Voluntary Carbon Standard
Project Description

15/09/2009

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1 Description of Project:

1.1 Project title

4.5 MW bundled wind power project. Version 1.3, Date 15/09/2009

1.2 Type/Category of the project

The project is a 'Grid connected Renewable Electricity Generation' project that falls under the Scope -1 of Sectoral scope: Energy Industries (renewable-/non-renewable sources)[1].
Type: Type I (Renewable Energy Projects) Category D

Methodology: UNFCCC approved CDM methodology: AMS I.D, Version 14

The project is not a grouped project.

1.3 Estimated amount of emission reductions over the crediting period including project size:

The project activity is a 4.5 MW wind power project consisting of 6 WEGs of 750 kW capacity each. The emission reductions from the project over the crediting period would be around 88,200 tonnes of CO_2 equivalent (tCO_2e). According to the VCS approved methodology, renewable energy project activity with a maximum output capacity up to 15 MW is considered a small scale project activity. The project activity does not fall under either Micro or Mega project as defined by VCS Board, as the emission reductions are 8820 tCO_2e per year, which lies in between 5,000 and 1,000,000 tCO_2e reductions per year.

S. No	Crediting Period	Baseline Emission Factor (tCO_2/MWh)	Baseline Emissions (tCO_2e)	Project Emissions (tCO_2e)	Emission Reductions (tCO_2e)
1	2006-2007	0.92694742	8820	0	8820
2	2007-2008	0.92694742	8820	0	8820
3	2008-2009	0.92694742	8820	0	8820
4	2009-2010	0.92694742	8820	0	8820
5	2010-2011	0.92694742	8820	0	8820
6	2011-2012	0.92694742	8820	0	8820
7	2012-2013	0.92694742	8820	0	8820
8	2013-2014	0.92694742	8820	0	8820

[1] 7http://cdm.unfccc.int/DOE/scopes.html

9	2014-2015	0.92694742	8820	0	8820
10	2015-2016	0.92694742	8820	0	8820
Total estimated reductions (tonnes of CO_2e)			88200	0	88200
Total number of crediting years			10 years		
Annual average of the estimated reductions over the crediting period (tonnes of CO_2e)			88200		

1.4 A brief description of the project:

The project activity consists of 6 numbers of WEGs of 0.75 MW capacity each accounting to a total of 4.5 MW installed in Tirunelveli & Tenkasi taluks of Tirunelveli district, Tamil Nadu. The project activity is expected to generate approximately 9.5[2] Million Units of power every year and thereby resulting in emission reduction of approximately 88,200 tCO_2e over the entire crediting period of ten years. The first four WEGs of 0.75 MW capacity turbine are of NEG Micon India Pvt. Ltd make and remaining two WEGs of 0.75 MW capacity are of M/s. Vestas Wind Technology (formerly, NEG Micon India Pvt. Ltd)

The purpose of the project proponent in promoting this project is to generate electricity through tapping of clean and renewable wind energy available in the state of Tamil Nadu which is power deficit and to augment power supply during peak energy requirement periods, there by also contributing to GHG reductions.

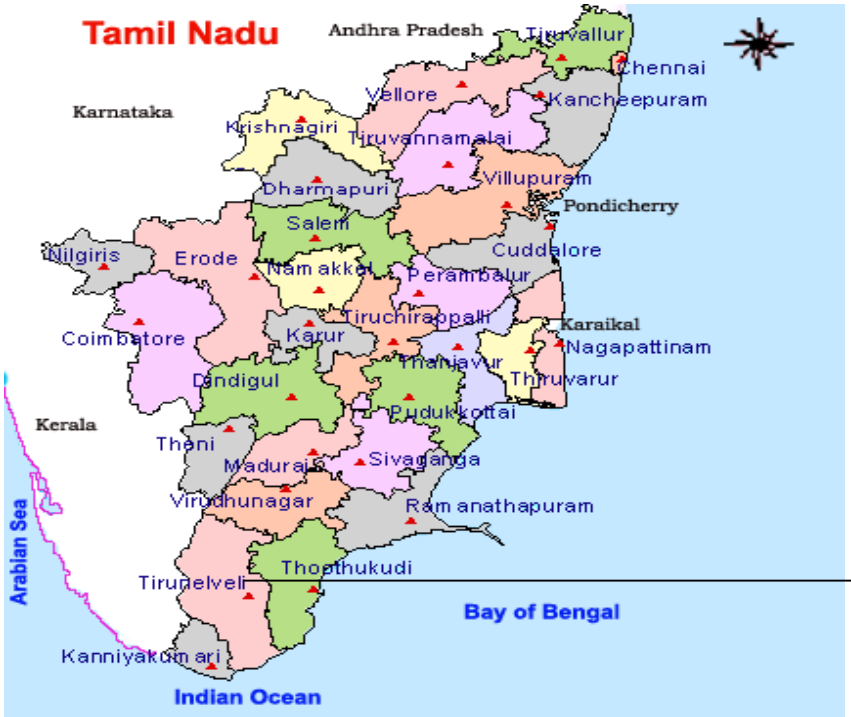
1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The 4.5 MW wind farm is located in Achankuttam, Ayyansurandai, Sambavar Vadakarai and Kulayaneri villages of Tirunelveli district, Tamil Nadu. The unique identification details in terms of the latitude and longitude details of each the WEGs are shown below.

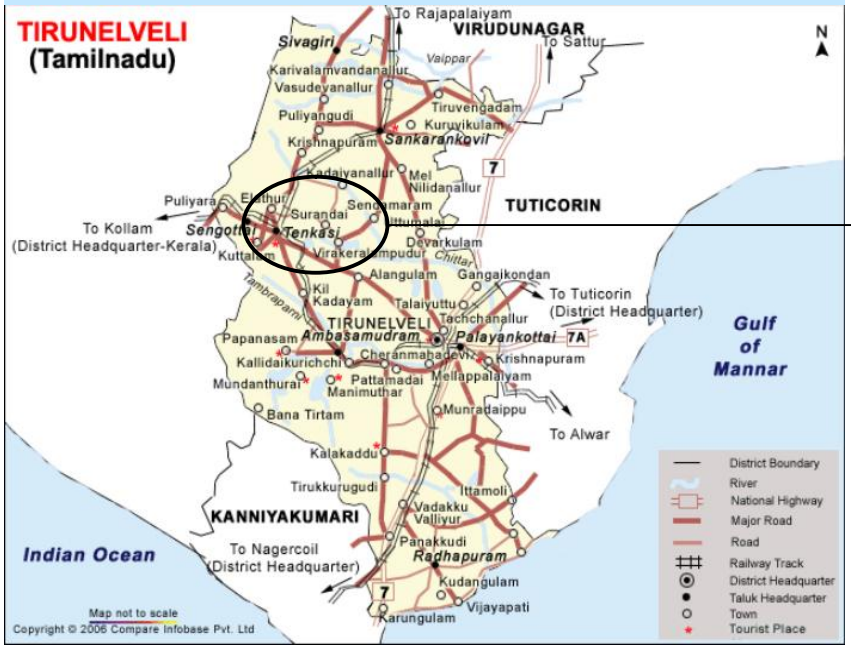
HT. SC. No.	Location (Village)	S. F. No.	Latitude	Longitude
1608	Ayan Surandai	474(P) & 510/2	N 8°59'07.3"	E 77°27'01.9"

[2] As guaranteed by the WEG supplier per six WEG per annum

1690	Achankuttam	201	N 8°57'44.9"	E 77°28'45.0"
2122	Sambavar Vadakarai	285/3 (P)	N 9°01'00.6"	E 77°24'05.5"
2123	Sambavar Vadakarai	188/7(P), 8,9(P)	N 9°00'42.6"	E 77°24'16.7"
2227	Sambavar Vadakarai	200/11,12 ,13,14,15 ,16B(P)	N 9°01'12.5"	E 77°24'05.2"
2245	Kulayaneri	187/4 (P)& 356/1A(P)	N 9°00'30.4"	E 77°26'21.7"



Project Distri



Project Locati
(Taluk)

1.6 Duration of the project activity/crediting period:

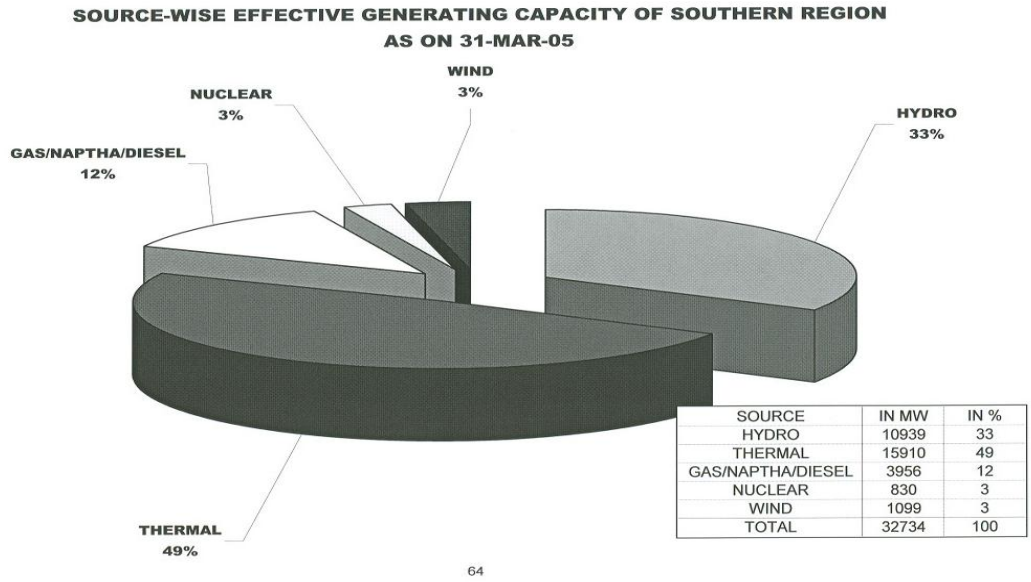
Project Start Date: 16/03/2006 (Date on which the project began reducing or removing GHG emissions i.e. the commissioning date of the first WEG in the project).

Crediting period start date: 15/04/2006

VCS project crediting period: 15/04/2006 to 15/04/2016

1.7 Conditions prior to project initiation:

The source wise effective generation capacity as on 31/03/2005[3] in the Southern Region is given below;



SOURCE	IN MW	IN %
HYDRO	10939	33
THERMAL	15910	49
GAS/NAPTHA/DIESEL	3956	12
NUCLEAR	830	3
WIND	1099	3
TOTAL	32734	100

From the above figure it is evident that the share of wind power in the total effective generation capacity of Southern Region is only 3.0%, whereas the share of thermal power generation in the total installed generation capacity is 61.0%. From this it can be understood that the project boundary i.e. the Southern Grid is dominated by fossil fuel fired power plants. However, in terms of potential wind has been estimated to have high potential in certain belts of the Southern Region and still remains to be tapped.

[3] www.srldc.org/var/ftp/reports/yearlyrep/2004-05-year.pdf

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The scenario of power generation before the commencement of this project is dominated by fossil fuel fired power plants which are GHG intensive in nature. Also, according to the National Electricity Policy[4] (dated 12 February 2005) coal will continue to be the major power generation source in India. However, the project proponent is promoting 4.5 MW wind power project as it is not GHG intensive in nature and is also contributing to sustainable development. As the project is connected to the Southern Grid, it displaces an equal amount of power supplied to the grid by other GHG intensive sources and thus also displaces the GHG emissions generated through these sources. The project though small in size promotes electricity generation from renewable sources promoted by a company in the region.

1.9 Project technologies, products, services and the expected level of activity:

Expected level of activity

There are 6 Nos. of 750 kW WEGs and each WEG consists of

- Nacelle assembly consisting of gear box, generator and other accessories
- Three bladed active stall rotor of 48.2 m diameter
- WEG microprocessor control unit and control panels
- 55 m conical steel painted tower
- Civil foundation
- Transformers and related electrical including circuit breakers and Metering units

The salient features of the project are further detailed as below:

Operational conditions	
Calculated lifetime	20 years
Cut in wind speed	<3.5 m/s
Cut out wind speed	25 m/s
Maximum rotational speed	22/15 rpm
Main specification	
Rotor Diameter	48.2 m
Number of Blades	3
Rotational speed (synchronous)	22.2/14.8 rpm

[4] http://powermin.nic.in/indian electricity scenario/national electricity policy.htm

Hub height	55 m
Tower type	Conical modular tower
Rotor position	Upwind
Blade	
Blade length	23.5 m
Blade profile	NACA 63 Series
Air Brake	Turn able blade tips, hydraulic
Generator	
Nominal Power	750/200 kW
Rotational Speed	1500/1000 rpm
Yawing System	
Yaw bearing, type	Ball bearing
Motor	4 No's 3Φ Induction Motor, 0.37 kW
Gearing ratio	1:2716
Brake	Hydraulic disc, 3 pieces
Mechanical Brake	
Type	Disc brake
Position	Output shaft on gear box
Control system	
Manufacture	DAN CONTROL / VESTAS control systems
Type	Microprocessor based

1.10 Compliance with relevant local laws and regulations related to the project:

The project activity is compliant to the relevant local laws and regulations and is not prohibited by any law. General applicable legislations along with required approvals obtained for the project are detailed below:

Laws/Regulations	Authority
No Objection Certificate	Tamil Nadu Electricity Board(TNEB)
CEIG Approval	Government of Tamil Nadu Electrical Inspectorate
Environment Impact Assessment	Not Applicable. Wind power projects doesn't fall under the purview of EIA[5]

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

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Any drop in the capacity utilization factor from the estimated figure mentioned in the section 1.4 will result in the significant reduction of GHG emission reductions.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The renewable wind power project was taken up during the time when the grid was dominated by fossil fuel power plants which are GHG intensive in nature. Also, the wind power project being a renewable source provides for a clean power generation. Therefore, the project is not implemented to create GHG emissions for the purpose of its subsequent removal or destruction.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The project has not created another form of environmental credit. The project has not applied to any other GHG abatement program nor created another form of environmental credits. A self declaration letter by the project proponent, stating that the project has not applied to any other GHG abatement program nor created another form of environmental credit has been provided.

1.14 Project rejected under other GHG programs (if applicable):

Not applicable. The project is being considered solely under the VCS 2007.1 programme.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

The role and responsibility of the project proponents is to be responsible to assist in providing all documentation and assistance that would be required at every stage of the project cycle, from validation to verification; such that the project formalities of emission reduction certification are carried out. The project proponent would use the verified emission reductions for future and further trading purposes.

CONTACT INFORMATION of PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	VVD and Sons Private Limited
Street/P.O.Box:	No. 182, Palayamkottai Road
Building:	
City:	Thoothukudi
State/Region:	Tamil Nadu
Postcode/ZIP:	628 003
Country:	India
Telephone:	+91461 2320148
FAX:	+91461 2327718
E-Mail:	vvdwind@vvd.in,vvdwind@vvdgold.in
URL:	www.vvd.india.com
Represented by:	D Kabilan
Title:	Mr.
Salutation:	Executive Director
Last name:	Kabilan
Middle name:	
First name:	D
Department:	
Mobile:	
Direct FAX:	+91-461 2327718
Direct tel:	+91-461 2333148
Personal e-mail:	vvdd.kabilan@gmail.com

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

Project's contribution to sustainable development

The project primarily assists the region as a whole in stimulating and accelerating the commercialization of grid connected renewable energy technologies.

The project activity contributes to the sustainable development[6] in the following way:

[6] As stipulated by Ministry of Environment and Forest social,economic, environmental and technological well being are the sustainable development indicators for a project activity. MoEF Web site http://envfor.nic.in/cdm/host approval criteria.htm#

Social well being:

- Enhancing local employment of rural area around the project.
- Capacity building and empowerment of vulnerable sections of the rural community dwelling in the project area

Economical well being:

- During the construction and operation phases, the project activity would generate small business opportunities for local stakeholders such as bankers, suppliers, manufacturers, contractors and land owners.

Environmental well being:

- This project activity contributes to sustainable development through generation of eco-friendly power resulting in the increase of the share of renewable energy power generation in the regional and national grid. It would aid in strengthening India's rural electrification coverage. Wind power projects also aid in reducing GHG emissions and other pollutants (SOx, NOx, and Particulates etc).

Technological well being:

- The project activity helps in increasing the share of renewable energy power generation in the regional and national grid. The project activity also, encourages clean, renewable and efficient technologies.

1.17 List of commercially sensitive information (if applicable):

None

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

Title: "Grid Connected Renewable Electricity Generation[7]".

Reference: This is an UNFCCC approved small scale methodology AMS I.D, Version 14.
As the project is a grid connected renewable wind power project, the above methodology as applicable for VCS 2007.1 has been chosen.

Tool referenced in this methodology is Version 1.1 of "Tool to calculate the emission factor for an electricity system[8]"

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The chosen small scale methodology AMS-I.D (Version 14) is applicable to the project activity (6 X 0.75 MW which accounts to 4.5 MW) as it is a renewable energy project activity with a maximum output capacity less than 15 MW.

The AMS-I.D (UNFCCC approved CDM) methodology is applicable to the project as the project is a grid connected wind power project that exports electricity to TNEB and thus displaces the electricity supplied by at least one fossil fuel fired power plant.

The below table clearly shows the applicability of AMS I. D methodology

AMS I.D Applicability conditions	**Project applicability**
This category comprises renewable energy generation units, such as photovoltaic's, hydro, tidal/wave, **wind,** geothermal, and renewable biomass, that supply electricity to and/or displace electricity from an	The project activity involves wind energy generating units that supply electricity to the southern regional electricity distribution system of India. Hence applicability condition is satisfied.

[7] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_PHPV5WESACMBTJ2YY54GAJYSIEI3HD
[8] http://cdm.unfccc.int/Reference/tools/ls/meth_tool07_v01_1.pdf

electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	
If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel [9], the capacity of the entire unit shall not exceed the limit of 15MW.	The project has only renewable component with a capacity of 4.5 MW (is less to 15MW eligibility limit). Hence applicability condition satisfied.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[10] from the existing units.	The project activity is the installation of new renewable energy capacity where currently no power generation occurs. Hence applicability condition doesn't applicable to this project
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	Not Applicable.

Eligibility as a small-scale CDM project activity:
The table below demonstrates, following the "Simplified modalities and procedures for small-scale project activities" and its recent revisions, the eligibility of the project activity as a small-scale project activity

[9] Co-fired system uses both fossil and renewable fuels.
[10] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

confirms that it will remain under the small-scale limits over the crediting period.

Criteria	Eligibility
For Type I: Demonstrate that the capacity of the project activity will not exceed 15 MW.	The project activity involves 6 nos. of WEGs each of capacity 750 kW. The sum of maximum rated capacity of all the WEGs is 4.5 MW (Less than the 15 MW threshold).

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

For the baseline determination, project participants account CO2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity. Since the project activity is wind power project, there are no emissions within the project boundary.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

"No project option" is the chosen baseline scenario which would have happened in the absence of the proposed project activity.In the case of no project activity; there will a be continuation of current situation

Non implementation of project activity results in the continued current grid mix of Southern Grid. There is no displacement of electricity of the grid mix of Southern Grid.

In absence of project activity, an equivalent amount of electricity would be generated by the power plants comprising the grid mix and an equivalent amount of carbon dioxide would be generated. This would have been the scenario prior to the current project implementation.

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

As per the baseline identified by the PP, the kWh produced by the renewable generating unit would displace the same amount of electricity produced by a carbon intensive power plant, hence reducing the emissions that would have generated by the carbon intensive power

plants. By this fact the kWh exported to the grid by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) will result in the net emission reductions in kg CO_2e.

In accordance with the VCS 2007.1, the project proponent demonstrates that the project is additional by following steps as per Test 1:

Step 1: Regulatory surplus

The project is not mandated by any enforced law, statute or other regulatory framework in the country.

Step 2: Investment Barrier:

Economic feasibility is the major criteria for implementation of any project activity. The feasibility of setting up a wind farm at a particular location is primarily dependent on two factors which determine the financial returns from the project activity and are as follows:

The annual average generation of the WEG: The annual average generation provided by the WEG suppliers is considered, which is 15.94 Lakh units per WEG per annum. (Though the actual revenue is generated from the export to the grid the PP conservatively took the guaranteed figure provided by the WEG supplier.)

Total project cost: Due to the investment barriers/cash flow the PP planned to invest the money in a phased manner to set up a 4.5 MW project. PP invested on 1.5 MW at each phase with a six months interval between each investment.

As per the Annex 45 of EB 41 "General issues in calculation and presentation" Para 3
Guidance: *The period of assessment should not be limited to the proposed crediting period of the CDM project activity. Both* ***project IRR*** *and equity IRR calculations shall as a preference reflect the period of expected operation of the underlying project activity (technical lifetime), or - if a shorter period is chosen - include the fair value of the project activity assets at the end of the assessment period. In general a minimum period of 10 years and a maximum of 20 years will be appropriate. The IRR calculation may include the cost of major maintenance and/or rehabilitation if these are expected to be incurred during the period of assessment. Project participants are requested to justify and DOEs are*

requested to validate the appropriateness of the period of assessment in the context of the underlying project activity, without reference to the proposed CDM crediting period.
Rationale: *The purpose of undertaking an investment analysis is to determine whether or not the project activity would be financially viable without the incentive of the CDM. The actual project activity is not limited in time to the crediting period being requested.*

From the above guidance the PP selected project IRR as the financial indicator of the project.
The calculated project IRR is compared with an appropriate benchmark. The benchmark calculated is based on the guidance provided in the Annex 45 of EB 41 (para 11):
Selection and Validation of Appropriate Benchmarks
Guidance: *In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or* ***weighted average costs of capital (WACC)*** *are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented.*
Rationale: *For the same project activity the project IRR and equity IRR will be different, therefore the benchmark shall be appropriate to the type of calculation applied.*

Project participant has considered (Weighted Average Cost of Capital) WACC as the benchmark. Where Cost of equity has been estimated based on Capital Asset Pricing Model (CAPM). As per the model, Cost of Equity can be estimated as below

$$R_e = R_f + \beta \times (R_m - R_f)$$

Where,
R_e = Return on Equity
R_f = Risk free Returns
R_m = Market Returns
β = Asset Beta value

Significance of Risk free Returns (R_f):
Risk in finance is viewed in terms of the variance in actual returns around the expected return. The rate of return attributed to an investment with zero risk is called as a risk free return. The risk-free rate represents the interest on an investor's money that an

investor would expect from an absolutely risk-free investment over a specified period of time.
The PP considered the interest on the Government bond rates which is provided by the Reserve Bank of India[11] (RBI). PP chose the conservative value provided for Central Government securities rather than state government securities. The value of the year 2004-05, 6.11% is considered for the calculation purpose.

Significance of market returns (R_m): Return on market portfolio. The market returns represents the interest that an investor would expect from a market if he or she would have invested in the market. Market indices are indicators of expected market return. PP considered India's most popular market representative BSE SENSEX[12] as an indicator and calculated returns on market. To decrease the standard error of risk premium estimate the sampling years considered is 26.42 years (from April, 1979 to September 2005 – total possible years, please refer Benchmark calculation sheet). The compounded return is computed by taking the value of the investment at the start of the period ($Value_0$) and the value at the end ($Value_N$), and then computing the following:

$$\text{Geometric Average} = \left(\frac{Value_0}{Value_N}\right)^{\frac{1}{N}} - 1$$ [13]

For realistic market returns the PP considered geometric average rather than the arithmetic average[14], which gives actual returns when the same return on investment is reinvested at the start of each period/year. Project proponent considered **BSE Sensex** as an index because it is the value-weighted average for the Bombay Stock Exchange. The Sensex is comprised of the 30 blue chip stocks from the Bombay Stock Exchange and is the equivalent to the Dow Jones in India. These top 30 stocks account for one-fifth of all the market capitalization on the Bombay Stock Exchange. Since this basket of stocks reflects the broader Indian Stock Market, the Sensex is recognized around the world as the key indicator for the health of the Indian economy.

Beta (β): The beta coefficient is a key parameter in the Capital Asset Pricing Model (CAPM). It measures the part of the asset's statistical variance that cannot be

[11] http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/87503.pdf
[12] http://www.bseindia.com/about/abindices/bse30.asp
[13] As per the book titled "Corporate finance theory and Practice", by Dr.Aswath Damodaran,
[14] http://pages.stern.nyu.edu/~wsilber/Geometric%20Average%20Versus%20Arithmetic%20Average.pdf

mitigated by the diversification provided by the portfolio of many risky assets, because it is correlated with the return of the other assets that are in the portfolio. Beta can be estimated for individual companies using regression analysis against a stock market index. The PP considered the beta values of the power generating companies listed in BSE Sensex during that period, to relate his investment in power sector with the other players in the power sector.

As per the Law of Large Numbers [15] and Central Limit Theorem[16] if the sampling of the data is more the standard error decreases. Hence the PP considered five years of average beta value of five power generating companies to decrease the standard error. For a conservative approach PP considered the geometric average of beta values. Also PP took a conservative and least beta from the sampled data. This represents that the PP took a normalized and stable beta value for the calculation of the market returns.

The beta values of the companies considered are shown below:

Company Name	**Beta 5 year**	**Beta 4 year**	**Beta 3 year**	**Beta 2 year**
RELIANCE INFRASTRUCTURE	0.9594	1.0561	1.2521	1.3969
GUJARAT INDUSTRIES	1.2867	1.4164	1.4322	1.4625
TATA POWER COMPANY	1.2072	1.2464	1.3221	1.44
NEYVELI LIGNITE	1.2008	1.3758	1.3211	1.3918
BF UTILITIES	0.804	0.8227	0.7671	0.8404
Geometric Mean	**1.0755**	**1.1611**	**1.1916**	**1.2804**

From the above beta values shown PP took a conservative value of five years average. The above beta values are taken from Capitaline database[17]. For conservativeness PP considered geometric mean over arithmetic mean.

Hence the return on equity is conservatively calculated from the above equation and mentioned sources, which is 19.31%.

[15] http://en.wikipedia.org/wiki/Law_of_large_numbers
[16] http://en.wikipedia.org/wiki/Central_limit_theorem
[17] http://www.cline.capitaline.com/new/index.asp

Weighted Average Cost of Capital (WACC) is calculated as weighted average cost of equity and cost of debt as illustrated below

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

Where

D	Debt
E	Equity

Cost of Debt:

Cost of debt is defined as the rate at which lenders agree to lend money to a project. Accordingly, the RBI prime lending prevailing at the time of project start date has been considered as the cost of debt. The prime lending rate at the time of investment was in the range of 10.25 – 10.75%[18], the average PLR of 10.50% has been considered as the cost of debt.

Using the above parameters the WACC works out to 12.49%

Since the project is commissioned in phased manner the project IRR is computed for each phase and compared with the benchmark.

Phase I:

Basic Assumptions:

Basic Assumptions for the project : (Technical)			
	Parameters	**Units**	**Values**
a.	Location		Tirunelveli, Tamil Nadu
b.	Project size	MW	1.5
d.	No. of WEGs		2
c.	Capacity of each WEG	MW	0.75
e.	Total project cost	Million	69.74
Break-up for project cost per WEG			
f.	Supply of WEG, Civil works & Electrical work	Million	31.53
g.	Erection and commissioning	Million	1.102
h.	Cost of land	Million	0.07
i.	Infrastructure Development Charges	Million	2.168
	Total cost	Million	**34.87**

Basic Assumptions for the project : (Financial)			
a.	Promoter's contribution	Million	20.94

[18] http://www.rbi.org.in/scripts/WSSView.aspx?Id=9428

b.	Term loan component	Million	48.8
	Total cost of the project	Million	**69.74**
c.	Moratorium	months	6
d.	Repayment period	months	72
e.	Depreciation under Companies Act (Plant & Machinery)	%	4.75%
h.	Depreciation under IT Act (Plant & Machinery)	%	80% (Accelerated)

With the above basic assumptions the project IRR is calculated which is, 9.95% less than the benchmark.

As per the Annex 45 of EB 41 Para 16,
Sensitivity analysis
Guidance: *Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets.. Where a DOE considers that a variable which constitute less than 20% have a material impact on the analysis they shall raise a corrective action request to include this variable in the sensitivity analysis*
Rationale: *The initial objective of a sensitivity analysis is to determine in which scenarios the project activity would pass the benchmark or become more favorable than the alternative.*
The project proponent considered project cost and generation at the LCS panel as variables which would have a material impact on returns.
The table below shows the sensitivity analysis of the project with a 10% variance in the variable components mentioned above.

	IRR without VER	**IRR with VER**	**WACC**
Actual Generation	9.95%	11.32%	**12.49%**
10% increase in Generation	11.59%	12.88%	
10% increase in Tariff	11.60%	12.75%	

10% decrease in O&M	10.22%	11.57%	
10% decrease in project cost	11.53%	12.98%	

In spite of performing a 10% variation in the sensitive parameters, the project does not even reach close to the considered benchmark. The VER revenues are crucial for the sustained operation of the project activity. An increase in the guaranteed generation is not envisaged, however even while considering a 10% increase in generation, the project does not cross the benchmark without VCS revenue.

Phase II:

Basic Assumptions:

Basic Assumptions for the project : (Technical)			
	Parameters	**Units**	**Values**
a.	Location		Tirunelveli, Tamil Nadu
b.	Project size	MW	1.5
d.	No. of WEGs		2
c.	Capacity of each WEG	MW	0.75
e.	Total project cost	Million	72.64
Break-up for project cost per WEG			
f.	Supply of WEG, Civil works & Electrical work	Million	33.19
g.	Erection and commissioning	Million	1.12
h.	Cost of land	Million	0.07
i.	Infrastructure Development Charges	Million	1.942
	Total cost	Million	**36.32**

Basic Assumptions for the project : (Financial)			
a.	Promoter's contribution	Million	22.64
b.	Term loan component	Million	50
	Total cost of the project	Million	**72.64**
c.	Moratorium	months	4
d.	Repayment period	months	66
e.	Depreciation under Companies Act (Plant & Machinery)	%	4.75%

h.	Depreciation under IT Act (Plant & Machinery)	%	80% (Accelerated)

With the above basic assumptions the project IRR is calculated, 9.40% which is less than the benchmark. The sensitivity in terms of variance for generation, tarrif, O&M as well as for project costs have been carried out. Sensitivity analysis of the project activity is shown in the below table:

	IRR without VER	**IRR with VER**	**WACC**
Actual Generation	9.40%	10.45%	**12.49%**
10% increase in Generation	11.08%	12.20%	
10% increase in Tariff	11.08%	12.10%	
10% decrease in O&M	9.69%	10.72%	
10% decrease in project cost	11.01%	12.15%	

Phase III:

Basic Assumptions:

Basic Assumptions for the project : (Technical)			
	Parameters	**Units**	**Values**
a.	Location		Tirunelveli, Tamil Nadu
b.	Project size	MW	1.5
d.	No. of WEGs		2
c.	Capacity of each WEG	MW	0.75
e.	Total project cost	Million	73.54
Break-up for project cost per WEG			
f.	Supply of WEG, Civil works & Electrical work	Million	33.64
g.	Erection and commissioning	Million	1.12
h.	Cost of land	Million	0.07
i.	Infrastructure Development Charges	Million	**1.942**
	Total cost	Million	**36.77**

Basic Assumptions for the project : (Financial)			
a.	Promoter's contribution	Million	23.54

b.	Term loan component	Million	50
	Total cost of the project	Million	**73.54**
c.	Moratorium	months	6
d.	Repayment period	months	66
e.	Depreciation under Companies Act (Plant & Machinery)	%	4.75%
h.	Depreciation under IT Act (Plant & Machinery)	%	80% (Accelerated)

With the above basic assumptions the project IRR is calculated, 8.87% less than the benchmark.

	IRR without VER	**IRR with VER**	**WACC**
Actual Generation	8.87%	9.88%	**12.49%**
10% increase in Generation	10.48%	11.55%	
10% decrease in project cost	10.41%	11.51%	
10% increase in Tariff	10.48%	11.46%	
10% decrease in O&M	9.15%	10.14%	

After subjecting to the 10% increase of generation and 10% decrease in project costs also the project IRR doesn't crosses the benchmark. The actual generation (export to the grid) is generated at the 22.07% plant load factor whereas 24.26% which is 9% greater than assumed plant load factor.
Hence PP demonstrated the investment barrier of the project.

Common Practice Barrier
Indian Scenario:
As per the annual report provided by the Ministry of New and Renewable Energy for the year 2004-05[19], the energy generation by the wind power is given below.

[19] http://mnes.nic.in/annualreport/2004-2005_English/ch2_pg3.htm

Table 2.1 NEW AND RENEWABLE SOURCES OF ENERGY — POTENTIAL AND CUMULATIVE ACHIEVEMENT (AS ON 31.12.2004)

	POTENTIAL	CUMULATIVE ACHIEVEMENT
Biogas Plants	120 lakh	36.71 lakh
Improved Chulhas	1,200 lakh	339 lakh
Wind	45,000 MW	2,980 MW
Small Hydro	15,000 MW	1,693 MW
Biomass Power/Cogeneration	19,500 MW	727 MW
Biomass Gasifiers		62 MW_e
Solar PV	20 MW/sq.km	191 MW*
Waste-to-Energy	1,700 MW	46.50 MW_e
Solar Water Heating	1,400 lakh sq.m Collector Area	10.00 lakh sq.m Collector Area

** Of this 105 MW_p SPV products have been exported.*

Where the generation by the wind power generation is 2980 MW compared to the countries total generation which is shown in the below table[20]

TYPE	SUB - TYPE	MW	%
HYDRO		31865	25.90%
	COAL	68308	55.53%
	GAS	12172	9.89%
	Diesel	1202	0.98%
THERMAL	TOTAL	81681	66.40%
NUCLAER		3310	2.69%
Renewable Energy Systems[21]		6158	**5.01%**
TOTAL		123015	

Where, the total generation by the renewable energy generation on a whole is only 5% of the total generation of the India. If wind energy generation alone is considered it would be around 3% of the total generation capacity of India. Southern region scenario is explained in the section 1.7, which infers that the percentage of penetration of wind power in southern region is only 3%. From the above it is vivid that the wind power generation is not a common practice in India and it is not well penetrated at the time of project conceptualization. The installed capacity of the wind power to its estimated potential is around 7%, where it shows that the wind power generation is much to be penetrated into the Indian power scenario.

[20] http://www.cea.nic.in/cea-archive/body/Reports/Executive%20Summary/2005/2005_09/6.pdf

[21] Renewable Energy Sources (RES) includes Small Hydro Power, Bio Gassifier, Biomass Power, U&I, and Wind Energy

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

Title: "Grid Connected Renewable Electricity Generation[22]".

Reference: This is an UNFCCC approved small scale methodology AMS I.D, Version 14.

As the project is a grid connected renewable wind power plant, the above methodology has been chosen.

Tool referenced in this methodology is Version 1.1 of "Tool to calculate the emission factor for an electricity system[23]"

Monitoring requirements: As per AMS I.D version 14, "Monitoring shall consist of metering the net electricity supplied by the project activity to the grid. Measurement results shall be cross checked with records for sold electricity. Hourly measurement and monthly recording are required. Monitoring is detailed in Annex 2 of the PD.

Justification of choice of Methodology

The chosen small scale methodology AMS-I.D (Version 14) is applicable to the project activity (6 X 0.75 MW) as it is a renewable energy project activity with a maximum output capacity less than 4.5 MW.

The AMS-I.D methodology is applicable to the project as the project is a grid connected wind power project that exports electricity to TNEB and thus displaces the electricity supplied by at least one fossil fuel fired power plant.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

The purpose of monitoring, the types of data and information to be reported, including their units of measurement, the origin of the data and the roles and

[22] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_PHPV5WESACMBTJ2YY54GAJYSIEI3HD

[23] http://cdm.unfccc.int/Reference/tools/ls/meth_tool07_v01_1.pdf

responsibility of the project proponent are provided in detail in Annex 2.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Data / Parameter:	E_{Gen}
Data unit:	kWh
Description:	Net Electricity Generated
Source of data to be used:	Energy Meter
Value of data applied for the purpose of calculating expected emission reductions	9,516,180 kWh[24]
Description of measurement methods and procedures to be applied:	The net electricity generated is the net electricity pumped into the southern grid. Hence this figure is taken into account for the emission reductions and the cash flow calculations. This parameter is calculated using electricity exported and imported to/from the grid. The above figure is calculated using the WEG supplier provided generation at the LCS and assuming a conservative 0.5% of electricity generated as import from grid.
QA/QC procedures to be applied:	Refer to Annex 2
Any comment:	$E_{Gen} = E_{Exp} - E_{Imp}$

Data / Parameter:	E_{Imp}
Data unit:	kWh
Description:	Electricity Imported
Source of data to be used:	Energy Meter
Value of data applied for the purpose of calculating expected emission reductions	48,000 kWh
Description of measurement methods and	This parameter is monitored using TNEB energy meter

[24] Please refer the IRR computation sheet for detailed calculation

procedures to be applied:	installed by the government of Tamil Nadu in the transformer yard. The meter reading is noted down every month by the TNEB personnel in the presence of the O&M personnel. The project proponent will raise an invoice to the TNEB called as form B for the supply based on the generation report provided. These reports would be archived by the wind farm manager. please refer Annex 2 for a detailed explanation
QA/QC procedures to be applied:	Refer to Annex 2
Any comment:	Data monitored is to be kept for two years after the end of the crediting period or the last issuance of VCUs for the project whichever occurs later

Data / Parameter:	E_{Exp}
Data unit:	kWh
Description:	Electricity Exported
Source of data to be used:	Energy Meter
Value of data applied for the purpose of calculating expected emission reductions	9,564,000kWh
Description of measurement methods and procedures to be applied:	This parameter is monitored using TNEB energy meter installed by the government of Tamil Nadu in the transformer yard. The meter reading is noted down every month by the TNEB personnel in the presence of the O&M personnel. The project proponent will raise a invoice to the TNEB called as form B for the supply based on the generation report provided. These reports would be archived by the wind farm manager. please refer Annex 2

	for a detailed explanation
QA/QC procedures to be applied:	Refer to Annex 2
Any comment:	Data monitored is to be kept for two years after the end of the crediting period or the last issuance of VCUs for the project whichever occurs later

3.4 Description of the monitoring plan

Monitoring methodologies / guidelines mentioned in the UNFCCC document of "Annex II of the simplified modalities and procedures for small scale CDM project activities" for small scale projects (Type I: D) is considered as basis for monitoring methodology for the activity.

Please refer to the Annex 2 for detailed monitoring plan.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

As per the version 14 of AMS-I.D methodology for "Grid connected renewable electricity generation" the baseline is the kWh produced by the renewable generating unit multiplied by baseline emission factor of Southern Grid (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner.

A combined margin emission factor (CM), consisting of the combination of operating margin emission factor (OM) and build margin emission factor (BM) according to the procedures prescribed in the "Tool to calculate the emission factor of an electricity system".

Calculation of CM according to the Tool

The Indian power system is divided into two independent regional grids, namely NEWNE and Southern Grid. The state of Tamil Nadu falls within the boundary of Southern grid.

Version 4.0 of the Carbon dioxide Baseline database[25] of CEA has been used for the estimation of the baseline emission factor. The procedure for estimation of the baseline emission factor is in line with the version 1.1 of the "Tool to calculate emission factor for an electricity system". The detailed procedure is as given below.

Calculation Procedure:

Operating Margin Emission Factor
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 Southern Grid, not including low-cost/must-run power plants/units. It has been calculated based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the Southern Grid.

The formula applied for the calculation of Simple Operating Margin is

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

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power plant / 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 electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
m	=	All power plants / units serving the grid in year y except low-cost / must-run power plants / units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	The three most recent years for which data is available.

The average simple operating margin of the years 2005-06, 2006-07 and 2007-08 is

OM = 0.998157296tCO2/MWh

Build Margin Emission Factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available.

The build margin BM is calculated by CEA and is the generation weighted average emission factor of the most recent power plants consisting of the capacity additions that represent 20% of the system generation (in MWh) and that have been built most recently. This option is considered for calculation as it represents the larger sample. The data pertaining to the units thus identified are detailed in the Version 4.0 of the Baseline Carbon Dioxide Baseline database of the CEA.

The build margin emission factor is calculated as

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

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

The Build Margin calculated is based on the most recent data available and the build margin thus calculated is 0.7133177 tCO2/MWh

Therefore,
BM = 0.7133177 tCO2/MWh

Calculation of Combined Margin emission factor

The combined margin will be calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

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 (%)

As per the Version 1.1 of "Tool to calculate the emission factor for an electricity system", the default values to be used for Wind Power projects are

w_{OM}= 0.75
w_{BM}= 0.25

Hence, the Combined margin Co_2 Emission Factor is calculated as below:

$$EF_{Grid,CM} = w_{OM} * OM + w_{BM} * BM$$

$$= 0.75 * 0.998157296 + 0.25 * 0.7133177$$

$$= 0.92694742 \ tCO_2/MWh$$

Therefore, the baseline is the kWh produced by the renewable wind power generating unit multiplied by 0.92694742 tCO_2/MWh calculated in a transparent and conservative manner.

Baseline Emissions:
Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants connected to the Southern Grid that are displaced by the project activity.

The net electricity exported to the grid per annum by the project activity is 9,516,180 kWh. Hence the baseline emissions are calculated as below.

The Baseline Emissions would be calculated using the formula

$BE_y = EF_{Grid,CM} \times EG_y$

Where,
BEy is the baseline emission in the year y.
EG_y is the amount of electricity exported to the grid in the year y.

Baseline Emissions = 9,516,180 kWh x 0.92694742 tCO_2/MWh
= 8,820 tonnes of CO_2
= 8,820 tonnes of CO_2e

Project Emissions

As per the methodology, there are no project related emissions for wind power projects. Please refer section 4.3 for detailed explanantion.

Leakage

As per the methodology, no leakage is considered from the project activity.

Emission Reduction

$ER = (EG_y \times BEF) - PE - EL$

Where
ER = Emission reduction per annum by project activity (tones/year)
EG_y = Total clean power export to grid
BEF = Baseline Emission Factor
PE = Project Emissions
EL = Emission leakage (tonnes/year) (= 0)

Emission Reductions (ER)
= (9,516,180 kWh x 0. 92694742 tCO_2 e/MWh) - 0 – 0
= 8,820 tCO_2 e

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

Following table estimates the baseline emission reductions. The project activity accounts for tCO_2e of baseline emission reductions over the crediting period of 10 years.

Year	Net Electricity Exported (kWh)	Combined Margin Emission Factor (tCO_2e/MWh)	Estimation of baseline emission reductions tCO_2e
2006-2007	9,516,180	0.92694742	8820
2007-2008	9,516,180	0.92694742	8820
2008-2009	9,516,180	0.92694742	8820
2009-2010	9,516,180	0.92694742	8820
2010-2011	9,516,180	0.92694742	8820
2011-2012	9,516,180	0.92694742	8820
2012-2013	9,516,180	0.92694742	8820
2013-2014	9,516,180	0.92694742	8820
2014-2015	9,516,180	0.92694742	8820
2015-2016	9,516,180	0.92694742	8820
Total	95,161,800	0.92694742	88200

4.3 Quantifying GHG emissions and/or removals for the project:

As per the methodology implemented AMS I.D version 14 para 11, *"In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, where the existing and new units share the use of common and*

limited renewable resources (e.g., streamflow, reservoir capacity, biomass residues), the potential for the project activity to reduce the amount of renewable resource available to, and thus electricity generation by, existing units must be considered in the determination of Baseline Emissions, project emissions, and/or leakage, as relevant."

Power generation through the wind energy doesn't falls under this category. Though the WEGs share the wind energy in common; the source is unlimited renewable energy source but not a limited source as stipulated in the methodology. Hence there are no project emissions.

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Period	Baseline Emissions (tCO_2e)	Project Emissions (tCO_2e)	Leakage (tCO_2e)	Emission Reductions (tCO_2e)
2006-2007	3688	0	0	3688
2007-2008	8820	0	0	8820
2008-2009	8820	0	0	8820
2009-2010	8820	0	0	8820
2010-2011	8820	0	0	8820
2011-2012	8820	0	0	8820
2012-2013	8820	0	0	8820
2013-2014	8820	0	0	8820
2014-2015	8820	0	0	8820
2015-2016	8820	0	0	8820

5 Environmental Impact:

In India, Ministry of Environment and Forest is the host party. As per the prevailing host party laws, (the Schedule 1 of Ministry of Environment and Forests, Government of India notification dated September 14, 2006), 38 activities are required to undertake environmental impact assessment studies. The details of these activities are available at http://envfor.nic.in/legis/eia/so1533.pdf . However the Environmental Impact Assessment study is not required for wind mill project as there is no negative environmental impact due to the project activity and wind energy is one of the cleanest sources of energy.

6 Stakeholders comments:

The project proponent identified the following local stakeholders to be associated with the project activities, directly or indirectly.

The typical groups of the stakeholders identified are

- ✓ Employees of the TNEB
- ✓ Local people
- ✓ Farmers
- ✓ Contractors (Vestas)

All the stakeholders were informed about the agenda, venue and date of the meeting through notices issued 7 days prior to the meeting. Further, a project concept note, which gives a clear idea on the project activity including the measures taken under the project and the benefits achieved by the project, was also issued along with the notice as information to the concerned stakeholders.

The consultation meeting was conducted by the project proponent on 10th December 2008 at the Radhapuram in Tamil Nadu at the wind farm site office. The stakeholder consultation meeting at Tirunelveli wind farm site was attended by participants representing various groups of the stakeholder (as mentioned above), details on the participants has been recorded. The meetings started with a brief presentation on Climate Change. There after it was explained to the stakeholder as how the wind farm project by the project proponent has lead to significant reduction in emissions of greenhouse gases either directly or indirectly and hence how it helps in contributing to the global efforts towards combating global warming. The project proponent further explained the other sustainable development benefits associated with the project. The stakeholders viewed the project proponent as a reputed company contributing to local socio-economy. Overall there was unanimous agreement that the proposed project was a beneficial project from sustainability viewpoint.

Description of how comments by local stakeholders have been invited and compiled

Concerns and responses as recorded during the meeting at the sites of the wind farm area:
All the stakeholders were happy in knowing that a project activity in their locality is contributing to a global cause and they commended the project proponent management

for their initiatives in the areas of climate change and sustainable development. In particular, the stakeholders lauded the project promoters for the environment friendly power generation using wind.

Summary of the comments received

The stakeholder meeting was conducted at the project proponent's plant site at Tirunelveli and was attended by the residents of the nearby villages, the employees of the project proponent and representative of relevant Electricity Board. Summary of the comments received from the stakeholders

Local Population: The villagers expressed their pleasure with the setting up of the power project as it had provided the rural population with permanent employment opportunities. Indirect employment generated as result of the project activity was highlighted by the villagers. The increase in the land prices subsequent to the setting up of the project was a welcome boon for the villagers.

Employees: The local population hired for the project activity are pleased with the employment opportunity available to them which was absent in the region prior to the commissioning of the plant.

Report on how due account was taken of any comments received

No account of the comments was taken as all the received comments were positive.

7 Schedule:

The chronology of the events pertaining to the project proponent project activity has been given below;

S. No	DATE	DESCRIPTION
1	30 December 2005	Purchase Order Agreement for first set of WEGs (2 nos.) between the project proponent and NEG Micon (India) Private Limited
2	04 January 2006	Agreement for erection and commissioning between the project proponent and NEG Micon (India) Private Limited
3	16 March 2006	Commissioning Date of the first WEG at Ayyansurandai village,

		Tamil Nadu
4	26 March 2006	Commissioning Date of the second WEG at Achankuttam village, Tamil Nadu
5	11 October 2006	Purchase Order Agreement for second set of WEGs (2 nos.) between the project proponent and NEG Micon (India) Private Limited
6	23 October 2006	Agreement for erection and commissioning between the project proponent and NEG Micon (India) Private Limited
7	26 December 2006	Commissioning Date of the second set of WEGs (3^{rd} and 4^{th}) at Sambavar Vadakarai village, TamilNadu
8	26 February 2007	Purchase Order Agreement for third set of WEGs (2 nos.) between the project proponent and Vestas (India) Private Limited
9	03 March 2007	Agreement for erection and commissioning between the project proponent and Vestas (India) Private Limited
10	26 March 2007	Commissioning Date of the fifth WEG at Sambavar Vadakarai village, Tamil Nadu
11	27 March 2007	Commissioning Date of the sixth WEG at AyyanSurandai village, Tamil Nadu
12	Project Period	The lifetime of the project activity is 20 years. Hence the terminating of the same would be occur after 20 years from the commissioning of the WEGs
13	16 March 2026	Terminating the first WEG of the project activity.
14	27 March 2027	Terminating the last WEG of the project activity
15	Frequency of monitoring and reporting	Project proponents appointed WEG suppliers for their operation and maintenance purpose of the project activity. The O&M personnel daily monitors the WEGs at the project site and reports to the Area Service Manager of the wind farm. For the detailed monitoring plan and

		reporting please refer Annex 2

8 Ownership:

8.1 Proof of Title:

All the activities of the project are done in the name of VVD and Sons Private Limited (VVD). The purchase of equipment, power purchase agreement and all clearances have been done in the name of VVD, which will be provided as evidence of proof of title.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not applicable

Annex 1

Baseline Information

The Central Electricity Authority (CEA) has published the baseline emission factors database for the various electricity grids in India. The emission factors have been calculated based on UNFCCC guidelines (**ACM0002/ Version 07 and "*Tool to calculate the emission factor for an electricity system*" – *Annex 12 of EB35***). For further details on the calculation methods and data used, please refer the following web link:
http://www.cea.nic.in/planning/c%20and%20e/database publishing ver4.zip
In the CEA database, the weighted average emission rate, simple operating margin, build margin and combined margin emission factors of the regional electricity grids have been provided separately for two cases; including electricity imports and excluding electricity imports from other regional grids. Since, emission factors including and excluding imports are one and the same, the same are taken for the calculation of emission factor. The below data extract from the CEA database (Table 1) shows the simple operating margin data for the most recent three year data vintage and the build margin data.

Table 1: Extract from CEA CO_2 database

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE			
VERSION	**4.0**		
DATE	**Sep-08**		
BASELINE METHODOLOGY		**ACM0002 / Ver 07 and "Tool to Calculate the Emission Factor for an Electricity System", Version 1.1**	

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.84	0.83	0.82
South	0.73	0.72	0.72
India	0.82	0.80	0.80
Simple Operating Margin (tCO2/MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	1.02	1.02	1.01
South	1.01	1.00	0.99
India	1.02	1.01	1.01

Build Margin (tCO2/MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.67	0.63	0.60
South	0.71	0.70	0.71
India	0.68	0.65	0.63

Combined Margin (tCO2/MWh) (excl. Imports)			
	2005-06	2006-07	2007-08
NEWNE	0.85	0.82	0.80
South	0.86	0.85	0.85
India	0.85	0.83	0.82

Where **NEWNE** is Integrated Northern, Eastern, Western and North Eastern grid
South is Southern Grid

ANNEX 2
Details of Monitoring

As per the VCS 2007.1 Project Document template and per the applied (UNFCCC CDM), Baseline and Monitoring Methodology Version 14 of AMS-I.D:

Purpose of monitoring:
To obtain reliable data, to check the functioning / performance of the WEG and the authentic metering of the energy exported to the grid.

Types of data and information to be reported, including units of measurement:
Electricity exported: The generated electricity by all the WEGs are exported to Southern Grid. It is measured by a dedicated energy meter installed by TNEB. The unit of measurement is in kilo watt hour (kWh).
Electricity Imported: The electricity imported from the Southern Grid. It is measured by the same energy meter installed by TNEB. The measurement is in kilo watt hour (kWh).
Net electricity generated: The imported electricity from the grid is subtracted from the electricity exported resulting in net electricity generated by the WEG. The electricity sales realization is based on net electricity generated. Hence this component is used for the calculation of emission reductions and for the IRR calculations. Please refer section 3.3 for detailed explanation of each monitored parameters.

Origin of the data: The generation data is taken from the TNEB energy meters.

Monitoring, including estimation, modelling, measurement or calculation approaches:

As per the AMS I.D version 14, para 14, "*If the energy generating equipment is transferred from another activity, leakage is to be considered*". The project does not involve any transfer of energy generating equipment from another activity. The generated electricity from the project will be exported to the TNEB, which is an integral part of the Southern Grid. Throughout the VCS crediting period and beyond, the electricity generated from the project will be monitored by both the project proponent (PP) and the State utility namely TNEB. The PP has hired the Services of M/s Vestas Wind Technology for the O&M of the project activity at Tirunelveli district, Tamil Nadu of the wind farm under a contract. The

delivered energy shall be metered by the PP and TNEB at each HTSC (High Tension Service Connection). The metering equipment is located at transformer yard of each WEG. The data is accurately measured with 0.5 accuracy class energy meters. The energy meters installed at transformer yard will be used to measure variables like export energy (in kWh), running hours, error stoppage and TNEB export (in kWh), import energy (in kWh) & reactive power utilised (in kVARh) on continuous basis.
The energy meters at the transformer yard are two-way meters and will be in custody of TNEB. The TNEB officials take readings of the meter and the same readings will be used to determine the net power exported to the Southern Grid. The readings of the individual meters of each WEG are taken on a monthly basis by the TNEB personnel. The net energy exported to the grid is calculated and issued by TNEB as a "Monthly statement". The meter shall be jointly inspected and readings noted down and then sealed on behalf of the PP & TNEB in the presence of its authorised representatives.

The metering equipment shall be maintained in accordance with Central Electricity Authority (CEA) standards[26]. All the meters shall be calibrated every year with reference to a portable standard meter of class 0.2. As the instruments are calibrated and marked at regular intervals, the accuracy of measurement can be assured at all times.

The measurement of electricity is carried out as per the prevailing guidelines of the State Electricity Regulatory Commission, which mandates implementation of 0.5 accuracy class meters at grid interconnection point for measurement of generated electricity.

In exceptional circumstances of failures of metering system, immediate replacement is carried out on 24 x 7 hour basis. The turbines continue to generate electricity even during the failure hours and no payment is made to the PP for such duration. The fault meter is replaced by the new meter within 48 hours from the fault detection.

Meter and Relay Test (MRT) Laboratory/ TNEB tested spare energy meter is kept at the TNEB/MRT office. As per TNEB procedures, the defective energy meter is always replaced by a spare energy meter and is done by TNEB

[26] http://www.cea.nic.in/e&c/regulations/notified_regulations/Metering_Regulations.pdf

representative in the presence of company's personnel, readily available at TNEB/MRT Office.

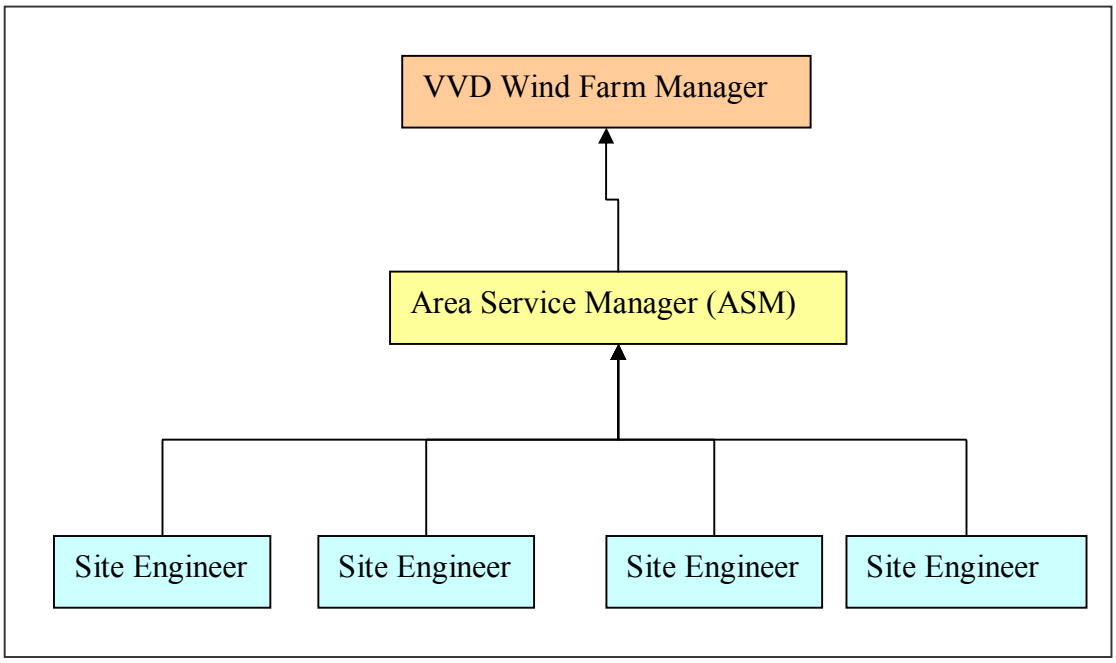
The working condition of the TNEB energy meter is daily verified by the site engineer of O&M team. This data is used for the calculation of emission reductions. The continuous monitoring of data is done by the O&M personnel; this ensures the proper working of the WEG and this data is used to compare with the TNEB energy meter data, in case of large differences between these two meter readings O&M team will inform the wind farm manger of the PP. The PP would request TNEB to change or calibrate the faulty energy meter.

Monitoring times and periods, considering the needs of intended users:

The PP had been appointed WEG suppliers for the O&M of the WEGs. The O&M personnel appoint a site engineer to physically verify the working condition of the WEG and TNEB energy meter as well. The TNEB energy meter readings are noted down monthly in the presence of the site engineer and the TNEB personnel.

Monitoring roles and responsibilities:

As part of the reporting structure of the O&M / Supplier, respective site in charge of various sites report respective site data to the Area Service Manager (ASM) who in turn is makes it available to the PP.



Operations & Maintenance structure

Roles & responsibilities:

Site Engineer:

Role: Monitors the WEGs at the site.

Responsibility: Reports to ASM on working condition of the WEG and the TNEB energy meter.

Area Service Operator:

Role: Manages the wind farm data of each machine

Responsibility: Replacement of TNEB energy meter in case of failure. Identifies the WEGs which are not working and escalating it to the wind farm manager. Uploads the generation data in their (WEG Supplier) respective website to make the same available for the PP.

VVD Wind Farm Manager:

Role: Manages the wind farm data and raises the invoice.

Responsibility: Verifies the monitoring data submitted by the O&M team and TNEB energy meter data. In case of any discrepancies between them, then the he escalate it to VVD's management.

Managing data quality:

The amount of emission reduction units is proportional to the net energy export to the grid. The same has been measured by the TNEB energy meter. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result, all power measuring instruments are calibrated once in every two years for ensuring reliability of the system. Therefore, the system ensures the final generation data which is used for the emission reduction calculations is conservative and highly reliable.

Appendix 1

LIST OF ABBREVIATIONS

AMS	Approved Small- Scale Methodology
ASM	Area Service Manager
BEF	Baseline Emission Factor
BM	Build Margin
BSE	Bombay Stock Exchange
CAPM	Capital Asset Pricing Model
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CEIG	Chief Electrical Inspector to Government
CM	Combined Margin
DOE	Designated Operational Entity
EB	Executive Board of UNFCCC
EIA	Environment Impact Assessment
GHG	Greenhouse Gas
HTSC	High Tension Service Connection
INR	Indian Rupees
IRR	Internal Rate of Return
IT	Income Tax
kW	kilo Watt
kWh	KiloWatt hour
m	Minute
m/s	Meters/second
MNES	Ministry of Non-conventional Energy Sources
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forests
MW	MegaWatt
MWh	MegaWatt hour
NEWNE	North Eastern West North East
O&M	Operation and Maintenance
OM	Operating Margin
PD	Project Document
PLR	Prime Lending Rate
PP	Project Proponent
PP	Project Proponent
RBI	Reserve Bank of India
rpm	revloutions per minute
S.F.No	Survey Field Number
SG	Southern Grid
tCO2e	Tonnes of Carbon dioxide equivalent
TNEB	Tamil Nadu Electricity Board
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCU	Voluntary Carbon Unit
VER	Voluntary Emission Reductions

WACC	Weighted Average Cost of Capital