Voluntary Carbon Standard

Project Description

Date of the VCS PD – 20th October 2009

Content .

1. Description of project
2. VCS Methodology
3. Monitoring
4. GHG Emission Reductions
5. Environmental impact
6. Stakeholders comments
7. Schedule.
8. Ownership

1 Description of Project:

1.1 Project title

"16.65 MW Bundled Wind Power Project in Tamilnadu"

Version: 01.1

Date : 20/10/2009

1.2 Type/Category of the project

As per Voluntary Carbon Standard (VCS) -2007.1 the Project falls under Renewable energy Wind power project.The total capacity of the project activity is 16.65 MW which is more than 15 MW (limit for small scale project).Hence the project activity is a large scale project and falls under the following:

Sectoral Scope : Energy Industries (renewable/ non-renewable sources)

Project Type : **I- Renewable Energy Projects**

Category : **ACM0002**"Consolidated Baseline Methodology for grid connected electricity generation from renewable sources".

Version : ACM0002/Version 10/Sectoral scope: 01,EB 47

Reference : http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

This project is a bundled grid connected wind power project in Tamil Nadu.

The specified project is not a part of a grouped project

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

The grouped activity falls under projects as the reductions are in the range of 5,000-1,000,000 tCO2e per year. The generated power from this project is supplied to southern Regional grid dominated by the fossil fuel based power Generation. Electricity generated from wind projects being GHG neutral, the annual GHG emission reduction through this project activity is estimated to be 39,642 tonnes of Carbon dioxide equivalent.

Table-1: Estimated annual amount of emission reductions over crediting period (From 28th March 2006 to 27th March 2016)

Year	Annual estimation of emission reductions (tCO2e)
2006-2007	39,642
2007-2008	39,642
2008-2009	39,642
2009-2010	39,642
2010-2011	39,642
2011-2012	39,642
2012-2013	39,642
2013-2014	39,642
2014-2015	39,642
2015-2016	39,642
Total estimated reduction (tCO_2 e)	396,420
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tCO2e)	39,642

The project activity is neither a micro project nor a mega project, since the emission reductions are neither below 5000tCO_2e/annum or nor above 1000000tCO_2e/annum.

Hence, the project activity falls under "project category" as per VCS guidelines. However, since the project is a grouped project, option 2 has been chosen as per VCS guidelines.

1.4 A brief description of the project:

The project activity generates electricity from wind mills. The capacity of the project is 16.65 MW. This project activity is located in the Districts of Coimbatore and Tirunelveli, Tamilnadu. The project activity consists of fifteen number of NEG Micon make Wind Electricity Generators (WEGs) of capacities of 0.75 MW and 1.65 MW, aggregating to a total installed capacity of 16.65 MW.

The generated power from this project is supplied to southern Regional grid dominated by the fossil fuel based power Generation. The Generated electricity is being GHG neutral; the annual GHG emission reduction through this project activity is estimated to be 39,642 tonnes of Carbon dioxide equivalent.

There are ten promoters in the project activity. The below table gives the details of the project promoter and capacities of the wind electric generators (WEGs):

S No	Project Promoter	Capacity(MW)	Date of Commissioning	Location
1	Dollar Apparels I	1.65	30.09.2005	Raghlpavi
	Dollar Apparels II	1.65	30.09.2005	Raghlpavi
	Dollar Apparels 1	0.75	21.03.2005	Anthiyoor
	Dollar Apparels 2	0.75	21.03.2005	Anthiyoor
	Dollar Apparels 3	0.75	21.03.2005	Anthiyoor
	Dollar Apparels 4	0.75	21.03.2005	Anthiyoor
	Dollar Apparels 5	0.75	21.03.2005	Anthiyoor
2	Devi Sea Foods 1	1.65	08.05.2005	Anthiyoor
	Devi Sea Foods 2	1.65	20.07.2006	Rahlpavi
3	MCTM Global Investments	0.75	11.05.2006	Surandai
4	Srinivasan Raghavan	0.75	26.09.2005	Veeranam
5	Thirunavakuarsu	0.75	27.09.2005	Veeranam
6	Standard Fireworks	1.65	17.01.2006	Veeranam
7	Thiagarajar Mills	1.65	26.01.2005	Anthiyoor
8	Aditya Marine	0.75	26.09.2005	Veeranam
	Total	**16.65**		

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

The WEGS are located in Coimbatore and Tirunelveli districts which is in Tamilnadu State.. The project site falls within latitudes N 8° 57′ and N 10° 37′ and longitudes E 77° 10′ and E 77° 29′, Figure 1 shows a map of the project site.

Figure – 1 Map showing the location of wind farm

The below table provides details regarding the physical location of the WEGs

.

Sl. No.	Project Promoter	Capacity of WEG (MW)	Longitude	Latitude	HTSC No.
1	Dollar Apparels	1.65	77°12′45.3″	10°35′33.1″	1015

	I				
	Dollar Apparels II	1.65	77^{0}13’50.2”	10°35’45.3”	1016
	Dollar Apparels 1	0.75	77^{0}10’00.1”	10°35’39.3”	664
	Dollar Apparels 2	0.75	77^{0}10’13.0”	10°35’36.8”	665
	Dollar Apparels 3	0.75	77^{0}10’12.6”	10°35’49.9”	666
	Dollar Apparels 4	0.75	77^{0}10’08.5”	10°36’14.9”	667
	Dollar Apparels 5	0.75	77^{0}10’21.7”	10°36’03.3”	668
2	Devi Sea Foods 1	1.65	77^{0}11’23.1”	10°37’41.2”	782
	Devi Sea Foods 2	1.65	77^{0}11’60.1”	10°34’37.2”	1283
3	MCTM Global Investments	0.75	77^{0}27’05.7”	8°57’16.6”	1913
4	Srinivasan Raghavan	0.75	77^{0}29’29.9”	8°57’35.8”	1414
5	Thirunavukarasu	0.75	77^{0}29’15.7”	8°57’23.7”	1420
6	Standard Fireworks	1.65	77^{0}28’56.5”	8°58’52.5”	1545
7	Thiagarajar Mills	1.65	77^{0}10’52.9”	10°37’19.0”	833
8	Aditya Marine	0.75	77^{0}29’16.7”	8°57’30.6”	854

1.6 Duration of the project activity/crediting period:

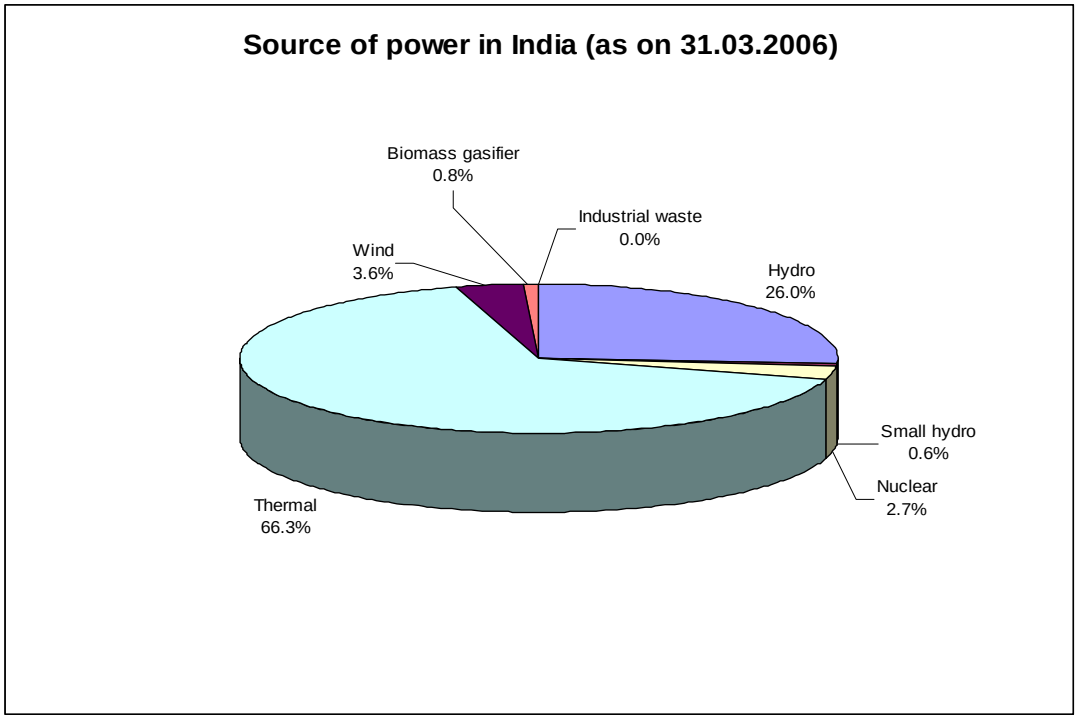
Project Start Date: 26th January 2005 (Which is the earliest commissioning date in the bundled project activity)

Crediting period start date: 28th March 2006 (As per VCS guidelines)

VCS Project crediting period: 10 years 0 Months this will be renewed.

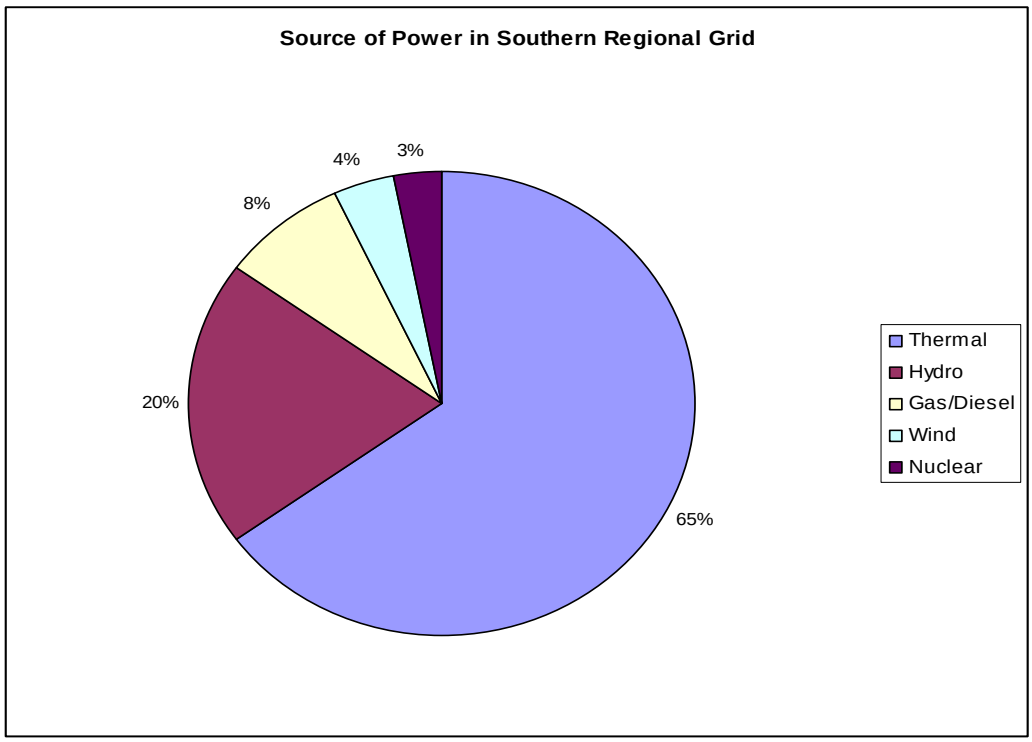
1.7 Conditions prior to project initiation:

Wind energy contributes about 3.6 % of the total electricity generation in India[1], as shown in the following figure



The electricity generation scenario in the southern regional grid[2] is shown is the below figure. Fossil fuel is the dominant source of power, wind energy contributes only 4 % of the total installed capacity.

[1] Central Electricity Authority Annual Report 2005-06, Annexure -10-B page 7
[2] Central Electricity Authority Annual Report 2005-06, Annexure -10-B page 2



In the absence of the project activity the equivalent amount of electricity would have been generated by the operation of grid connected power plants that are predominantly GHG intensive thermal power plants. The Project activity will thus reduce the anthropogenic emissions of greenhouse gases (GHGs) in to the atmosphere associated with the equivalent amount of electricity generation.

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

Tamilnadu has been highly dependent on fossil fuels as source of power, predominantly coal. The proposed project utilises renewable wind energy for generation of electricity. The electricity thus generated is evacuated to the Tamilnadu grid under a long term Power Purchase Agreement (PPA).

The Project replaces emissions of greenhouse gases (GHGs) in to the atmosphere by displacing the equivalent amount of electricity generation through the operation of existing/proposed fossil fuel based power plants connected to the Grid.

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

The project involves the installation of WEGs of NEG Micon. The WEGs are ideal for Indian meteorological conditions. WEGs of 750 kW and 1650 kW have been installed. The NM 48/750 WEG with a rated capacity of 750 kW is one of the machines well known for its best performance. The NM 48/750 WEG is a stall regulated machine with a cut-in speed of 4 m/s and a cut-out speed of 25 m/s. The NM 82/1650 with a rated capacity of 1650 kW is an ACTIVE STALL™ machine with cut-in and cut-out speeds of 2.5 m/s and 32 m/s, respectively. The NM 48/750 and NM 82/1650 machines are type tested and certified by DNV, Denmark A/S. The technical specification of the WEGs is as tabulated below.

Technical Specification of the WEGs in the Project

Sl No	Parameters	NM 48/750	NM 82/1650
1	**Operational Data**		
	Nominal Output	750 KW	1650 KW
	Power Regulation	Stall	Active-Stall™
	Cut-In Speed	4 m/s	3.5 m/s
	Cut-Out Speed	25 m/s	24 m/s
2	**Rotor**		
	Rotor Diameter	48.2 m	82 m
	Rotor Swept Area	1824 cm^2	5281 m^2
	Number of Blades	3 nos.	3 nos.
3	**Brake System**		
	Blade tip Air Brake	Hydraulic, fail safe	Full Blade Pitch
	Disc Brake	Hydraulic	Hydraulic Disc Brake

Sl No	Parameters	NM 48/750	NM 82/1650
4	**Generator**		
	Type	Asynchronous	Asynchronous
	Nominal Voltage	690 V	690 V
	Nominal Frequency	50 Hz	50 Hz
	Name Plate Rating	750/200 KW	1650/900 KW
	Cooling	Closed circuit liquid cooling	Closed circuit liquid cooling
5	**Tower**		
	Type	Conical, Steel, PU Painted	Tubular, Steel, PU Painted
	Hub Height	According to type approvals	According to approvals
6	**Controller**		
	Type	Computer controlling	Microprocessor based computer control system
	Capacitor Bank	NO LOAD Compensated	Automatic intelligent phase compensation logic, multistage

The technical design of the NM 48/750 and NM 82/1650 WEGs is from NEG Micon A/S, Denmark where a dedicated team of professionals are actively involved in design and testing. Vestas Wind Technology India Private Limited has had an effect on technology transfer and has manufacturing plants in Chennai and Pondicherry.

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

Project meets all local laws and regulation (Electricity Act 2003 of India). All WEGs in this project have signed long term Power Purchase Agreement with the state electricity board.

Also, the project proponent has obtained the necessary approvals like NOC from state electricity board.

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

The following are risks that could substantially reduce the project's emission reductions:

1) Low Capacity Utilization Factor:

The capacity utilisation of the WTGs depends on the wind profile of the area. It has been observed that the wind profile is not stable and wind speeds are intermittent, resulting in decreased capacity utilization factor of the WTG. Thus change in the PLF may have significant impacts on the power generation from wind and subsequently affect the project's GHG emission reduction.

2) Grid Evacuation facility:

Power from wind turbines is considered to meet demand only in the event when it cannot be met with conventional power sources in Tamil Nadu. Often, wind turbines in Tamil Nadu have been asked to back down as power generation in thermal power stations had been running at their peak resulting in high frequency in the grid. Thus the Tamil Nadu Electricity Board (TNEB) is not able to evacuate power that the windmill units are generating. This may lead to dependence of power generation from fossil fuel other than wind which subsequently affects the project's GHG emission reduction.

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 project activity involves installation and operation of 15 Wind Electric Generators thereby reducing corresponding electricity consumption from grid, which ultimately results less GHG emissions. Thus the project activity was not primarily implemented to create GHG emissions.

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

This project activity has not created any other form of environmental credit certificate. The evidence for the same was submitted to the validator.

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

Not applicable since the project promoter does not apply for any other Carbon Mechanism

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

The Carbon Advisory Services of Vestas Wind Technology India Private Limited acts as a facilitator for the project and has entered into contractual agreements with the project participants to carry out the VCS Program on its behalf.

Vestas Wind Technology India Private Limited is a wholly owned subsidiary of Vestas Wind Systems A/S, Denmark. The Carbon Advisory Services of Vestas Wind Technology India Private Limited shall be the single point contact for all communications with the VCS Registry. Vestas Wind Technology India Private Limited shall act as a coordinator for providing all relevant information during this process.

In the following table, the contact information of all project participants is shown.

Organization:	Vestas Wind Technology India Private Limited
Street/P.O.Box:	298, Rajiv Gandhi Salai
Building:	Sholinganallur
City:	Chennai
State/Region:	Tamil Nadu
Postfix/ZIP:	600 119

Country:	India
Telephone:	+91 44 2450 5100
FAX:	+91 44 2450 5101
E-Mail:	muraj@vestas.com
URL:	
Represented by:	
Title:	General Manager
Salutation:	Mr.
Last Name:	Rajaram
Middle Name:	
First Name:	Murali
Department:	Sales
Mobile:	
Direct FAX:	+91 44 2450 5106
Direct tel:	+91 44 2450 5101
Personal E-Mail:	muraj@vestas.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.):

The project participants obtained all clearances from stakeholders hence no legal risks are anticipated. The project activities contribution towards sustainable development in terms of society, environment and economy (both direct and indirect impacts) are stated below:

Contribution of the project to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated the social well being, economic well being, environmental well being and technological well being as the four indicators for sustainable development.

Social Well-being

The project produces power from cleaner source i.e., wind energy. The project leads to employment of local people which provides boost to local economy. The project helps to reduce demand supply gap in electricity in the state. The project has led to rural upliftment and infrastructure development in the areas around the project such as

improving the condition of roads connecting to the project site.

Environmental Well-being

The project utilizes wind energy for generating electricity which otherwise would have been generated through alternate fuels (most likely -fossil fuel) based power plants, contributing to reduction in emissions including GHG emissions. Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment contributing to environmental well-being.

Economic Well-being:

The project creates job opportunities for local people during construction and operation period. The project provides business opportunity for local stakeholders such as suppliers, manufacturers, contractors etc. There is demand-supply gap in the grid; the project helps in reducing the gap by pumping the electricity produced into the local grid.

Technological Well Being:

The project has demonstrated the success of large capacity wind electricity generators (WEGs) in the region and promotes state-of-art WEGs.

1.17 List of commercially sensitive information (if applicable):

Not Applicable

2 VCS Methodology:

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

The VCS methodology applied to the project activity is:

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

Reference: Approved consolidated baseline methodology ACM0002/Version 10, Sectoral Scope: 01, EB 47

Title: Tool to calculate the emission factor for an electricity system

Reference: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The methodology ACM0002 refers to the latest approved versions of the following tools:

- ✓ Tool to calculate the emission factor for an electricity system
- ✓ Tool for the demonstration and assessment of Additionality,
- ✓ Combined tool to identify the baseline scenario and demonstrate additionality;
- ✓ Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.

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

The project activity involves grid connected electricity generation from renewable source that is wind energy and hence the methodology ACM0002 Version 10 has been chosen for this project activity. The project activity meets all the applicability criteria as defined in the methodology of ACM0002 Version 10 that are demonstrated below:

Applicability criteria as per ACM0002	Applicability to this Project activity
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-	This Project activity generates Electricity from wind power project. Hence this methodology is applicable for this project activity.

of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	
In the case of capacity additions, retrofits or replacements: 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;	The project activity is the installation of new windmills and does not involve modification/retrofit of a power plant/unit
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	This is a wind power project.

section, is greater than 4 W/m^2. - 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/m^2.	

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;	The project activity is the installation of grid connected wind power plant and does not involve switching from fossil fuels to renewable energy sources.
Biomass fired power plants;	The project activity is the installation of grid connected wind power plant and not a biomass fired power plant
Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2.	The project activity is the installation of grid connected wind power plant and not a hydro power plant

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

	Source	Gas	Included	Justification /

			?	Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	CO2 emissions from combustion of fossil fuels for electricity Generation in Solar thermal power plants and geo thermal power Plants.	CO_2, CH_4, N_2O	No	The project activity is a renewable energy project and hence no emissions.

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

This project activity is the installation of a new grid-connected renewable power plant/unit; the baseline scenario is the following:

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

This wind power project is located in Tamilnadu and the generated electricity is supplied to the southern regional grid. So even in absence of this project activity the power generation would continue to be by the existing and/or new grid connected power plants in the southern regional grid.

According to the current scenario in southern grid, the power generation by fossil fuel based thermal power plants are dominating the grid.

Type of power plants and their net power generation in 2007-08

Type of Power Plant	GWh	%
Thermal Power Plants	1,23,224	73.79
Hydro Power Plant	39,514	23.66
Nuclear Power Plant	4,247	2.54
Total	1,66,987	100.00

Reference:

http://www.cea.nic.in/god/opm/Monthly Generation Report/18col A_08_03/FILE-02.pdf

Baseline Scenario:

The baseline scenario as explained above is that the electricity supplied by this project activity would have been supplied by the operation of the power plants connected to the grid and by addition of new generation sources. These generation sources will be depicted in OM and BM calculations as part of the combined margin method for calculation of the baseline emission factor.

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):

The project activity meets the VCS program approved Methodology as explained in the above sections of the VCS PD.The project additionality is demonstrated below:

Test 1- The project test:

Step 1: Regulatory Surplus

If the absence of this project activity continuation of current practise where in the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions .This is the chosen baseline scenario which would have happened in the absence of the proposed project

activity. Thus, this project activity shall not be mandated by any enforced law, statute or other regulatory framework. For power generation, the Electricity Act 2003 does not restrict or empower any authority to restrict the fuel choice, the applicable environmental regulations do not restrict the use of wind energy and there is no legal requirement on the choice of a particular technology

Step 2: Implementation barriers

In this step, as per the VCS 2007.1 it is required to show that the project faces one or more distinct barriers compared with barriers faced by alternative projects.

The barriers analysed for this project is

a) Investment barrier

a.1) Investment analysis

b) Institutional barriers

The above barriers are analysed below.

a) Investment barrier

a.1) Investment analysis

The project faces capital or investment return constraints that can be overcome by the additional revenues associated with the generation of VCU. The investment date of the each project activity in this bundling project is varying from project to project. So the benchmark is calculated for individual project activity based on the every individual investment decision date. The investment decision date of each project is mentioned in the below table.

Appropriateness of choosing benchmark:

As per the guidance note issued by CDM EB at its 41st meeting *"In case 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 cost of capital (WACC) are appropriate benchmarks for a project IRR" (annex 45, page No.3, item 11 Selection and Validation of Appropriate Benchmarks - EB 41). Based on this the PP* has taken into account the Weighted Average Cost of capital as the Benchmark Return. Project IRR is used to demonstrate the Additionality of the project. Since the project is financed by

both equity and loan, the appropriate benchmark is WACC, since WACC represents the weighted average of the costs of various sources of financing in the financing structure. In other words, WACC represents the minimum rate of return, which the project should earn to merit consideration, as failure to earn the minimum rate of return is indicative of unattractiveness of the investment.

WEIGHTED AVERAGE COST OF CAPITAL

Weighted average cost of capital

= **(E/I)*Ri + D/I * b * (1-tc/100)**

Where

I is the Total Investment

E is the Equity investment (30%)

D is the Debt component of the total investment (70%)

tc is the corporate tax rate

b is the cost of debt

1. Cost of Equity:

The cost of equity has been determined based upon the Capital Asset Pricing Model (CAPM).

1.1 CAPM:

The Capital Asset Pricing Model (CAPM) is used to determine a theoretically appropriate required rate of return of an asset. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset.

The following formula is used to calculate the rate of return of an asset.

Ri = *Rf* + (β) *(Rm - Rf)*

Where,

Ri = Required Rate of Return on Equity

Rf = Rate of a risk free investment

Rm = Expected market return

Beta (β) = Indicator towards measuring the volatility of the security, relative to the asset class

It is apparent from the above equation that the Required Rate of Return on Equity is the return of a risk-free investment plus Beta times the difference between the expected market return and the return from the risk-free investment (termed as market risk premium). Hence CAPM justifies that the expected return of an investor should be commensurate with the higher expected risk of the investment.

Required Rate of Return on Equity = Risk free return + Market risk Premium * Beta

In order to calculate the Required Rate of Return on Equity the following parameters are required.

- Risk Free return
- Market Risk Premium
- Beta

Risk Free return

The risk free rate is the return on a security (or a portfolio of securities) that is free from default risk. Typically, the rate of long term government bonds is used to determine the risk free rate. This value is taken from the annual report of Reserve Bank of India.

The value is 6.11 %* for the financial year 2005-2006 and 7.34% for the financial year 2006-2007.

* http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/86531.pdf

Market Risk Premium

The market risk premium is the difference between the expected market rate of return and risk free rate and is usually measured by looking at the average of the historical returns on a market portfolio.

Expected market return (Rm)

The market rate of return is calculated by Compound Annual Growth Rate - CAGR

The year-over-year growth rate of an investment over a specified period of time .The compound annual growth rate is calculated by taking the nth root of the total percentage growth rate, where n is the number of years in the period being considered.

This formula as follows:

$$CAGR = \left(\frac{\text{Ending Value}}{\text{Beginning Value}}\right)^{\left(\frac{1}{\#\text{ of years}}\right)} - 1$$

Towards calculating the average of the historical returns on a market portfolio, the project participants had the following stock market indices to select from BSE 500. The index represents about 93% of the total market capitalizations, ideally said to represent the total market. In the context of the present project activity, the period of 1st Feb 1999 (opening date of BSE 500) to investment decision date of the individual project has been selected to calculate the expected market return (CAGR).

The over all risk premiums depends on market risk premium as well as on a parameter called Beta, which has been explained below.

Beta:

Beta is the measure of the expected volatility of a particular stock relative to a well-diversified market portfolio. It measures the systematic risk of a stock, i.e. the risk that cannot be eliminated in a well-balanced, diversified portfolio. The beta is calculated as the covariance between its return and the return on a well-diversified market portfolio, divided by the variance of the return on a well-diversified market portfolio.

Beta = Covariance (R,Rm) / Variance (Rm)

Where:

R is the return from the investment in a single stock

Rm is the return from the investment in the well-diversified market portfolio

Towards determining the value of Beta, the below listed companies which are also involved in the similar business domain (power generation) have been compared.

1. Tata Power Company Limited
2. Gujarat Industries
3. CESC Limited
4. Neyveli Lignite Corporation
5. BF Utilities
6. Reliance Infra energy Limited

Towards calculating the beta value of the listed power companies, the project participants had the following stock market indices to select from BSE 500. In the context of the present project activity, the period of 1st Feb 1999 (opening date of BSE 500) to investment decision date of the individual project has been selected to calculate the beta value of the listed companies on the investment decision date. The detailed calculation of beta for the individual project activity is given in the annexure. While computing the expected return on equity average value of beta has been taken.

2. Cost of Debt

The weighted average cost of capital is calculated from the BPLR of Reserve Bank of India, Debt and Equity of this project activity.

WEIGHTED AVERAGE COST OF CAPITAL

Weighted average cost of capital

$$= (E/I)*Ri + D/I * b * (1-tc/100)$$

Where

I is the Total Investment

E is the Equity investment

D is the Debt component of the total investment

tc is the corporate tax rate

b is the cost of debt

Summary

The Weighted Average Cost of Capital (WACC) of the individual project activity based on investment decision date is calculated and presented in the below table.

Project Promoter	**Date of Investment decision**	**Staring Date of the project activity**	**WACC**
Dollar Apparels 2*1650KW	30/06/2005	20/07/2005	13.26%
Dollar Apparels 5*750kW	17/01/2005	24/01/2005	12.96%
Devi sea Foods 1	02/04/2005	10/04/2005	13.25%
Devi Sea Foods 2	01/04/2006	20/04/2006	15.00%
MCTM Global Investments	10/03/2006	20/03/2006	15.08%
Srinivasan Raghavan	12/08/2005	19/08/2005	13.96%
R Thirunavakarasu	12/08/2005	19/08/2005	13.96%
Standard Fireworks	04/10/2005	06/10/2005	13.43%
Thiagarajar Mills	22/12/2004	29/12/2004	13.26%
Aditya Marine	30/06/2005	17/07/2005	13.26%

Calculation and comparison of financial indicators

The project IRR is compared to the Benchmark to establish the additionality of the project activity. All the assumptions made while estimating the projected profitability of the project activity and the IRR are based on documentary evidence, copies of which will be submitted to DOE for verification.

The project IRR for different proponents has been worked out and the same has been tabulated below.

Name of Project Promoter	IRR without VCUs (%)	IRR with VCUs (%)	Benchmark (%)
Dollar Apparels - 2 * 1650	10.81	11.48	13.31%
Dollar Apparels – 5 * 750	9.04	9.75	12.96%

Devi Sea Foods 1	10.63	11.33	13.25%
Devi Sea Foods 2	10.46	11.13	15.00%
MCTM Global Investments	7.24	8.78	15.08%
Srinivasan Raghavan	9.39	11.59	13.94%
R Thirunavakuarsu	9.39	11.59	13.94%
Standard Fireworks	10.39	11.92	14.43%
Thiagarajar Mills	10.98	12.5	13.26%
Aditya Marine	8.85	9.59	13.26%

The above table shows that in all the cases the IRR is lower in contrast to the benchmark value. Thus it may be concluded that the project is financially additional.

Sensitivity Analysis:

The robustness of the conclusion derived above, i.e., the project is additional has been tested with a sensitivity analysis of some parameters. The PP has subjected the critical assumptions made in the projections to reasonable variations, i.e., by 10%. The PLF, Operation and Maintenance cost and project cost are considered to perform sensitivity analysis. The results of the sensitivity analysis are as follows:

Project Promoter	Parameters	-10%	0%	10%
Dollar Apparels 2*1650kW	PLF	9.26%	10.81%	12.28%
	O&M Cost	10.95%	10.81%	10.68%
	Project Cost	12.29%	10.81%	9.55%
Dollar Apparels 5*750KW	PLF	7.31%	9.04%	10.64%
	O&M Cost	9.35%	9.04%	8.73%
	Project Cost	10.49%	9.04%	7.80%
Devi Sea Foods 1	PLF	9.00%	10.63%	12.16%
	O&M Cost	10.80%	10.63%	10.46%
	Project Cost	12.12%	10.63%	9.35%
Devi Sea Foods 2	PLF	8.87%	10.46%	11.95%
	O&M Cost	10.62%	10.46%	10.29%
	Project Cost	11.92%	10.46%	9.20%
MCTM Global Investments	PLF	5.45%	7.24%	8.72%
	O&M Cost	7.48%	7.24%	6.85%
	Project Cost	8.55%	7.24%	5.99%
Srinivasan	PLF	7.49%	9.39%	11.14%

Raghavan	O&M Cost	9.72%	9.39%	9.06%
	Project Cost	10.85%	9.39%	8.16%
R. Thirunavukuarasu	PLF	7.49%	9.39%	11.14%
	O&M Cost	9.72%	9.39%	9.06%
	Project Cost	10.85%	9.39%	8.16%
Standard Fireworks	PLF	8.78%	10.39%	11.91%
	O&M Cost	10.57%	10.39%	10.21%
	Project Cost	11.91%	10.39%	9.09%
Thiagarajar Mills	PLF	9.34%	10.98%	12.52%
	O&M Cost	11.15%	10.98%	10.81%
	Project Cost	12.49%	10.98%	9.69%
Aditya Marine	PLF	7.02%	8.85%	10.54%
	O&M Cost	9.18%	8.85%	8.52%
	Project Cost	10.30%	8.85%	7.61%

However the optimistic assumptions made for the purpose of sensitivity analysis are not realistic and such conditions are unlikely to occur for the following reasons:

1. Project cost: The PP has already commissioned the wind turbines and it has been observed that in the last few years, the prices have been going up steadily. Hence, an assumption of even a 10% decrease in project cost is unlikely to happen.
2. PLF: The generation estimate provided by wind turbine supplier has been used to determine PLF. Though 10 % increase is not a likely situation and hence, not relevant to be considered for sensitivity, however the equity as well as project IRR for the project with 10% increase in generation is well below the benchmark IRR.
3. O&M Cost: The PP has already signed an O&M Contract with the WTG supplier or a third party, which provides for yearly escalation also. Hence, any reduction in O&M Cost is also unrealistic.

In the above background, it may be concluded that the project is unlikely to achieve a project IRR of more than the Bench mark rate as tabulated above. However, the IRR improves while

considering the VER revenues. Thus, it is evident that VER revenue will definitely help the project to overcome certain barriers primarily associated with the additional investment with regards to the supply of power to the distribution grid.

Step 3: Common Practice:

The source of power generation in the southern regional was analysed. The total installed capacity of southern regional grid as on March 31, 2005 was 31730.95 MW.

Power Plant	Total Installed Capacity in MW	%
Hydro	10672.24	33.63
Coal	13892.50	43.78
Gas	2720.40	8.57
Diesel	939.32	2.96
Wind	2056.70	6.48
Renewable Energy Sources	619.79	1.95
Nuclear	830.00	2.62
Total	31730.95	100.00

The above table clearly depicts that wind energy for power generation is not very actively being used in southern regional grid for power generation; hydro and thermal power are still more preferred sources of power generation in this region. Wind energy has only 6.48% of the installed capacity as compared to 33.63 % of hydro and 55.31% of thermal. Thus, investing in wind energy was not a common practice in this region.

(Source: http://cea.nic.in/power_sec_reports/Executive_Summary/2005_03/22-28.pdf).

Thus it may be concluded that although wind energy projects have been installed in the region, carbon revenue has been an important point of consideration for the financial viability of a majority of the projects as they face barriers due to low capacity factors, grid non-availability and regulatory aspects which have been discussed in the sections above.

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:

The monitoring methodology applied to the project activity is:

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

Reference: Approved consolidated monitoring methodology ACM0002/Version 10, Sectoral Scope: 1, EB 47

Grid connected electricity generation from renewable source has been considered as the project activity because:

- The project activity involves generation of electricity from a renewable source i.e. wind.
- The generated electricity is connected to the grid as the electricity generated from the WEGs is supplied to the grid.
- The geographic and system boundaries for the relevant grid (Southern Regional Grid) can be clearly defined and information on the characteristics of the grid is also available.
- The project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.

The methodology ACM0002 refers to the latest approved versions of the following tools:

- ✓ Tool to calculate the emission factor for an electricity system, Version 1.1.

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

- Purpose of monitoring

  The purpose of monitoring the project is to verify the annual emission reductions in tonnes of CO2 that the project activity has achieved as per the requirements of VCS.

- Types of data and information to be reported, including units of measurement

  Net electricity export to the grid in MWh

- Origin of the data

  Electricity bill and Central Electricity Authority – CDM – Carbon Dioxide baseline database

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

  Calculation for monitoring will be made on actual generation data and current - Central Electricity Authority data list version 4.0 published in October 2008

- Monitoring times and periods, considering the needs of intended users;

  Monitoring will be done on hourly basis for entire crediting period and recorded monthly.

- Monitoring roles and responsibilities

  Project proponent and wind turbine supplier together will be involved for collecting the monitoring information.

- Managing data quality

  All meters and equipment which measures data will be calibrated on regular basis (generally once in three year). The monthly data of electricity generation is collected in both log book and electronic form.

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

Data / Parameter:	**EGy**
Data unit:	MWh
Description:	Net quantity of electricity supplied to the grid by the project activity during the year y Net quantity of electricity supplied = Export of electricity - Import of electricity

Source of data to be used:	Monthly electricity generation statement issued by Tamil Nadu Electricity Board (TNEB)
Value of data applied for the purpose of calculating expected emission reductions	42767
Description of measurement methods and procedures to be applied:	Net electricity supplied to the grid is used in calculation of emission reductions. Monitoring: Trivector meter will be used for monitoring Data Type: Measured Frequency: monthly measured Recording: Monthly from joint meter Archiving Policy: Paper & Electronic Calibration Frequency: Once in three year
QA/QC procedures to be applied:	The project revenue is based on the net units displaced as measured by main metering system installed at the interconnection point (substation point). The meters used are calibrated periodically by state electricity utility with 0.5 class accuracy. Sales record to the grid and other records are used to cross heck this data and hence ensure consistency.
Any comment:	Data will be archived during the whole crediting period + 2 years.

3.4 Description of the monitoring plan

The project activity essentially involves generation of electricity from wind, the employed WEG only converts wind energy into electrical energy and does not use any other input fuel for electricity generation. Thus no special ways and means are required to monitor leakage from the project activity.

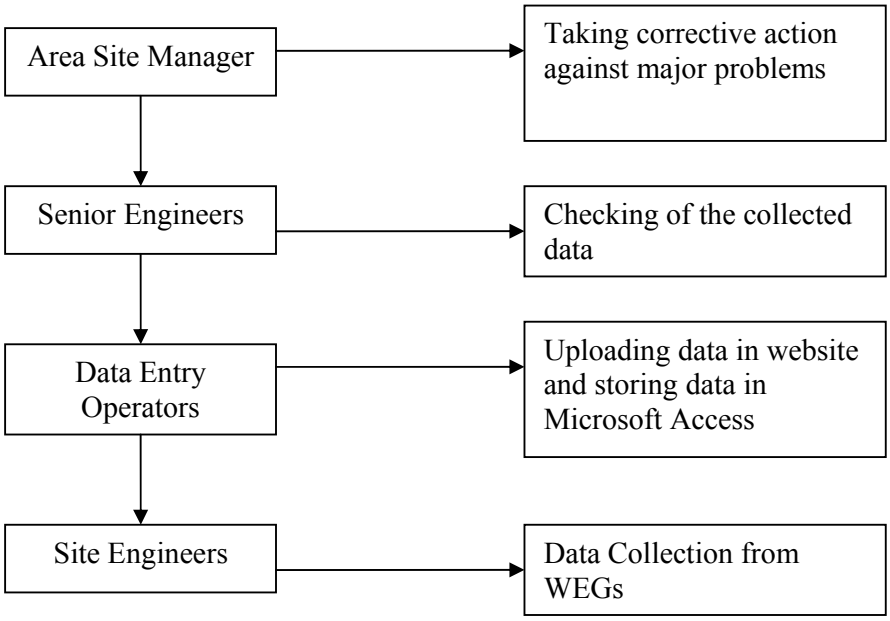
The primary monitoring of the electricity fed to the state utility grid will be carried out at the incoming feeder of the state power utility. The energy meter will be maintained by TNEB and will have the capability of continuous measurement of electricity supplied to the grid. The accuracy class of the energy meter is 0.5S.

The WEGs are equipped with a micro-processor based Controller (Local Control System) specially designed to control the WEG. The primary function of the LCS is to ensure that all the components of the WEG remain fully operational under all conditions. In order to meet this requirement, it is necessary to monitor wind speed, wind direction, temperature, rotational speeds, electricity generated, voltage etc. The LCS display and keyboard enable control of all WEG functions. The LCS stores all the data and it can be linked to a PC to transfer the data. As LCS is the central control unit there is no calibration required for it and if there is any failure in the internal part of the LCS, the WEG will automatically shut down and will be replaced by a new LCS.

The project proponents have signed an O& M contract with the supplier (Vestas).The performance of WEG, safety in operation and scheduled / breakdown maintenances are organized and monitored by Vestas. The organogram structure of the O&M team with their roles and responsibilities is given below

Organogram Structure of O&M Team:

Structure	**Responsibility**



Metering:

The delivered Energy shall be metered by the parties (TNEB and the Owner) at the high voltage side of the step up transformer installed at the project site.

Daily Meter Reading:

Daily energy meter reading for all WEGs will be taken by the maintenance staff, and will be recorded in the generation log, in a controlled format. The daily readings recorded in the log book will be uploaded by the data entry operator in the customer portal, www.power2customer.com. Thus the daily readings are archived both electronically and in paper form.

Monthly Meter Reading:

The electronic meters installed at the grid interconnection point by the TNEB will be used to measure the electricity supplied to the grid on a monthly basis. Every month these meter readings will be recorded by the officers of the TNEB. These records will be archived for crosschecking yearly figures. The meters at the grid interconnection point will be two-way meters and will be owned by SEB. SEB will take the readings from these meters and the same reading may be used to determine the net power wheeled to the user and determine the extent of mitigation of GHG over a period of time.

Thus, the above mentioned monitoring procedures for metering are only for WTGs of this project that are connected to the grid.

Calibration:

Calibration of energy meters will be done once in three year by TNEB with 0.5 class accuracy. If inaccuracy found more than the allowed error, the meter will be changed. The metering equipment shall have sufficient accuracy so that any error resulting from such equipment shall not exceed 0.5% of full-scale rating, which is permissible limits of error for a meter and is said to be the allowed error.

Measurement Frequency

Frequency of measurement by TNEB - Once in a month

Frequency of measurement by site Operator - Once in a day

Calibration of the Energy Meter - This is carried out by TNEB (Once in three year).

Data Collection and Archiving

The monthly data of electricity generation is collected in both log book and electronic form. However, the data in electronic form is archived throughout the life time of the project. The electricity records are maintained regularly by the team at the site.

Hence, the monitoring at the ground level is done by the O & M service providers, which in case of the project activity are the same as the suppliers of the WEGs. Also, as per the contract, a monthly generation report is made available to the WEG owner with gross and net energy generation from the wind electric generators.

Monitoring report:

Every year the project promoter will prepare a monitoring report showing all emission reduction calculations as per monitoring plan. The monthly electricity generation statement issued by the TNEB will be archived in paper form by the project proponent. All generation data will be archived for two years beyond the crediting period.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

The project uses ACM0002, version 10 "Grid connected electricity generation from renewable source" has been considered for the purpose of calculating the Emission Reductions because:

- The project activity involves generation of electricity from a renewable source i.e. wind.
- The generated electricity is connected to the grid as the electricity generated from the WEGs is supplied to the grid.
- The geographic and system boundaries for the relevant grid (Southern Regional Grid) can be clearly defined and information on the characteristics of the grid is also available.
- The project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.

The methodological choices considered in order to calculate the calculation for Emission Reductions has been explained below.

Baseline calculation:

The project activity is generation of electricity using wind energy and exporting the same to the Southern grid system. For the baseline determination, project participants account CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity calculated as follows:

$$BEy = EG_{PJ,y} * EF_{grid,CM,y}$$

Where,

BE_Y = Baseline Emission in year y (tCO2/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".

Calculation of $EG_{PJ,y}$

The calculation of EGPJ,y is different for (a) Greenfield plants, (b) retrofits and replacements, and (c) capacity additions.

This project activity is a Greenfield plants not a retrofits and replacement or Capacity Additions.

Greenfield renewable energy power plants

This project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, so:

$$EG_{PJ,y} = EG_{facility,y}$$

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)

EGfacility,y = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Procedure to calculate Emission Factor EFy

Based on the above the baseline emission factor has been calculated Ex-ante based on baseline methodology ACM0002 (Version 10). 'Tool to calculate the emission factor for an electricity system' is used for emission factor calculation.

The following steps to be used to calculate the baseline emission factor.

Step 1. Identify the relevant electric power system.

The project activity is located in the Southern Region of India and the electricity generated by this project displaces the electricity from southern regional grid. Due to the displacement of electricity the project activity would have impact on the southern grid, serving the four southern states and one union territory namely Pondicherry. Hence the project also has an impact on all the generation facilities in the southern grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. For the baseline calculation a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) are used. The southern grid is also connected with other regional grids, however, the net exchange of energy within the regional grids is very small and negligible and hence other regional grids are not included in the boundary for estimation of baseline emissions.

Step 2 Select an operating margin (OM) method:

In the southern regional grid the power generation is dominated by fossil fuel based power plants and the power generation by low cost/must run resources constitute (average of the five most recent years) less than 50% of total grid generation, so simple operating margin method is used for operating margin emission factor calculation. According to the current scenario in southern regional grid, the power generation by fossil fuel based thermal power plants are dominating the grid

The simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system,

Step 3 Calculate the Operating Margin emission factor according to the selected method.

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

• *Ex ante option:* 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,

or

• *Ex post option:* The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

The simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,\ OMsimple,y} - \frac{\Sigma\ FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y}}{\Sigma EG_{m,y}}$$

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 ytCO_2/GJ)
$EGm_{,y}$	-	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 except low cost must run power plants/units
i	-	All fossil fuel types combusted in power plant/unit m in year y
y	-	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation.

http://cdm.unfccc.int/methodologies/Tools/EB32_repan09_Tool_proj_emiss.pdf.

"Tool to calculate the emission factor for an electricity system" Version -01.1, Page No 6.

The Operating Margin (including imports) calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units using the CEA3 data base for the Southern Grid (for the years 2005-06, 2006-07 and 2007-08) the value is 0.998157296 tCO2e/ MWh.

Year	2005-06	2006-07	2007-08	Total
Emission(tCO2)	101,551,293	109020456	113,626,240	324,197,989
Net generation(MWh)	100,978,000	109,116,000	114,702,000	324,796,000
Operating Margin Emission Factor (tCO2 / MWh)	0.998157296			

Source: Central Electricity Authority: CO2 Baseline Database.

Version: 4, Dated November 2008

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

[3] Source: CDM Carbon Dioxide Baseline Data base, Version 4.0, September'08 (www.cea.nic.in)

Step 4: Identify the cohort of power units to be included in the build margin Project participants can choose between one of the following two options:

Option 1

For the first crediting period Calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Option 2

For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1 above. The sample group m consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Step 5 Calculate the Build Margin Emission factor

Option 1 as described above is chosen in the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units

m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} - \frac{\Sigma EG_{m,y} * EF_{EL,m,y}}{\Sigma EG_{m,y}}$$

Where:

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

http://cdm.unfccc.int/methodologies/Tools/EB32_repan09_Tool_proj_emiss.pdf.

"Tool to calculate the emission factor for an electricity system" Version -01.1, The Build Margin emission factor will be

EF_{BM} **=0.71331778** tCO_2 e/ MWh

Year	2007-08
Emission(tCO2)	22,550,310
Net generation(MWh)	31,613,000
Build Margin Emission Factor (tCO2 / MWh)	0.71331778

Source: Central Electricity Authority: CO2 Baseline Database.

Version: 4, Dated Oct 2008

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

Step 6 Calculate the combined margin emission factor

The combined margin emissions factor is calculated as follows:

$EF_{grid,CM,y}$ - $EF_{grid,OM,y} * w_{OM}$ + $EF_{grid,OM,y} * w_{BM}$

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 (%)

The following default values should be used for w_{OM} and w_{BM}

For wind and solar power generation project activities: $w_{OM} = 0.75$and $w_{BM} = 0.25$

EF_{OM} - 0.998157296tCO_2/MWh

w_{OM} - 0.75

EF_{BM} - 0.71331778 tCO2/MWh

w_{BM} - 0.25

$EF_{grid,CM,y}$ = 0.75*1.00 + 0.25*0.71

Baseline emission factor will be ($EF_{grid,CM,y}$)= **0.92694742 t**CO2/MWh

The emission factor ($EF_{grid, CM,y}$) is fixed and it is same for the entire crediting period.

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

The baseline emission for the project activity is calculated as follows:

Baseline Emission are calculated by multiplying the net quantity of electricity supplied by this project activity (EG_Y) with the CO2 baseline emission factor for the electricity displaced due to the project ($EF_{grid,CM,y}$) as follows:

BEy = EGY* $EF_{grid,CM,y}$

Where:

EG_Y = Net electricity supplied to the southern regional grid

EGy = 42,767 MWh/year

BEy = 42767 *0.92694742

= 39,642 tCO2/year

Baseline emission (BEy) = 39,642 tCO2/year

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

Project Emissions (PEy):

This project activity is grid connected wind power generation. Hence there is no project emission from the project activity.

PE_Y =0 tCO2/year

Leakage Emissions (LEy):

The proposed VCS project activity engages neither transferring the energy generating equipment from another activity, nor is the existing equipment transferred to another activity. So the leakage emissions are not applicable and hence not considered.

LEy = 0

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

Emission reduction by this wind power project is

$ER_Y = BE_Y - PE_Y - LE_Y$

ERy =Emission reduction per year by the project activity tCO2/year

PE_Y = Project Emission by this project activity in tCO2/year

LE_Y = Leakage emissions in year y (t CO2/yr)

ER_Y = 39,642 -0

= 39,642 tCO2/year

Year	**Estimation of leakage (tCO2e)**	**Estimation of project activity emissions (tCO2e)**	**Estimation of overall emission reductions (tCO2e)**
2006-2007	0	39,642	39,642

2007-2008	0	39,642	39,642
2008-2009	0	39,642	39,642
2009-2010	0	39,642	39,642
2010-2011	0	39,642	39,642
2011-2012	0	39,642	39,642
2012-2013	0	39,642	39,642
2013-2014	0	39,642	39,642
2014-2015	0	39,642	39,642
2015-2016	0	39,642	39,642
Total estimated reduction (tCO_2 e)	**0**	**396,420**	**396,420**
Total number of crediting years	**0**	**10**	**10**
Annual average over the crediting period of estimated reductions (tCO2 e)	**0**	**39,642**	**39,642**

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 January 27, 1994 and further modified on 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. There is no significant environmental impact due to this project activity hence EIA is not required for this project activity.

6 Stakeholders comments:

The project promoters conducted a stakeholder consultation meeting on 29th November 2007 at project site in Coimbatore and Tirunelveli Districts with the local people and residents of the neighbouring villages, Local employees, Representative of TNEB, Social workers active in the local region.A brief introduction about the project activity was given to the stakeholders and their doubts and concerns were clarified by the Vestas representatives. The local people expressed satisfaction over the project activity due to creation of local employment opportunities, lead to increase in land values, improvement in the infrastructure like better connecting roads, regular health camps etc., During the stakeholder consultation meeting, individual stakeholders were consulted by Vestas representatives to comment on the proposed project activity. The comments can be summarized as positive.

7 Schedule:

The chronological plan for the project activity is as follows:

- Start date of the project – 26th January 2005
- VCS Crediting period start date: 28th March 2006
- Duration of crediting period: 10 years which will be renewed once.
- Lifetime of the project: 20 years

The PP will monitor the parameters as explained in Section 3.3. The PP plans to conduct annual verifications to quantify the emission reductions (VCUs) from the project activity and report them in a transparent manner.

8 Ownership:

8.1 Proof of Title:

For the ownership details of the project following may be referred:

1. Power Purchase Agreement (PPA) between Tamil Nadu Electricity Board (TNEB) and the proponents
2. Commissioning certificates
3. Purchase Orders

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

Not Applicable