to the calibration and testing of the metering equipment once each year. 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.

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 WECs, it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that Enercon's service staff is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. The Enercon Training Academy provides need-based training to meet the training requirements of Enercon projects. The 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.

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.

VIPCPL commits that a CSR team will be appointed to oversee the activities towards sustainable development and also that the activities are undertaken and concluded in a timely manner each year.

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: 22/03/2010

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:

01/07/2011.

The project activity is expected to be registered by the 01/07/2011 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[12] 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[13]& 01st December 2009[14] 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 Tirunelveli District in Tamilnadu on 23 February 2010. A local newspaper advertisement was placed in Daily Thanti on 8 February 2010 inviting the local stakeholders for the meeting. The personal invitations were also sent to the local villagers. The meeting was presided over by Mr. CR Venkateshwaran (EIL-Coimbatore), Ms Sapna Pednekar (EIL-CDM) and Mr. K V Suresh (EIL-Coimbatore).

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

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

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

E.2. Summary of the comments received:

Mr. CR Venkateshwaran welcomed the participants and introduced the company. Ms. Sapna Pednekar briefed about project activity, reasons for setting up the project, costs and benefits of setting up the project and role and benefits of wind power project to reduce the emissions of green house gases in the atmosphere.

Mr. CR Venkateshwaran gave an explanation on global warming and its impacts, Kyoto Protocol, Clean Development Mechanism and role of wind power in mitigating the global warming and then requested the Chairperson to give his viewpoints on the wind power projects taken up at district Tirunelveli.

The Chairperson, Mr. Chelliah appreciated the management of VIPCPL for proposing pollution free technology for power generation. Mr. Arumugam, President in his speech; explained about the Distribution of Electricity to villages improved dramatically. He pointed out that there is no adverse impact of Wind Energy Projects.

Mr. S.Shanmugam, Executive Engineer TNEB in his speech explained about the present socio-economic condition of Tirunelveli and he compared the recent developments to the olden days.

Mr. Rajasekaran, Assistant Executive Engineer, TNEB in his speech explained about the advancements in the villages after the installation of wind power projects. He opined that after setting-up of wind projects in these villages, the village roads were developed significantly and employment opportunities are being created in wind power projects such as casual labours, securities, drivers and technicians.

The following queries were raised by the stakeholders:

1. Whether wind turbines have any impact on the rain clouds?
2. Does the noise of WECs affect the milk yield of cattle's?
3. The electricity generated from this project will be directly fed to the local community?
4. What is the procedure and steps involved in installation of the wind power project in Tamilnadu?
5. Will installation of wind mill affect the groundwater level or water level of nearby lake/ well?

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 by Enercon representatives
1	Mr. Perumal	Whether wind turbines move away rain clouds?	The clouds are at much higher height than the height of the wind turbines and it is absolutely unlikely that it would be the obstacle in the way of rain clouds. This has already

			been established by various studies undertaken in this aspect.
2	Mr. Subramani	Does the noise of WECs affect the milk yield of cattle's?	The noise level in Enercon WEC's is around 46 DB. As per Indian Industrial Act, the noise level should be less than 50 DB. So, there is no chance of the cattles getting disturbed by this sound.
3	Mr. N Vishwanathan	Will the electricity generated from this project be directly fed to the local community?	The electricity generated will be supplied to the state electricity grid which further distributes the electricity as per the state policy.
4	Mr Gurusamy	What is the procedure and steps involved in installation of the wind power project in Tamilnadu?	The procedure to set up windfarm in Tamilnadu involves various steps from identifying the potential wind farm site to get evacuation approvals from TNEB. On the approval of TNEB only the activity can be carried forward
5	Mr. Murugan	Will installation of Wind machines affect the groundwater level or water level in lakes/ wells nearby to the project	The foundation level of the wind mills are in depth upto the maximum of 2 meters only and it will not disturb the level of water in the earth while the depth for installation of earth pit will be maximum of 20 feet only and it also doesn't disturb the water level.

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)
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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
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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 electricity supplied to the grid will be metered from main meters 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 monthly joint meter readings noted from the dedicated meters connecting 63 turbines of the project activity.

The PP will make clusters of WECs at the project site for the purpose of metering. Each cluster will have one main meter. Summation of meter reading for all the clusters (connecting 63 machines) will provide net electricity generated by the project activity after adjustment of transmission loss.

In addition to the cluster meters there is one main & check meter at high voltage side of Enercon Sub-station Pillyarkulam.at 110kV. The machines of the project activtity and other project developers are connected to 110 KV metering point.

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 TNEB) for every last month. At the conclusion of each meter reading an appointed representative of TNEB 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 each year as per the PPA. 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.

Main and Check meter: In case the main meter(s) at 33kV metering point (cluster meter) is found to operate outside the permissible limits, the main meter will be either replaced or calibrated immediately and for the period during which meter was faulty the LCS controller reading will be referred to calculate electricity exported by WEGs.

At 110kV metering point at Enercon pooling sub-station; 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.

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.

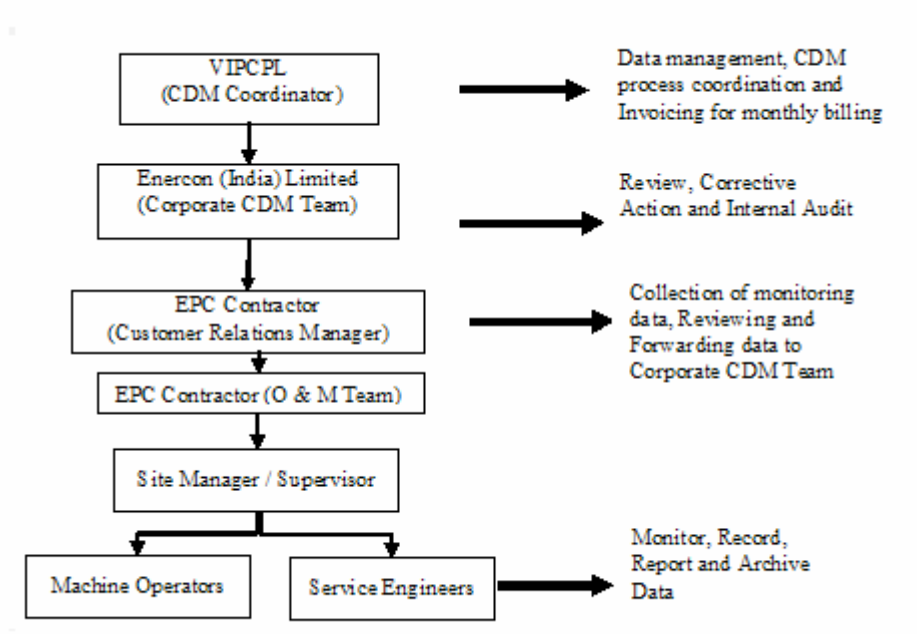
PP will be monitoring the data sent by the O&M contractor and the data for electricity generated by the project activity will be kept as records for the period of 10+2 years i.e. 2 years beyond the term of crediting period. Enercon is O&M contractor and will be responsible for data recording.

All the main meters and check meters are calibrated once each year and 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. Further more the net electricity supplied to the grid that is used for calculation of emission reductions can be cross checked from the invoices raised by the PP on the state utility. Therefore there is no data uncertainty.

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:



Appendix 1
Geo-coordinates of Project Activity

S.No.	Location Number	Village	Latitude	Longitude
1	7	KURUCHIKULAM	8° 53' 26.985" N	77° 35' 43.461" E
2	8	KURUCHIKULAM	8° 53' 18.435" N	77° 35' 51.873" E
3	146	VAGAIKULAM	8° 55' 58.299" N	77° 37' 54.634" E
4	147	KALAKUDI	8° 56' 23.880" N	77° 37' 48.373" E
5	149	VAGAIKULAM	8° 55' 38.340" N	77° 37' 38.952" E
6	150	VAGAIKULAM	8° 55' 37.857" N	77° 37' 24.555" E
7	151	VAGAIKULAM	8° 55' 47.538" N	77° 37' 26.390" E
8	153	VAGAIKULAM	8° 55' 37.857" N	77° 37' 24.555" E
9	154	VAGAIKULAM	8° 56' 37.357" N	77° 37' 19.517" E
10	155	VAGAIKULAM	8° 56' 19.107" N	77° 37' 15.101" E
11	156	VAGAIKULAM	8° 55' 55.775" N	77° 37' 11.630" E
12	157	VAGAIKULAM	8° 55' 42.415" N	77° 37' 10.193" E
13	158	VAGAIKULAM	8° 55' 48.057" N	77° 36' 59.013" E
14	159	MUTHAMMALPURAM	8° 56' 33.966" N	77° 37' 6.832" E
15	160	MUTHAMMALPURAM	8° 56' 28.029" N	77° 36' 55.438" E
16	163	VAGAIKULAM	8° 56' 11.019" N	77° 36' 36.636" E
17	165	UKKIRANKOTTAI	8° 56' 12.215" N	77° 36' 19.240" E
18	167	KALAKUDI	8° 55' 8.373" N	77° 36' 58.664" E
19	179	VAGAIKULAM	8° 56' 45.130" N	77° 37' 33.509" E
20	180	VAGAIKULAM	8° 56' 6.770" N	77° 37' 11.676" E
21	181	VAGAIKULAM	8° 56' 3.605" N	77° 36' 54.544" E
22	V48	KURUCHIKULAM	8° 53' 6.300" N	77° 35' 0.824" E
23	V49	KURUCHIKULAM	8° 52' 57.577" N	77° 35' 10.805" E
24	V51	KURUCHIKULAM	8° 52' 40.412" N	77° 35' 9.180" E
25	V58	KURUCHIKULAM	8° 53' 30.146" N	77° 35' 9.922" E
26	V59	KURUCHIKULAM	8° 53' 22.443" N	77° 35' 13.695" E
27	V60	KURUCHIKULAM	8° 53' 10.091" N	77° 35' 16.977" E
28	V63	KURUCHIKULAM	8° 52' 34.838" N	77° 35' 29.519" E
29	V72	KURUCHIKULAM	8° 53' 12.156" N	77° 35' 33.445" E
30	V73	KURUCHIKULAM	8° 53' 2.788" N	77° 35' 33.248" E
31	V74	KURUCHIKULAM	8° 52' 53.993" N	77° 35' 34.953" E
32	V90	KALAKUDI	8° 52' 44.966" N	77° 36' 14.566" E
33	V94	KALAKUDI	8° 52' 22.001" N	77° 36' 14.274" E
34	V100	KALAKUDI	8° 52' 58.118" N	77° 36' 31.636" E
35	V101	KALAKUDI	8° 52' 48.402" N	77° 36' 30.161" E
36	V104	KALAKUDI	8° 52' 20.945" N	77° 36' 35.036" E
37	V105	KALAKUDI	8° 52' 12.502" N	77° 36' 32.883" E
38	V106	KALAKUDI	8° 52' 2.346" N	77° 36' 33.826" E
39	V107	KALAKUDI	8° 53' 21.734" N	77° 36' 59.574" E
40	V108	KALAKUDI	8° 53' 8.659" N	77° 36' 45.416" E

41	V109	KALAKUDI	8° 53' 0.568" N	77° 36' 44.148" E
42	V110	KALAKUDI	8° 52' 51.507" N	77° 36' 46.537" E
43	V114	ETTANKULAM	8° 52' 12.368" N	77° 36' 51.919" E
44	V116	KALAKUDI	8° 53' 12.200" N	77° 37' 22.992" E
45	V119	KALAKUDI	8° 53' 5.291" N	77° 37' 1.747" E
46	V120	KALAKUDI	8° 52' 54.106" N	77° 37' 5.527" E
47	V123	VAGAIKULAM	8° 54' 1.042" N	77° 37' 7.115" E
48	V125	KALAKUDI	8° 53' 20.931" N	77° 37' 25.769" E
49	V127	KALAKUDI	8° 53' 32.234" N	77° 37' 9.822" E
50	V129	KALAKUDI	8° 53' 21.809" N	77° 37' 11.906" E
51	V130	KALAKUDI	8° 53' 2.610" N	77° 37' 22.073" E
52	V132	KALAKUDI	8° 52' 47.738" N	77° 37' 22.916" E
53	V134	VAGAIKULAM	8° 54' 1.377" N	77° 37' 24.029" E
54	V137	KALAKUDI	8° 53' 52.241" N	77° 37' 23.375" E
55	V139	KALAKUDI	8° 53' 44.058" N	77° 37' 25.901" E
56	V141	KALAKUDI	8° 53' 30.641" N	77° 37' 23.385" E
57	V145	KALAKUDI	8° 53' 4.624" N	77° 37' 36.251" E
58	V147	KALAKUDI	8° 52' 56.356" N	77° 37' 32.431" E
59	V164	KALAKUDI	8° 53' 28.505" N	77° 36' 44.968" E
60	V165	KALAKUDI	8° 52' 32.752" N	77° 36' 25.961" E
61	V166	KALAKUDI	8° 53' 36.953" N	77° 36' 41.757" E
62	V167	KALAKUDI	8° 52' 30.367" N	77° 37' 13.700" E
63	W23	VAGAIKULAM	8° 55' 29.524" N	77° 37' 39.052" E

Appendix 2:
Calculation on 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 worldwide. We have derived from text book on "Corporate Finance Theory and Practice" by Dr. Aswath Damodaran of Stern School of Business, New York University. Dr. Damodaran is one of the foremost authorities in the world in the field of Investment Analysis.

The guidance to investment analysis issued in EB 51states 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 and cost of Equity is appropriate benchmark for equity IRR.

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

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[15], 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 rates 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:-

.

	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 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

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

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 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 risk premium has been calculated as the difference in compounded annual return bewteen the BSE-200 and the yield rate since the year of inception of BSE 200. The detailed calculations are presented in the attached excel sheet.

The applicable 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. Therefore, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

Therefore, we have considered beta values of all major electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. It is understood that risky businesses are likely to have higher cost of equity than safer

businesses; projects in riskier businesses will have to cover these higher costs. Hence, investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks from significantly varying and unpredictable resource availability (e.g. wind), and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non conventional energy.

The applicable Beta value has been determined on the basis of the Beta values of major 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**
Period: Five years up to October 2009 from Bloomberg	

Calculation of Benchmark Cost of Equity:

Cost of Equity:

The expected return on equity has been determined using the Capital Asset Pricing Model (CAPM)[16]. The CAPM economic model is used worldwide to determine the required/expected return on equity based on potential risk of an investment. The CAPM framework is the Nobel award winning work of financial economist Dr. William Sharpe.

Ke = Rf + B x (Rm - Rf)

where:

Ke = Rate of return on equity capital;

Rf = Risk-free rate of return;

B = Beta;

Rm – Rf = Market risk premium;

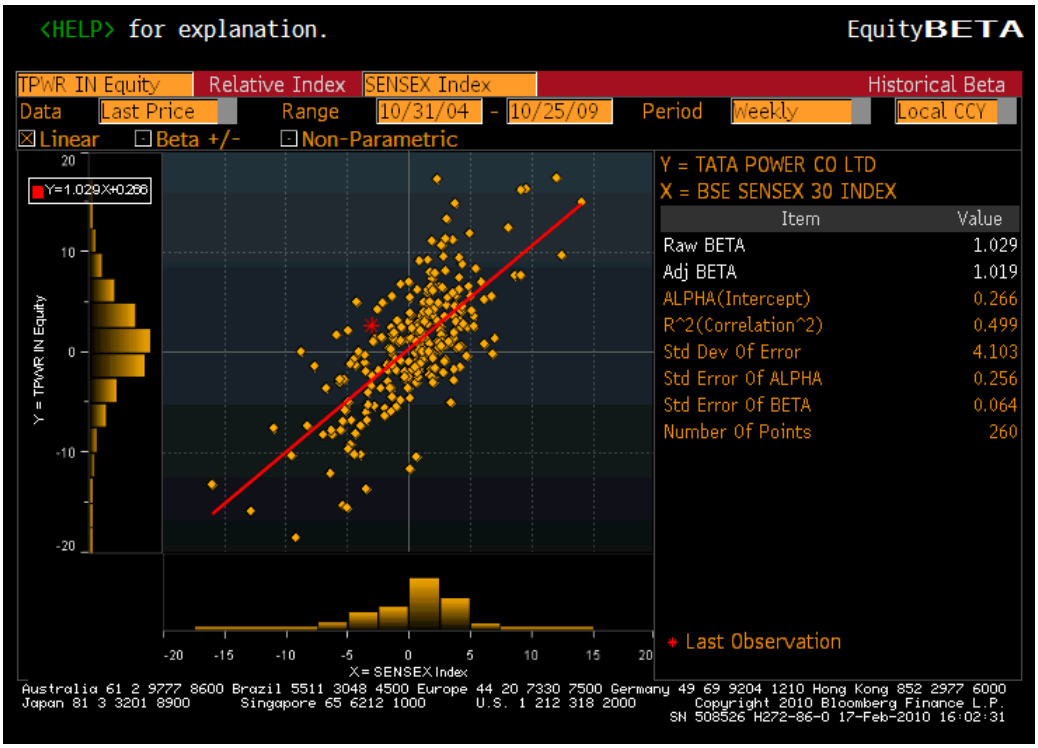
Cost of Equity = Risk Free Rate + Beta x Market risk premium

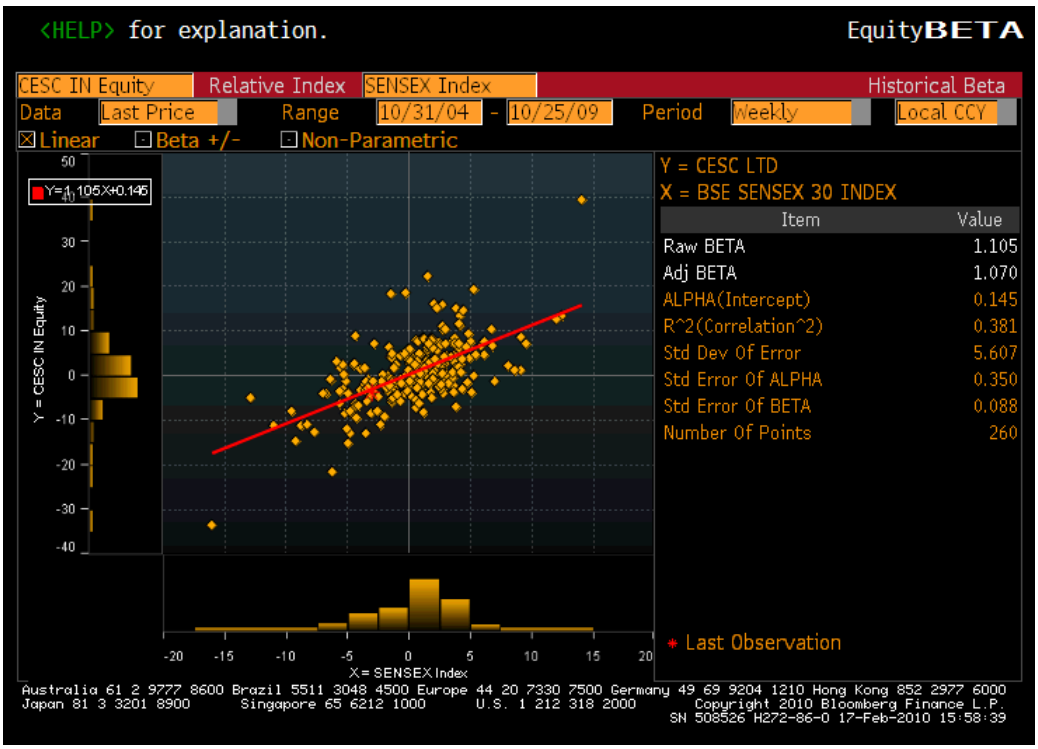
= 7.98% + 1.17 x 7.58%

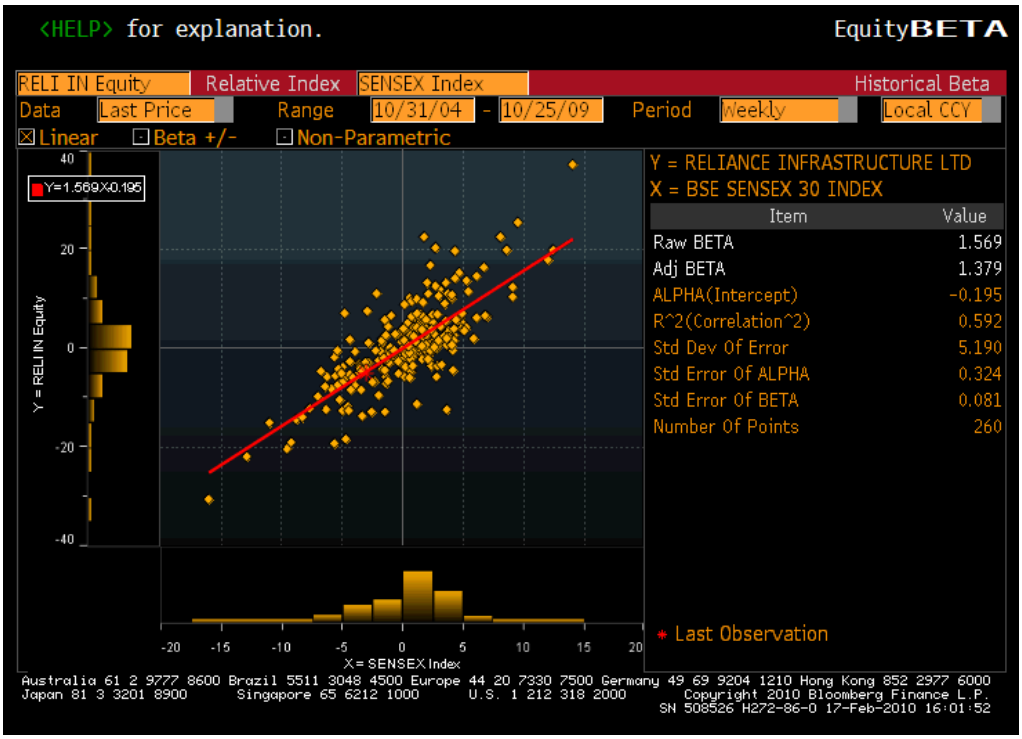
= 16.84%

[16] 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

Appendix 3
BETA SNAPSHOTS FROM BLOOMBERG



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EquityBETA
RELI IN Equity
Relative Index
SENSEX Index
Historical Beta
Data
Last Price
Range
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10/25/09
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Local CCY
Linear
Beta +/-
Non-Parametric
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Y = RELIANCE INFRASTRUCTURE LTD
X = BSE SENSEX 30 INDEX
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Adj BETA
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R^2(Correlation^2)
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Std Error Of ALPHA
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Std Error Of BETA
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Number Of Points
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Y = RELI IN Equity
X = SENSEX Index
* 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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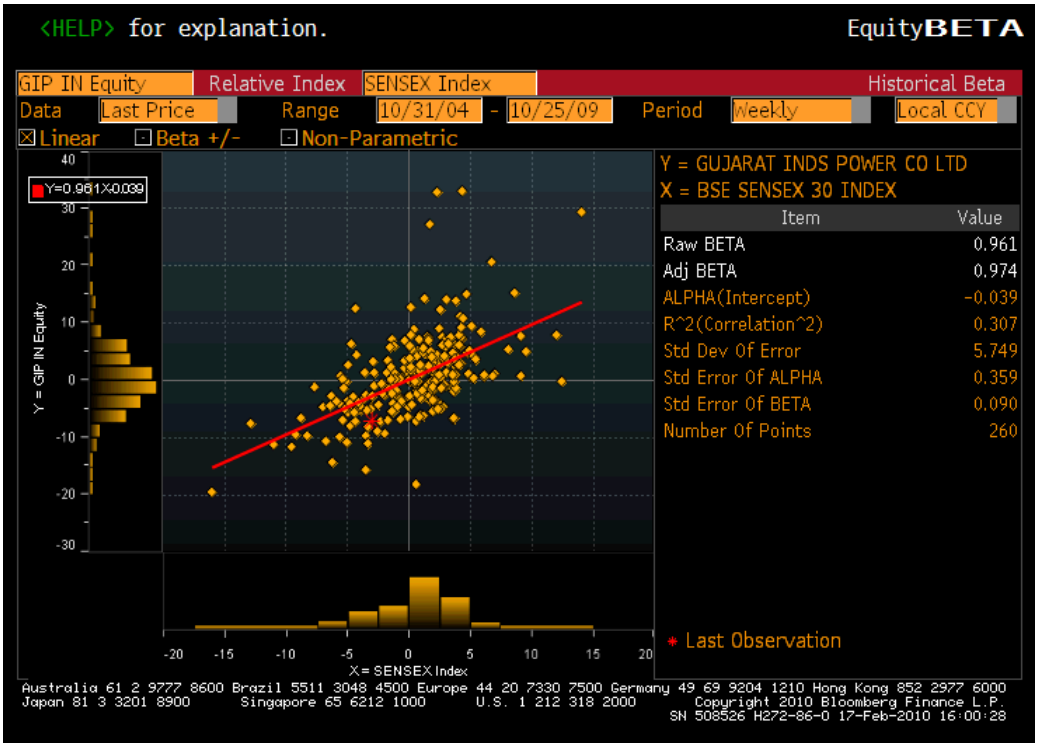
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EquityBETA
GIP IN Equity
Relative Index
SENSEX Index
Historical Beta
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Range
10/31/04
10/25/09
Period
Weekly
Local CCY
Linear
Beta +/-
Non-Parametric
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Y = GUJARAT INDS POWER CO LTD
X = BSE SENSEX 30 INDEX
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Std Error Of BETA
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X = SENSEX Index
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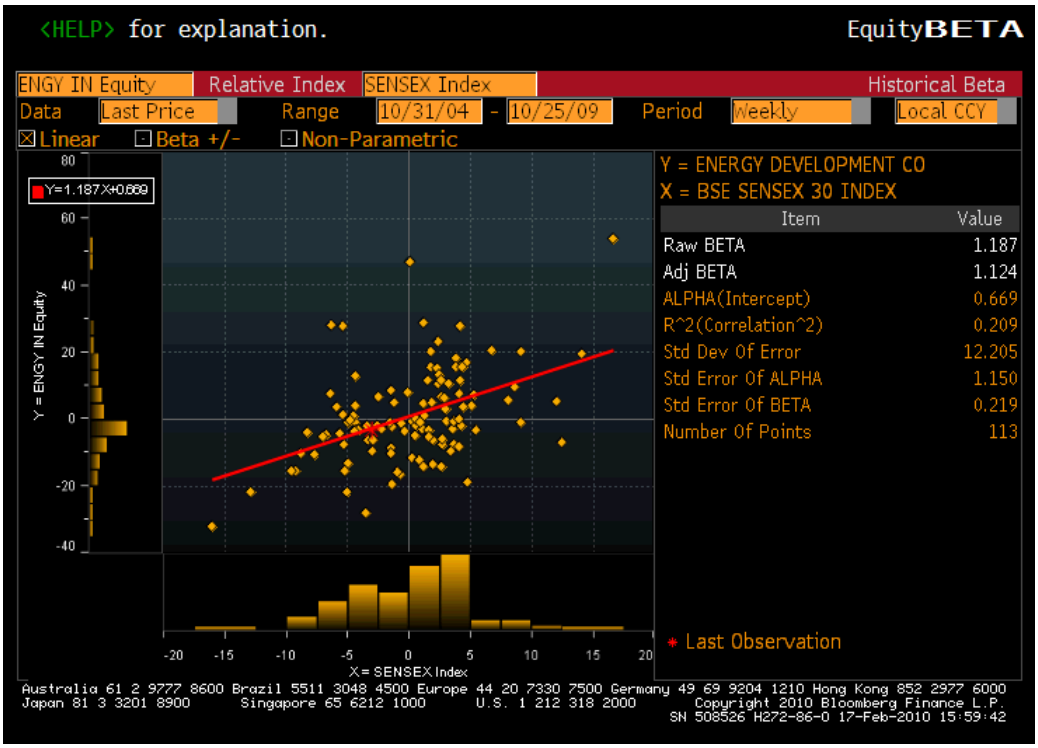
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EquityBETA
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Relative Index
SENSEX Index
Historical Beta
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Range
10/31/04
10/25/09
Period
Weekly
Local CCY
Linear
Beta +/-
Non-Parametric
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Y = ENGY IN Equity
X = SENSEX Index
Y = ENERGY DEVELOPMENT CO
X = BSE SENSEX 30 INDEX
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Std Error Of ALPHA 1.150
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Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000
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