Voluntary Carbon Standard
Project Description Template

19 November 2007

Date of the VCS PD
Date: 24th March, 2010.
Version 01
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1 Description of Project:

1.1 Project title

Grid-connected wind electricity generation project in Tamil Nadu, India

1.2 Type/Category of the project

- As per the Voluntary Carbon Standard, Methodologies for baseline estimation and formulation of monitoring plan include methodologies specified by the[1]:
    - Clean Development Mechanism (CDM) of United Nations Framework Convention on Climate Change (UNFCCC)
    - California Climate Action Registry

  For the GHG abatement project activity under consideration, the project proponent chooses to apply an appropriate methodology as specified by Appendix B to the simplified modalities and procedures for small scale CDM project activities[2]. The project activity under consideration fits into the following type and category:
    - Type: Type I – Renewable Energy Projects
    - Category: I.D. 'Grid Connected Renewable Energy Generation'

  The applicability criteria pertaining to the above for the project activity under consideration are quoted and addressed in section 2.2 of the VCS PD.

- The definition of "grouped projects" by the Voluntary Carbon Standard 2007.1 is as follows:

  "Any combination of GHG projects or project categories that meets the requirements of the VCS 2007.1 can be registered as a grouped project. A grouped project can include one or more sub-groups, for example a combination of project categories or projects, as long as each sub group retains its distinctive characteristics. A grouped project shall have one central GHG information system and controls associated with the project and its monitoring. It is anticipated that such central GHG information system and controls will include items identified in ISO14064-3:2006, clause 4.5.
  A number of projects and their related methodologies included in a single VCS Project Description (VCS PD) at the time of the validation."

  For the GHG abatement project activity under consideration, the various individual components, *i.e.*, Wind Turbine Generators (WTGs) are promoted by the same project promoting entity (National Enterprises), are categorized under and follow the same methodology, *i.e.*, AMS-I.D, as established in Section 2.2 of this document. The project activity also does not have any central GHG information system and controls associated with the project and its monitoring, as per the requirements for grouped projects by the VCS guidelines and hence is not a grouped project activity.

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

The cumulative power generation capacity of the project is 3.3 Mega Watt (MW) and the corresponding envisaged annual emission reduction potential is 7,402 tonnes CO_2

[1] Please refer to: http://www.v-c-s.org/methodologies.html

[2] Refer to: http://cdm.unfccc.int/methodologies/SSCmethodologies

equivalent (tCO_2e). Therefore the project activity fall under the project type "Projects" as specified in the "Voluntary Carbon Standard 2007.1" by the VCS Association:

- *Micro project*: Less than 5,000 tonnes CO_2 equivalent emissions reductions per year
- *Projects* : 5000 – 1,000,000 tonnes CO_2 equivalent emissions reductions per year
- *Mega Project*: More than 1,000,000 tonnes CO_2 equivalent emissions reductions per year

1.4 A brief description of the project:

The project activity under consideration has been promoted by National Enterprises, referred to as the project proponent throughout this document. The project activity involves the setting up of two numbers of WTGs of cumulative capacity of 3.3 MW (2 X 1.65 MW). The envisaged net electricity generation quantum from the project to the tune of 7938 MWh on an annual basis would be exported to the nearest grid substation of Tamil Nadu Electricity Board, a part of Southern Regional Electricity Grid of India[3]. The basic purpose of the initiative is to generate clean energy through renewable energy source and supply the power to the grid. The power generated by the project displaces an equivalent quantity of power generated by grid by a majority of fossil fuel combustion, thus contributing to the cause of conservation of the conventional sources of energy.

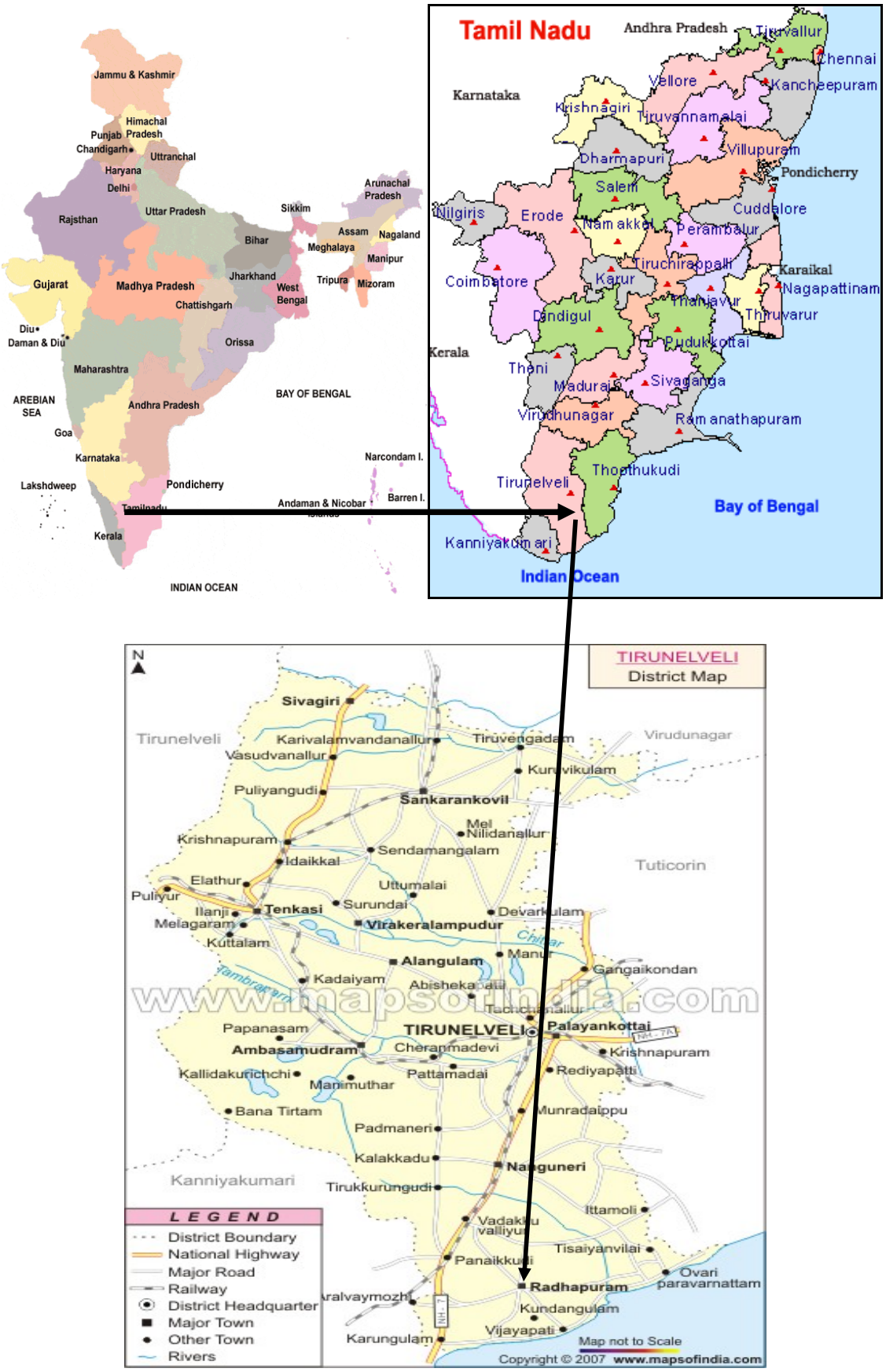
Sl. No.	Capacity (MW)	WTG Supplier	HTSC Number	Date of Commissioning	WTG Location
1	1.65	Vestas	2570	30/03/2008	Samugarangapuram Village
2	1.65		2595	31/03/2008	

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

The details pertaining to the location of each individual WTG installed under the project activity has been provided in the following table:

District	Site	HTSC No.	Latitude	Longitude	Local grid sub station
Tirunelveli	Samugarangapuram Village	2570	N 8˚19'32.7"	E 77˚40'59.2"	TNEB 33 KV (Tirunelveli)
		2595	N 8˚19'59.4"	E 77˚19'27.4"	

[3] The Indian power grid system (or the National Grid) is divided into two regional grids namely NEWNE Regional Grid and Southern Region Grid. These regional grids have independent state Load Dispatch Centres (LDCs) that manage flow of power in their jurisdiction. Power generated by state owned generation units and private owned generation units is consumed by the respective states. Power generated by central sector plants is shared by all states forming part of the grid in a fixed proportion.


Tamil Nadu
Andhra Pradesh
Karnataka
Kerala
Bay of Bengal
Indian Ocean
Tiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Villupuram
Dharmapuri
Pondicherry
Salem
Nilgiris
Erode
Cuddalore
Namakkal
Perambalur
Tiruchirappalli
Karaikal
Coimbatore
Karur
Nagapattinam
Thanjavur
Thiruvarur
Dindigul
Pudukkottai
Theni
Madurai
Sivaganga
Virudhunagar
Ramanathapuram
Thoothukudi
Tirunelveli
Kanniyakumari
Jammu & Kashmir
Himachal Pradesh
Punjab
Chandigarh
Uttranchal
Haryana
Delhi
Rajsthan
Uttar Pradesh
Sikkim
Arunachal Pradesh
Assam
Nagaland
Meghalaya
Manipur
Bihar
Tripura
Mizoram
Jharkhand
West Bengal
Gujarat
Madhya Pradesh
Chattishgarh
Diu
Daman & Diu
Orissa
Maharashtra
AREBIAN SEA
BAY OF BENGAL
Andhra Pradesh
Goa
Karnataka
Narcondam I.
Lakshdweep
Pondicherry
Barren I.
Andaman & Nicobar
Kerala
INDIAN OCEAN
TIRUNELVELI
District Map
N
Sivagiri
Tirunelveli
Karivalamvandanallur
Virudunagar
Vasudvanallur
Puliyangudi
Sankarankovil
Mel Nilidanallur
Krishnapuram
Sendamangalam
Idaikkal
Tuticorin
Elathur
Puliyur
Uttumalai
Ilanji
Tenkasi
Surundai
Melagaram
Virakeralampudur
Kuttalam
Alangulam
Kadaiyam
Gangaikondan
Papanasam
TIRUNELVELI
Palayankottai
Ambasamudram
Cheranmadevi
Krishnapuram
Kallidakurichchi
Pattamadai
Rediyapatti
Manimuthar
Bana Tirtam
Padmaneri
Kalakkadu
Nanguneri
Kanniyakumari
Tirukkurungudi
Ittamoli
Vadakku valliyur
Tisaiyanvilai
Panaikkudi
Radhapuram
Ovari
Kundangulam
Vijayapati
Karungulam
LEGEND
District Boundary
National Highway
Major Road
Railway
District Headquarter
Major Town
Other Town
Rivers
Map not to Scale
Copyright © 2007 www.mapsofindia.com

1.6 Duration of the project activity/crediting period:

Project Lifetime: 20 years

Project start date:
As per relevant guidelines of Voluntary Carbon Standard 2007.1, "project start date" is defined as:

"Date on which the project began reducing or removing GHG emissions"

For the GHG abatement project activity under consideration, the project start date, *i.e.*, the date on which the project began reducing GHG emissions by renewable energy based power generation is the earliest of the dates of the commissioning of the WTGs by the State Electricity Authority *i.e.*, TNEB. As per information furnished in the table in Section 1.4 of this PD, it is established that the project start date for the project activity is **30/3/2008**.

Crediting period start date:
As per relevant guidelines of Voluntary Carbon Standard 2007.1, "crediting period start date" is defined as:

"The date on which the first monitoring period commences"

For the GHG abatement project activity under consideration, the crediting period start date, *i.e.*, the date on which the first monitoring period of GHG abatement by the project activity is considered to commence is the date on which project began reducing GHG emissions by renewable energy based power generation. Hence, it is the *earliest* of the dates of the commissioning of the WTGs by the TNEB. As per information furnished in the table in Section 1.4 of this document, it is established that the crediting period start date is **30/03/2008**.

Crediting Period: 10years

The annual estimation of emission reductions pertaining to the crediting period is as follows:

Years	Annual estimation of emission reductions – tCO_2e
30th March 2008 – 29th March 2009	7,402
30th March 2009 – 29th March 2010	7,402
30th March 2010 – 29th March 2011	7,402
30th March 2011 – 29th March 2012	7,402
30th March 2012 – 29th March 2013	7,402
30th March 2013 – 29th March 2014	7,402
30th March 2014 – 29th March 2015	7,402
30th March 2015 – 29th March 2016	7,402
30th March 2016 – 29th March 2017	7,402
30th March 2017 – 29th March 2018	7,402
Total estimated emission reductions	74,020
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tCO_2e)	7,402

However, it may please be noted that in the event of CDM registration of any of the individual WTG(s) constituting the bundle for availing GHG abatement benefits, the crediting period of the same under VCS shall extend from the start date of the crediting period of the bundle under VCS to the registration date with UNFCCC/CDM.

1.7 Conditions prior to project initiation:

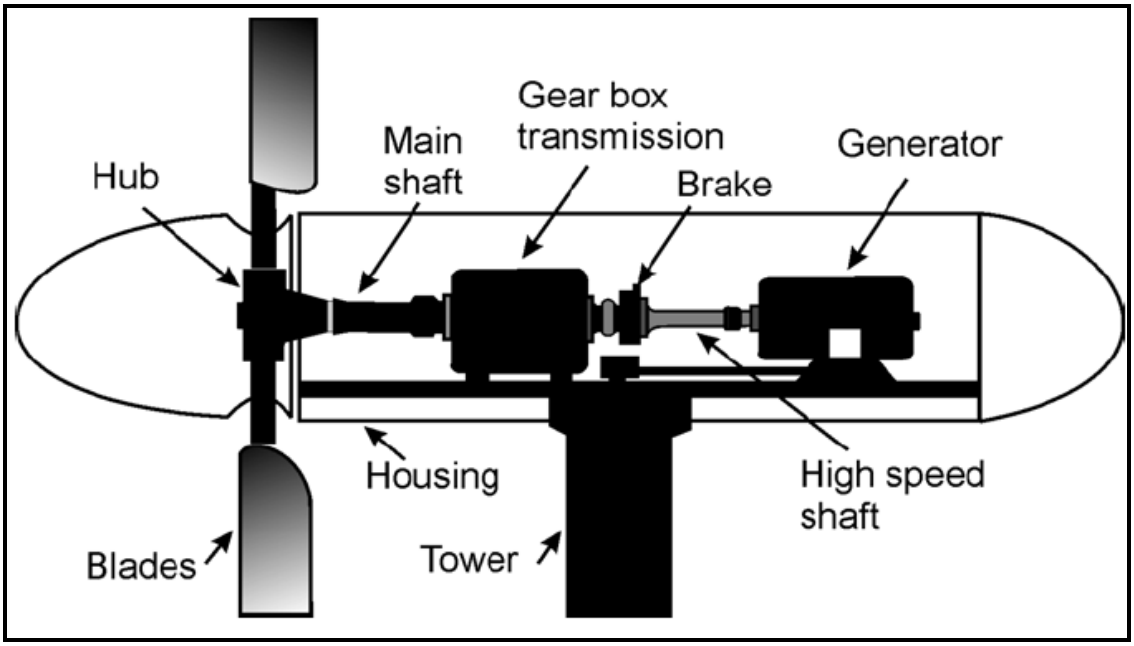
As per the justification provided in Section 2.4 of this document, it can be argued that in the absence of the windmills installed by the project activity, a corresponding quantity of electrical energy would have been generated by the majority of fossil-fuel fired thermal power plants dominating the Southern Regional Electricity Grid of India generation mix. This would result in GHG emissions as per the carbon intensity of the grid-mix. This situation has been identified as the baseline scenario for the project activity in Section 2.4 of this document.

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

The project involves generation of electrical energy using wind, a renewable source of energy. The project activity will generate 7938 MWh of of net electricity annually at a Plant Load Factor (PLF) of 27.46% and export the same to the Southern Regional Grid, mainly powered by the fossil fuel fired power plants. The electricity generation from this project will contribute to corresponding GHG emission reductions to the tune of 7,402 tCO_2e/year.

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

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind has considerable amount of kinetic energy when blowing at high speeds. This kinetic energy when passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity.



Major Mechanical Parts of a Wind Turbine

Technical specification of the Wind Turbines Generator (V 82 – 1650 kW) used in the project activity has been detailed below:

Features of WTG		
Sr. No.	**Particulars**	**Specifications**
Main Specifications		
1.	Rotor diameter	82 m
2.	Number of blades	3
3.	Power Control	Active Stall
4.	Rotational Speed (Synchronous)	14.4 rpm
5.	Rotor position	Upwind
6.	Nominal Power	1650 kW
7.	Hub height	78 m
Rotor		
8.	Rotor Diameter	82 m
9.	Tilt angle	5^0
10.	Swept area	5281 m^2
Blade		
11.	Material	Fibre/Epoxy/Wood
12.	Blade Length	40 m
12.	Blade Profile	FFA – W3, NACA 63.4
13.	Air Brake	Full Blade
Hub		
14.	Type	Spherical
15.	Material	EN-GJS-400-18U-LT
Main Shaft		
16.	Type	Forged shaft and flange
17.	Material	34 CrNiMo6
Main Bearings		
18.	Front Bearing	Spherical roller bearings
Main Gearbox		
19.	Gear Ratio	1:70.2
20.	Mechanical Power	1800 kW
Couplings		
21.	Gearbox/Generator	Flexible
Generator		
22.	Nominal Power	1650 kW
23.	Rotational Speed (Synchronous)	1012 rpm at rated power
24.	Insulation class	F/B
25.	Protection class (IEC529)	IP54
Machine Frame		
26.	Type	Casted front end
27.	Material	EN-GJS-400-18U-LT
Yawning System		
28.	Yaw bearing	Ball bearing, internal gearing
29.	Yaw Motor	6 Nos.
30.	Yaw gear	6 pcs
31.	Gearing ratio	1:1666
32.	Yaw brake	Hydraulic disc brakes, 6 pcs.

Mechanical Brake		
33.	Type	Fail Safe – Hydraulic release
34.	Position	Mounted on high speed shaft
35.	Number of calipers	1 pc.
Tower		
36.	Type	Conical tubular
37.	Height	75.5 m
38.	Corrosion protection	Acc. To ISO 12944:C5 I
Control System		
39.	Manufacturer	Vestas Control systems
40.	Type	Microprocessor based

The expected level of performance in terms of electricity generation from the project activity, along with the GHG abatement by the project activity is provided below:

- Installed power generation capacity: 3.3 MW
- Plant Load Factor (PLF) 27.46 %
- Net electricity export to the grid per annum: 7938 MWh
- GHG abatement potential per annum: 7,402 tCO_2e

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

The project activity under consideration complies with the applicable regional and national level legal and regulatory requirements for installation and operation of wind-farms. The same is listed as follows:

Sl. No.	Clearance/ Approval/ Agreement	Date of Issue
1	Land Sale Deed	19th February, 2008
2	Commissioning Certificates	30th & 31st March, 2008
3	Power Purchase Agreement	24th April, 2008
4	Clearance from TNEB Board	05th March 2008

The documents related to relevant statutory clearances would be made available to the Validator during the validation exercise.

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

The GHG emission reduction quantum accruable from the project activity is dependant on net electricity generation quantity. Factors contributing to considerable variations in the same are highlighted below:

- Variation in wind availability leading to variation in the plant load factor as compared to the estimated quantity based on the wind resource availability report
- Interruptions in plant operations and loss of potential electricity generation due to
  - Failure of WTG equipment or components
  - Failure in the local grid leading to evacuation problems
  - Natural calamities or other factors not under the control of the project promoter causing physical damages to equipment and erected structures

The project proponent is confronted by potential risks to the successful operation and achievement of the envisaged GHG abatement quantum of the project activity owing to the above mentioned factors. However, the average annual GHG abatement potential of the project activity has been estimated based on average of actual figures of electricity generation from the WTGs since commissioning. Thus actual GHG emission reduction per annum is unlikely to vary considerably from the value projected in the PD.

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 of 3.3 MW (2 X 1.65MW) of wind power generation at Samurangapuram Village, Tirunelveli, Tamil Nadu, India. When compared to fossil-fuel fired power generation applications, wind power generation does not entail fossil fuel combustion or any other direct or indirect act of GHG emissions. Thus removal or destruction of GHG emissions is also not possible. The above explanation confirms that the project activity under consideration was not implemented to create GHG emissions primarily 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).

It is to be noted that for each of the WTGs under consideration that the GHG abatement benefits (CERs/VCUs) for any particular duration of time can be claimed only under one GHG abatement scheme (CDM/VCS). Hence, the VCUs accumulated for the project activity from the date of crediting period would be claimed under the VCS mechanism. Furthermore, the VCS crediting period of the individual wind-mill would extend till the date of CDM Registration, after which CERs would be claimed under CDM for the same. In case of failure in registration in the CDM cycle, the carbon credits related benefits will be continued to be claimed under VCS scheme.

No mechanisms pertaining to Renewable Energy Certificates (RECs) have been implemented in the host country of the project activity under consideration, i.e., India as on the date of this document. However, in the event that any such future REC mechanisms are implemented for availing GHG abatement benefits and issuance of RECs imply that carbon credits cannot be issued under global mechanisms or vice-versa, the project proponents shall apply for issuance of only one of the two benefits, i.e., RECs or carbon credits.

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

The WTGs installed under the project activity are eligible to apply for environmental credit like CDM and VCS. The details of the progress of the individual WTGs in the CDM route (if applicable) are presented below:

Project Promoting Company	HTSC No	Other GHG Program(s)	Application Status
National Enterprises	2570	CDM	PDD under preparation
	2595		

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

Contact Information of Project Proponent in the Project Activity

Organization:	National Enterprises
Street/P. O. Box:	P.O. Box No. 44
Building:	
City:	Barabil, Keonjhar
State/Region:	Orissa
Postfix/ZIP:	758 035
Country:	India
Telephone:	06767-275521
Fax:	06767-275631
E-Mail:	gapl_sponge@yahoo.co.in
URL:	
Represented by:	
Title:	Proprietor
Salutation:	Mr.
Last Name:	Grewal
Middle Name:	Singh
First Name:	Charanjit
Department:	
Mobile:	
Direct Fax:	
Direct Tel:	
Personal E-Mail:	

Please refer to the subsequent Sections 3.4 of this document for details pertaining to the roles and responsibilities of Project proponent for the project activity.

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.):

Purpose:
The purpose of the wind-mills set up by the project activity is as follows:

- Clean power generation by harnessing a renewable natural resource i.e., wind power
- Abatement of GHG emissions for power generation from combustion of non-renewable sources of energy
- Increased proportion of renewable energy directly in the regional electricity grid and indirectly in the national electricity grid
- Contribution to the causes of fossil-fuel conservation, climate change mitigation and energy security

Contribution of the Project Activity to Sustainable Development:
The contribution of the project activity to the sustainable development can be substantiated as follows:

Social Well Being	• Harnessing renewable energy by means of a clean power generation technology • No requirement of relocation or rehabilitation as there is no human

	displacement attributable to the project activity • Provision of employment and business opportunities for local populace during installation, commissioning and operational phases • Development of road network, transportation facilities and other infrastructure development initiatives
Economic Well being	• Contribution towards grid stability and abridging the demand-supply gap in the Indian Electricity Grid • Creation of business opportunities for local stakeholders
Technological Well being	• Employment of clean power generation technology by harnessing wind energy potential • Reduction in transmission and distribution losses from power plants in the grid to remote areas
Environmental Well being	• GHG abatement by displacement of electricity generated by the fossil fuel dominated grid-mix • Contribution to causes of mitigation of climate change and global warming • No environmental disturbance or ecological imbalance caused to the surroundings, over total project lifetime • Contribution towards reduction in the levels of SOx, NOx, and SPM associated with combustion of fossil fuels for power generation

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:

Approved Baseline Methodology: **'**Grid Connected Renewable Electricity Generation'

Reference: Category I.D - Renewable Energy Projects: Approved Small Scale Methodology AMS –I.D. / Version 15[4] of the Appendix B of Simplified Modalities and Procedures (M & P) of Small Scale CDM Project Activities

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

The project activity has been categorised under renewable electricity (wind power) generation for a grid system (Southern Regional Electricity Grid of India). Hence as per appendix B - 'indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories', of the simplified modalities and procedures for small scale CDM project activities the proposed CDM project falls under category I.D – Grid connected renewable electricity generation. The applicability of the project activity as small scale as per approved methodology AMS I.D. has been demonstrated below:

1. "This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit."

The project activity involves the setting up of two WTGs, i.e., renewable generating units of cumulative power generation capacity of 3.3 MW to harness a renewable source of energy (wind power potential) and export of the net electricity generation to the fossil fuel dominated electricity generation and distribution system, i.e., the Southern Regional Electricity Grid of India[5]. In the process, an equivalent quantum of electricity that would have been generated by the grid by the grid electricity generation mix is displaced by the project activity.

The carbon intensity of the fossil-fuel dominated generation mix of the grid is evident from the value of the Simple Operating Margin CO_2 Emission Factor of the Southern Regional Electricity Grid system: 0.97 tonnes CO2e/MWh. As per the worksheet named "Data" of the Central Electricity Authority CO_2 Baseline Database Version 5.0, dated November 2009, the ranges of carbon intensity of various types of power generation applications in the Indian Power System presently operational are provided below:

Carbon Intensity of India's Present Power Generation Capacity Installation		
Power Plant	**Power Generation Fuel**	**Carbon Intensity (CO_2e/MWh)**

[4] http://cdm.unfccc.int/EB/050/eb50_repan29.pdf

[5] The Southern Regional Electricity Grid of India is primarily constituted of fossil- fuel fired thermal power plants. Refer to CO_2 Baseline Database Version 5.0 Dated November 2009 available at http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf

		Lower Limit	Upper Limit
Hydro	-	0.00	0.00
Nuclear	-	0.00	0.00
Thermal	Coal, Lignite	1.24	1.88
	Oil (Diesel, LSHS, Naphtha)	0.63	0.65
	Gas (NG, Naphtha, CCPP/CCGT)	0.33	0.78
	Multi-fuel (Coal, Oil, Naphtha, Gas)	0.63	1.0

Hence, it is evident from the above table that the GHG emissions associated with power generation are solely attributable to the various thermal power plants for the Southern Regional grid. It can be concluded that there is at least one fossil fuel fired based plant connected to the Southern Regional Grid of India to which the power in the form of electricity generated is being exported by the WTGs considered under the project activity.

Hence the project activity complies with this criterion of the methodology.

2. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:

- *The project activity is implemented in an existing reservoir with no change in the volume of reservoir;*
- *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/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.*

The project activity involves generation of electricity for harnessing the wind power potential by means of installation of WTGs and does not involve any hydro power generation. Hence, this point is not applicable for the project activity under consideration.

3. "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[6], the capacity of the entire unit shall not exceed the limit of 15MW".

The project activity solely involves wind power generation with cumulative capacity of 3.3 MW, which is less than the 15 MW cap stipulated by the methodology applicability criterion under consideration.
Hence the project activity complies with this criterion of the methodology.

4. "Combined heat and power (co-generation) systems are not eligible under this category"

The project activity involves generation of only one form of energy – electricity, by harnessing the wind power potential of the region through WTG installation and does not entail the installation or operation of any co-generation system.

[6] Co-fired system uses both fossil and renewable fuels.

Hence the project activity complies with this criterion of the methodology.

5. "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 distinct7 from the existing units."

The project activity is a greenfield project and does not involve capacity addition of renewable energy generation units at any existing renewable power generation facility.
Hence the project activity complies with this criterion of the methodology.

6. "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"

The renewable energy generating WTGs employed by the project activity are greenfield projects and hence do not involve retrofitting or modification of any existing renewable energy generation facility.
Hence the project activity complies with this criterion of the methodology.

Thus, the project activity fulfills all the applicability criteria of the simplified small scale methodology AMS-I.D./ Version 15.

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

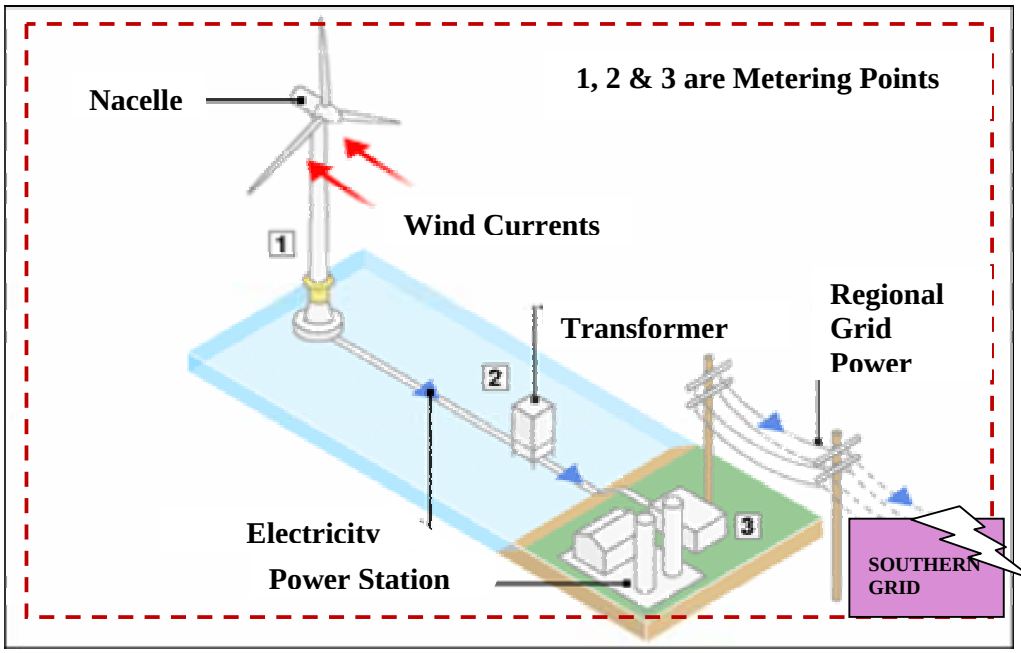
The GHG sources and sinks included in the project boundary are given in the table below:

Emission sources excluded or included in the project boundary				
	Source	**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants connected to the grid 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	No source	CO_2	No	Not applicable for wind projects
		CH_4	No	Not applicable for wind projects

[7] 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".

Emission sources excluded or included in the project boundary				
	Source	**Gas**	**Included?**	**Justification/ Explanation**
		N_2O	No	Not applicable for wind projects

Project boundary specified is that encompasses the physical, geographical site of the renewable generation source. This includes the wind turbine installation, pooling and sub-stations. The proposed project activity evacuates the power to the Southern Regional Grid. Therefore, all the power plants contributing electricity to the Southern Regional Grid are taken in the connected (project) electricity system for the purpose of baseline estimation.



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

The project promoters identified the following alternatives to the project activity under consideration:

Alternative 1 – Continuation of existing scenario: electricity generation at the grid end as per the grid-mix of power generating sources

In absence of the project activity under consideration, an equivalent amount of electricity would have been generated by the Southern Regional Electricity Grid of India as per the mix of power generating sources. The Southern Regional Electricity Grid will undergo a few capacity additions in due course of time to abridge the demand-supply gap in the long run. The most plausible choice in such a situation based on the existing grid-mix is the setting up of fossil-fuel fired thermal power plants, resulting in GHG emissions as per the carbon intensity of the above-mentioned grid. As per the following data sourced from the Central Electricity Authority, it can be seen that fossil-fuel fired thermal power plants in Southern Region are a major source of

power source of power generation.

(As on 31-08-09)

SL. NO.	REGION	THERMAL				Nuclear	HYDRO (Renewable)	R.E.S.@ (MNRE)	TOTAL
		COAL	GAS	DSL	TOTAL				
1	Northern	19532.95	3531.19	12.99	23077.13	1180.00	13425.15	1766.37	39448.65
2	Western	26665.18	7748.22	17.48	34430.88	1840.00	7448.50	4023.62	47743.00
3	Southern	17282.50	4150.20	939.32	22372.02	1100.00	10993.18	7047.90	41513.10
4	Eastern	16709.92	190.00	17.20	16917.12	0.00	3933.93	227.41	21078.46
5	N. Eastern	93.33	766.00	142.74	1002.07	0.00	1116.00	171.00	2289.07
6	Islands	0.00	0.00	70.02	70.02	0.00	0.00	6.11	76.13
7	All India	80283.88	16385.61	1199.75	97869.24	4120.00	36916.76	13242.41	152148.41

Captive Genrating capacity connected to the Grid (MW) = 19509

RES -Renewable Energy Sources includes Small Hydro Project(SHP), Biomass Gas(BG), Biomass Power(BP), Urban & Industrial waste Power(U&I), and Wind Energy.

Based on data as on 30.09.2008 as furnished by MNRE in November, 2008

This alternative is in compliance with all applicable legal and regulatory requirements and would also not entail any investment by the project promoter, as was required for the project activity under consideration.

Thus, this alternative may be a part of the baseline. Therefore the Alternative 1 is considered further for arriving at the baseline scenario.

Alternative 2 - The project activity undertaken without the consideration of GHG abatement benefits

The project activity involves the setting up of wind-mills and exporting the electricity generated to the Southern Grid at the nearest state grid sub-station(s). This alternative speaks of implementing the project but without the consideration of potential revenues available through the sale of GHG abatement benefits. This alternative is in compliance with all applicable legal and regulatory requirements. However, this alternative has associated barriers to its implementation which prevented the project promoter to implement the project activity. The consideration of potential revenues that can be generated through carbon trading played a key role in the project promoter's decision to proceed with the project activity. Therefore the alternative under discussion would not be a credible and realistic alternative option for the project promoters to implement.

Therefore the Alternative 2 is not considered further for arriving at the baseline scenario.

Hence, Alternative 1: "*Continuation of existing scenario: electricity generation at the grid end as per the grid-mix of power generating sources*" has been established as the most viable option available to the project promoters in absence of the project activity. Therefore this alternative option is considered as the baseline scenario. This is further substantiated by the fact that this scenario was the prevailing scenario before the implementation of the GHG abatement project.

Baseline Scenario for electricity generation:

The baseline scenario for electricity generation is the electricity supplied by the VCS 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. The calculation of the baseline emission factor using the combined margin methodology has been detailed in Section 4.1.

Baseline Estimation:

Baseline methodology for project category I.D has been detailed in paragraphs 8-13 of the approved small scale methodology AMS I.D. (Version 15, EB 50). Paragraph 10 of the approved methodology applies to this project activity, which states that:
For all other systems, the baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in kWh of electricity produced by the renewable generating unit multiplied by an emission factor.

$BE_y = EG_{BL,y} \times EF_{CO_2}$

Where:

BE_y : *Baseline Emissions in year y; t CO_2*

$EG_{BL,y}$: *Energy baseline in year y; kWh*

EF_{CO_2} : *CO2 Emission Factor in year y; t CO2e/kWh*

As per Paragraph 11 of the approved methodology, the Emission Factor can be calculated in a transparent and conservative manner as follows:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the Emission Factor for an electricity system'.

OR

b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.
Calculations must be based on data from an official source (where available)[8] and made publicly available.

Baseline emission reductions have been estimated using combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in 'Tool to calculate the emission factor for an electricity system Version 01 (EB 35)'.
In the proposed baseline, Southern Regional Grid of India grid is used as the reference for estimating the current generation mix.
Following information is used for baseline determination:

[8] Plant Emission Factors used for the calculation of Emission Factors should be obtained in the following priority:
1. *Acquired directly* from the dispatch center or power producers, if available; or
2. *Calculated*, if data on fuel type, fuel Emission Factor, fuel input and power output can be obtained for each plant; If confidential data available from the relevant host Party authority are used, the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon Emission Factor and the corresponding list of plants;
3. *Calculated*, as above, but using estimates such as: default IPCC values from the 2006 IPCC Guidelines for National GHG Inventories for net calorific values and carbon Emission Factors for fuels instead of plant-specific values technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's
technology, size and commissioning date; or
4. *Calculated*, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

Sr. No.	Key information/data used for baseline	Source of data/information
1.	Electricity generated	Actual electricity sale invoices.
2	Grid emission factor (Southern Regional Grid of India)	CO2 Baseline Database –Version 5, November, 2009 by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf

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):

Barriers and Additionality (As per the UNFCCC/CDM Additionality guidance for small scale CDM projects)

As per the decision 17/cp.7 paragraph 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The additionality aspects of the project are discussed below in accordance with Attachment A of appendix B of the simplified M & P for small scale CDM project activities that states:

"Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:
(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."

Investment Additionality:

At the project conception stage, an investment analysis was conducted for the project activity under consideration by the project promoter with the equity Internal Rate of Return (IRR) as the financial indicator. IRR is one of the known financial indicators used by banks, financial institutions and project developers for financial evaluation of project feasibility during investment making decisions. At the project conceptualisation stage, the equity IRR for the project activity was calculated and compared with the benchmark or hurdle rate of investment for the approval of project of the project promoter. However, the equity IRR was found to be lesser than the hurdle rate of investment IRR for the project approval.
The hurdle rate of investment (cost of equity) has been determined using the Capital Asset Pricing Model (CAPM) considering Beta values of power generating companies in India that were listed in the stock market at the time of this investment.

This is in relevance to the guidance to investment analysis issued in EB 41[9] (paragraph 11) which states that *"In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR".*
The project activity is a greenfield wind power generation project that generates and supplies electricity to the Southern Regional Grid of India. The concept of generation of power through wind power has been conceived by other project developers also in the area concerned where the WTGs under consideration are commissioned. The tool for demonstration and assessment of additionality[10] states that in such cases (where the project has more than one potential developer) the benchmark cannot be based on internal cost of equity hence, company specific parameters (such as company specific beta, etc.) should not be used and shall be based on publicly available data sources which can be clearly validated by the DOE. Accordingly, the cost of equity applicable to the project type has been calculated using publicly available financial data sources and has been considered as the benchmark.
The cost of equity can be computed by the formula shown below:

$$K_e = R_e + B \times (R_m - R_f)$$

where:

K_e = Cost of equity;

R_f = Risk-free rate of return;

B = Beta;

$R_m - R_f$ = Market risk premium;

Risk free rate:

The risk-free interest rate is the interest rate which is obtained by investing in financial instruments with no default risk, therefore the rate of interest on government bonds are considered as risk free rates.
Accordingly the risk free rate has been taken from long dated Indian government bond rates available at the time of project approval by the project promoter. The data on government bond rates is published by Reserve Bank of India. (Web-link: http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/79542.pdf)
The applicable risk free rate is 7.89 %.

Risk Premium:

The most common approach for estimating the risk premium is to base it on historical data, in the CAPM, the risk premium is estimated by looking at the difference between average return on stocks and average return on government securities over an extended period of history.
Therefore the risk premium has been calculated as the difference in compounded annual return between the BSE-Sensex and the Government bond rates, *i.e*. 1999 – 2007. The detailed calculations are presented in the attached excel sheet.

[9] http://cdm.unfccc.int/EB/041/eb41_repan45.pdf

[10] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

The applicable risk premium is 22.70 %.

Beta:

Beta (β) indicates the sensitivity of the company to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group.
The applicable Beta value has been determined on the basis of the calculated Beta values of power generating companies in India which were listed on the stock exchange at the time of this investment.
The table below summarises the beta values:

Company Name	Beta
CESC LTD	1.04
JAIPRAKASH HYDRO	0.66
NEYVELI LIGNITE	0.95
RELIANCE INFRASTRUCTURE	0.72
TATA POWER	0.95
NTPC LTD	0.62
GUJARAT INDUSTRIES POWER COMPANY LTD	0.98
BF UTILITIES LIMITED	1.21

Minimum Beta = 0.62

Calculation of benchmark return on equity:

Cost of Equity, $K_e = R_e + B \times (R_m - R_f)$

= (7.89 % +0.62 * 22.70 %)

= 21.93 %

As can be seen, the benchmark cost of equity works out to **21.93 %**

The various assumptions in the calculation of the IRR provided above are elucidated below.

Various Assumptions in Calculating Equity IRR:

Sl. No.	Parameters	Unit	Value (per 1.65 MW WTG)	Reference
1	Project Lifetime	Years	20	Proposal/Offer from VWTIPL to the project promoters for WTG supply.
2	Capacity of each individual WTG	MW	1.65	
3	No of WTGs installed	Nos.	2	
4	Estimated annual net generation from each WTG	Lakh kWh	56.57	
5	Tariff for Power	INR/ kWh	2.90	

Sl. No.	Parameters	Unit	Value (per 1.65 MW WTG)	Reference
	Sale to the SEB			
6	Estimated annual escalation in Tariff	%	0	
7	Total Project Cost:			
A	- Cost of Land	INR Lakhs		
B	- Cost of windmills, Tower & Electrical Items	INR Lakhs	1050.06	
C	- Erection, Commissioning and Civil Work	INR Lakhs	44.94	
D	- Substation charges	INR Lakhs	0	
8	Insurance	INR Lakhs	4.93	
9	O&M cost for the first year	INR Lakhs	12	
10	Service Tax on O&M cost each year	%	12.36	
11	O&M free for no. of years	Years	2	
12	Annual escalation on O&M cost	%	7.5	
13	Income Tax Rate	%	33.99	http://ezinearticles.com/?Direct-Tax-Rates-in-India-for-AY-2008---2009&id=906600
14	Book Depreciation Rate	%	4.50	As per TNERC Tariff Order
15	Accelerated Depreciation Rate	%	80	Direct Tax Ready Reckoner

The IRR for the project activity is calculated to be:

Name of the Company	IRR	Benchmark
National Enterprises	13.39%	21.93 %

Sensitivity Analysis:

A Sensitivity Analysis is conducted to ensure the credibility and robustness of the IRR calculation with reasonable variations in the values of the various assumptions made for the relevant parameters, such that the IRR increases. For the IRR calculation presented above, an increment in the IRR can be a resultant of the increase in the project revenue, attributable to the following scenarios identified and addressed below:

1. *Increased Tariff Rate realisation for power sale:*

The project promoter has considered a tariff rate of Rs. 2.90/ kWh for the period of 20 years as the power purchase agreement is signed between the project promoter and Tamil Nadu Electricity Board for the same time frame. However, there can be situations, where in the tariff rate might suffer some fluctuations. Hence, a sensitivity analysis is carried by varying the tariff rate by 10% and is tabulated below:

Percentage Change in Tariff	**-10%**	**0%**	**10%**
Tariff Rate(Rs./unit)	2.61	2.90	3.19
IRR without CDM benefits	11.37%	13.39%	15.30%

The IRR does not cross the chosen benchmark even if the tariff rate increases by 10% of the existing value.

2. *Increased electricity generation from the project activity, represented by an increment in the Plant Load Factor (PLF)*

It can be perceived that financial return of the project activity is highly sensitive to generation. Therefore, variation in generation has been chosen as the parameter based on which the sensitivity analysis has been done. Given below are the results of 10% variation in generation on the returns to the project.The sensitivity analysis carried out for fluctuation in Plant Load Factor (PLF) value is being shown below in a table:

Percentage Change in PLF	**-10%**	**0%**	**10%**
PLF	35.23%	39.14%	43.05%
IRR without CDM benefits	11.38%	13.39%	15.29%

The IRR does not cross the chosen benchmark even if the PLF increases by 10% of the existing value.

3. *Variation in the project cost:*

It can be perceived that financial return of the project activity is highly sensitive to the project cost. Therefore, variation in the project cost has been chosen as the parameter based on which the sensitivity analysis has been done. Given below are the results of 10% variation in the project cost on the returns to the project.The sensitivity analysis carried out for fluctuation in the project cost value is being shown below in a table:

Percentage Change in the Project Cost	**-10%**	**0%**	**10%**
Total Project Cost (in Lacs INR)	1971	2190.00	2409
IRR without CDM benefits	15.91%	13.39%	11.44%

The IRR does not cross the chosen benchmark even if the Project Cost decreases 10% of the existing value.

In view of the above analysis, the proposed project activity is additional and not the same as the baseline scenario.

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:

Approved Monitoring Methodology: **'**Grid Connected Renewable Electricity Generation'

Reference: Category I.D - Renewable Energy Projects: Approved Small Scale Methodology AMS –I.D. / Version 15

As per the Indicative simplified baseline and monitoring methodology AMS-I.D./ version 15,

"Monitoring shall consist of metering the electricity generated by the renewable technology"
Please refer to the subsequent Sections 3.2, 3.3 and 3.4 of this document for details pertaining to the monitoring aspects for the project activity.

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

- *Purpose of monitoring:*
  The Monitoring and Verification (M&V) procedures establish a set of standards to monitor and verify the project's performance (*i.e.*, GHG reductions). Suitable data collection methods are to be devised and data interpretation techniques are to be defined for monitoring and verification of GHG emissions. Technical / efficiency / performance parameters are specifically focussed upon, simultaneously allowing the scope for review, scrutiny and benchmarking of all these information against the M & V plan.
  The M&V Plan provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.
  Effective GHG abatement monitoring and realisation of associated benefits stand on the quantification and keeping a track of the GHG emission reductions the project results in. The project activity would reduce the carbon dioxide whereas an appropriate monitoring system would ensure this reduction is quantified and helps maintaining the required level.
  Also a proactive and efficient monitoring system brings about the flaws in the system if any are identified and opens up the opportunities for improvement.

  The general monitoring principles are based on:
  - *Frequency*: Since the emission reduction units from the project activity would be determined by the electrical energy exported to the State Electricity Authority by the project activity, it becomes important for the project activity to monitor the amount of electricity exported. The data will be recorded by a main meter and a

check-meter at the grid-substation pertaining to the respective WTGs as mentioned in section 1.5 of this PD. Generation meters located at the generator outlet of each WTG would also measure the gross generation by each individual WTG. The meters will be provided with totalisers from which cumulative readings can be taken.

- *Reliability:* 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 energy meters will be calibrated on a regular basis i.e annually by the respective State Electricity Authorities for ensuring reliability of the system. The accuracy class of the monitoring equipments i.e the meters is 0.5 class.

- *Registration and Reporting*: Registration of data would be in the records maintained by the project proponent and there from the Electricity Export Invoices raised to the State Electricity Authorities. Monthly reports would be prepared stating the net electricity exported and archived by the project proponent. The relevant data will be archived in the paper/electronic form for a period of 2 years past the crediting period of the project activity

- *Types of data and information to be reported, including units of measurement:*
  Please refer to "Section 3.3: Data and parameters monitored" of the VCS PD for the monitoring details pertaining to types, units and sources of data and description of the monitoring procedure.

- *Origin of the data*
  There are primarily two types of data sources to be utilised for calculation of the GHG abatement quantum of the project activity:
  - Internal: Documents or records maintained by the project proponent which in turn are used to raise monthly invoices to the TNEB
  - External: Public Domain Sources like the Central Electricity Authority CO_2 Baseline Database Version 5.0

  For further details, please refer to the "Section 3.3: Data and parameters monitored" of this document.

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

For detailed GHG emission reduction procedures and sample calculation tables, please refer to the sections 4.2, 4.3 and 4.4 of the VCS PD.

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

Please refer to the "Section 3.3: Data and parameters monitored" of this document.

- *Monitoring roles and responsibilities :*

Please refer to the "Section 3.4: Description of the Monitoring Plan" of this document.

- *Managing data quality:*

Please refer to the "Section 3.4: Description of the Monitoring Plan" of this document.

- *Data uncertainty due to defects in energy meters*

In the event of defects in main energy meters, relevant data would be obtained from check-meters. Such arrangement ensures that data uncertainty is avoided in case of uncertainty in the main meter.

- *Data uncertainty during meter failure*

In the absence of alternative arrangements like check-meters for obtaining the measurements of the parameters monitored, the relevant data would be discarded and the corresponding time period for which the project operational data is absent would be removed from that monitoring period of the project activity crediting period. Reliability of the data derived from meter readings shall be ensured by means of the calibration of the energy meters and incorporation of the error correction applied to the meter readings from the date of last calibration.

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

The following parameters would be monitored as mentioned in the tables presented below.

Data / Parameter:	$EG_{BL,y}$
Data unit:	MWh /Year
Description:	Net Electricity Exported by the two WTGs to the Southern Regional Electricity Grid in the year y
Source of data to be used:	Monthly Electricity Export Invoices raised to regional electricity utility company for the two WTGs
Value of data applied for the purpose of calculating expected emission reductions	7938 (Please refer to Section 4.2 of this PD)
Description of measurement methods and procedures to be applied:	The data is calculated using certain measured and estimated parameters. (Measured parameters viz. import of electricity from the grid, export of electricity to the grid and the reactive power generated and estimated parameters viz. transmission losses) in a way as described in section 3.4 of PD. The Energy Meters (Tri vector meter of accuracy class 0.5) installed at the substation and the WTG switch yard measures the variable on a continuous basis. These are two-way meters. Utility officials take the readings (joint meter reading) on these meters on monthly basis and the same reading is used to determine the net power exported to the grid and determine the extent of mitigation of GHG over a period of time. A detail on metering and measurement methods is given in section 3.4 of the PD. **Metering equipment:** Tri vector Energy Meter **Accuracy Class:** 0.5 **Data type: Estimated (using meter readings) Archiving:** Electronic **Recording Frequency:** Monthly **Responsibility:** The O&M operator is responsible for the regular recording of data. **Calibration Frequency:** The meters are calibrated by the State Utility testing division annually.
QA/QC procedures to be applied:	The project activity emission reductions are based on the net electricity supplied ($EG_{BL,y}$) by the individual WTG. $EG_{BL,y}$ is referred from the monthly invoice raised by the PP to State Utility Department based on the monthly JMR Report issued by State Electricity Department to the Project Proponent. The main meter and a check meters at the sending end of the sub-station are sealed by and are in the custody of State Electricity Department. The accuracy of main meter can be verified by comparing it with the check meter. The calibration of the meters will be carried out

	by State Electricity Department annually/or at least once in three years, as per UNFCCC guidelines [11] and State Electricity Regulatory Commissions. Other than periodic calibration of the meters, the reading of both meters will be matched every month.
Any comment:	The relevant data will be recorded in electronic form and the same along with the electricity bills will be archived for two years beyond the crediting period.

The following parameters are available during validation and would be fixed for the duration of the crediting period of the project activity as mentioned in the tables presented below.

Data / Parameter:	Operating margin emission factor (inclusive of imports) - $EF_{grid,OM,y}$
Data unit:	tCO_2/ MWh
Description:	Operating Margin CO_2 emission factor of the grid
Source of data to be used:	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 5, Date: November, 2009) http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf
Value of data applied for the purpose of calculating expected emission reductions	0.97 (Value pertaining to the year 2008-2009)
Description of measurement methods and procedures to be applied:	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines of the 'Tool to calculate the emission factor for an electricity system'[12]
QA/QC procedures to be applied:	Not Applicable
Any comment:	The parameter has been calculated ex-ante and will remain fixed for the entire duration of the crediting period of the project activity. The relevant data will be recorded in electronic form and the same will be archived for two years beyond the crediting period.

Data / Parameter:	Build margin emission factor - $EF_{grid,BM,y}$
Data unit:	tCO_2/ MWh
Description:	Build Margin CO_2 emission factor of the grid
Source of data to be used:	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 5, Date: November, 2009) http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf
Value of data applied for the purpose of calculating expected emission reductions	0.82 (Value pertaining to the year 2008-2009)
Description of measurement methods and procedures to be	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines Tool to calculate the

[11] paragraph 12.c., EB 41 Report
[12] CDM Methodology Tool by UNFCCC; please refer to:
http://cdm.unfccc.int/Reference/tools/ls/meth_tool07_v01_1.pdf

applied:	emission factor for an electricity system'
QA/QC procedures to be applied:	Not Applicable
Any comment:	The parameter has been calculated ex-ante and will remain fixed for the entire duration of the crediting period of the project activity. The relevant data will be recorded in electronic form and the same will be archived for two years beyond the crediting period.

Data / Parameter:	Combined Margin Emission Factor - $EF_{grid,CM,y}$
Data unit:	tCO_2/ MWh
Description:	Combined Margin CO_2 emission factor of the Southern regional Grid of India
Source of data to be used:	CO_2 Baseline Database
Value of data applied for the purpose of calculating expected emission reductions	0.93 As per the calculation procedure explained in section 4.2 of this document.
Description of measurement methods and procedures to be applied:	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines Tool to calculate the emission factor for an electricity system'
QA/QC procedures to be applied:	Not Applicable
Any comment:	The parameter has been calculated ex-ante and will remain fixed for the entire duration of the crediting period of the project activity. The relevant data will be recorded in electronic form and the same will be archived for two years beyond the crediting period.

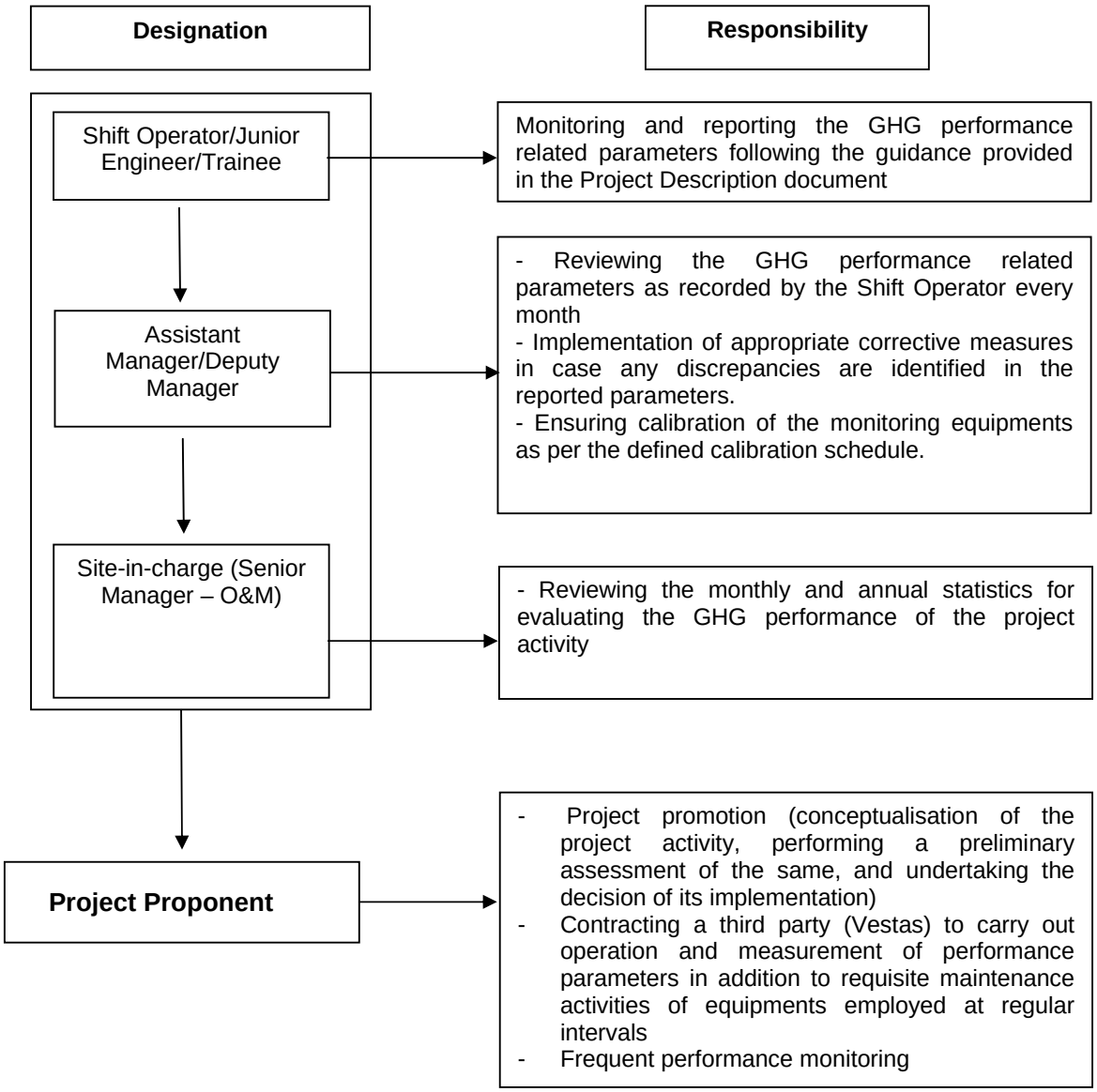
3.4 Description of the monitoring plan

The project activity falls in the technology measure as described in the paragraph 1 of the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. The applicable simplified baseline and monitoring methodology for selected small scale CDM project activities AMS I.D. version 15 requires monitoring of the following.

- Metering the electricity generated by the renewable technology
- In the case of co-fired plants, the amount of biomass and fossil fuel input consumed.

Further, wind based electricity generation is not associated with any kind of leakages.

Hence, the sole parameter for monitoring is the electricity supplied to the grid. The Project is operated and managed by Vestas. They follow the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project.
The accuracy of monitoring parameter is ensured by adhering to the calibration and testing procedure as set in the power purchase agreement. The project will adhere to all the mandatory regulatory and statutory requirements at the state as well as national level.
The operational and management structure implemented by National Enterprises along with Vestas is as follows



The daily generation report is sent to National Enterprises by Vestas. The daily generation report contains data on grid availability, machine availability and generation of electricity. National Enterprises reviews the machine availability from the generation report

The monitored data is maintained both as soft and hard copies in the form of photo copies of generation report, issued by TNEB every month showing export and import of energy. The copies of such TNEB generation report are primary document relating to actual number of units fed to the grid and will be maintained for 10 + 2 (crediting + 2 years) years. Daily generation reports from Vestas would be compiled into monthly reports and saved electronically for 10+2 years (crediting + 2 years).

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

The following Approved Small Scale Methodology has been followed for the project activity under consideration:

Approved Methodology: **'**Grid Connected Renewable Electricity Generation'

Reference: Category I.D. - Renewable Energy Projects: Approved Small Scale Methodology AMS –I.D. / Version 15

For further details regarding the applicability criteria pertaining to the above-Methodology in the context of the project activity, please refer to section 2.2 of the VCS PD.

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

Estimation of Baseline emissions:

For the project activity under consideration, the baseline is given by paragraph 9 of the methodology AMS-I.D. / Version 15 as follows:

"the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM)[13]*, consisting of the combination of operating margin (OM)*[14] *and build margin (BM)*[15] *according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered. OR*

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available) and made publicly available."

Therefore,

$BE_y = EG_{BL,y} \times EF_{CO_2}$ ..... (i)

Where,

$EG_{BL,y}$ = Energy baseline in year 'y' i.e. net quantity of electricity exported to the grid in year 'y' by the project activity.

EF_{CO_2} = CO_2 Emission Factor in year 'y '

In line with paragraph 11 of the Approved small scale methodology *AMS I.D*. (Version 15, EB 50), the CO_2 Emission Factor has been calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM)

[13] The project activity will have an effect on the both the operating margin and build margin.

[14] Present power generation sources of the grid, weighted according to their actual participation in the grid mix (all generating sources participating in the grid except hydro, geothermal, wind, low cost biomass, nuclear, and solar power)

[15] Weighted average emissions of recent capacity additions (most recent 20% or the 5 most recent plants)

according to the procedures prescribed in the 'Tool to calculate the Emission Factor for an electricity system'[16].

Here,

$$EF_{CO_2} = EF_{grid,CM,y}$$

Where,

- $$EF_{grid,CM,y} = EF_{grid.OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$ .....(ii)

Where,

w_{OM} = Weightage of operating margin emission factor

w_{BM} = Weightage of build margin emission factor

For wind power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

Hence, from (ii);

$$EF_{grid,CM,y} = EF_{grid.OM,y} \times 0.75 + EF_{grid,BM,y} \times 0.25$$ ..... (iii)

Net quantity of electricity supplied by the project (EG_y):

The values for the parameter used for ex-ante emission reduction calculations (as a mean of the figures obtained from the first two years of project operation) for the purpose of developing the VCS PD have been provided in the table below.

Parameter	Value	Reference
No. of WTGs	2	Purchase Orders
Total Installed capacity	3.3 MW	Purchase Orders
Capacity Utilization Factor (CUF) or Plant Load Factor (PLF)	27.46%	Amending Order No 5 dated 18-5-2006 http://tnerc.tn.nic.in/orders/NCESamend.pdf
Gross Electricity Generation of the project activity	7938 MWh/year	Generation as per PLF considered as mentioned above

Emission Factor of the Grid:

For the project activity, the baseline scenario entails the generation of electricity by the grid connected fossil fuel fired thermal power plants resulting in GHG emissions as per the carbon intensity of the grid. The emission factor for the electricity displaced in the grid due by the electricity generated by the project activity is calculated as per the 'Tool to calculate the emission factor for an electricity system' by CEA and made available publicly for use as a data source for all Indian projects. The Southern Regional Electricity Grid of India that is fed by a majority of the majority of fossil fuel based units is considered for baseline emission calculations over the project activity's crediting period. Justification pertaining to the choice of the grid and details of the calculation of its carbon intensity are presented below.

A) Choice of the grid that will be affected by the project activity

As per 'Tool to calculate the emission factor for an electricity system',

"In large countries with layered dispatch systems (e.g. state/ provincial/ regional/ national) the regional grid definition should be used. A state/ provincial grid definition

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

may indeed in many cases be too narrow given significant electricity trade among states/ provinces that might be affected, directly or indirectly, by a CDM project activity."

The Indian power grid system (or the National Grid) is divided into two regional grids namely NEWNE Regional Grid and Southern Region Grid. These regional grids have independent state Load Dispatch Centres (LDCs) that manage flow of power in their jurisdiction. Power generated by state owned generation units and private owned generation units is consumed by the respective states. Power generated by central sector plants is shared by all states forming part of the grid in a fixed proportion. The project activity is located in the state of Tamil Nadu in Southern India and hence falls under the Southern Regional Grid of India.

Taking into consideration the relevant grid displaced by the project activity and the guidelines for selection of the appropriate grid in large countries with layered dispatch systems like India as given in 'Tool to calculate the emission factor for an electricity system'), the Southern Regional Grid has been considered as the most representative system boundary (i.e. project electricity system) where an equivalent amount of electricity would be replaced by the implementation of the project activity. The carbon intensity of the Southern Regional Grid would be determined to arrive at the baseline emission factor for baseline emission calculations for the project activity's crediting period.

B) Determination of the Carbon Intensity of the chosen Grid

CEA has carried out a complete analysis of the electricity generation mix across the country for calculating the emission factor of Southern Regional Grid in its CO_2 Baseline Database Version 5.0 Dated November, 2009. The project proponent has used the analysis for computation of the grid emission factor by the CEA following the guidelines of the 'Tool to calculate the emission factor for an electricity system'. The combined margin grid emission factor computed from the above analysis is 0.93 for the Southern Regional Grid (Please refer to the calculation presented below). The grid emission factor would be fixed ex-ante for the entire duration of the crediting period of the project activity.

Calculation of the Carbon Intensity of the Southern Regional Grid		
Item	**Symbol**	**Value**
Operating Margin (tCO_2/MWh) (incl. Imports)	$EF_{GRID,OM}$	0.97
Build Margin (tCO_2/MWh) (not adjusted for imports)	$EF_{GRID,BM}$	0.82
For intermittent and non-despatchable generation types such as wind and solar photovoltaic, the Central Electricity Authority CO_2 Baseline Database Version 5.0 grid tool allows to weigh the operating margin and build margin at 75% and 25%, respectively. Hence, the calculation formula is: $EF_{GRID} = (EF_{GRID,OM} \times O.75) + (EF_{GRID,BM} \times 0.25)$ ..... (4)		
Combined Margin Emission Factor in tCO_2/MWh (including Imports)	EF_{CM}	0.93

Summary: Parameters required for calculation of baseline emissions:

Serial No.	Variable	Parameters	Data Sources
1	$EF_{CM,y}$	Combined Margin Grid emission factor	CEA CO_2 Baseline Database, Version 5.0 dated November, 2009.
2	BE_y	Net electricity exported to the grid	Invoices rasied by the individual project participants to the respective State Electricity Boards

Quantifying GHG emissions and/or removals for the project:

Project Emissions (PE_y):

As the project activity is a wind power project, there are no anthropogenic emissions by sources of GHGs within the project boundary as a result of the project activity. Hence there are no project emissions to be considered.

$$PE_y = 0$$

Leakage Emissions (L_y):

As per the methodology AMS-I.D./ Version 15

"If the energy generating equipment is transferred from another activity, leakage is to be considered".

There are no anthropogenic emissions identified by sources outside the project boundary due to the project activity. Furthermore, the equipments (WTGs) used by the project activity are newly procured and hence not transferred from another project. Thus, there are no leakage emissions attributable to the project activity.

Hence,

$$LE_y = 0$$

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

Emission Reduction Calculation:

The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions through substitution of electricity generation with fossil fuels (BE_y) and project emissions (PE_y) and leakage emissions (LE_y).

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, total emission reductions achieved due to the project activity is 7402 tCO_2e/year.
Accordingly, the year wise emission reduction is given in the table below:

Years	Estimation of project activity Emissions (tones of CO_2e)	Estimation of baseline Emissions (tones of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions in tonnes of CO_2e
30th March 2008 – 29th March 2009	0	7,402	0	7,402
30th March 2009 – 29th March 2010	0	7,402	0	7,402
30th March 2010 – 29th March 2011	0	7,402	0	7,402
30th March 2011 – 29th March 2012	0	7,402	0	7,402
30th March 2012 – 29th March 2013	0	7,402	0	7,402
30th March 2013 – 29th March 2014	0	7,402	0	7,402

Years	Estimation of project activity Emissions (tones of CO_2e)	Estimation of baseline Emissions (tones of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions in tonnes of CO_2e
30th March 2014 – 29th March 2015	0	7,402	0	7,402
30th March 2015 – 29th March 2016	0	7,402	0	7,402
30th March 2016 – 29th March 2017	0	7,402	0	7,402
30th March 2017 – 29th March 2018	0	7,402	0	7,402
Total (tones of CO_2 e)	**0**	**74,020**	**0**	**74,020**

5 Environmental Impact:

In line with the Environmental Impact Assessment (EIA) notification S.O. 1533, dated 14th September 2006[17] issued by Ministry of Environment & Forests (MoEF), Govt. of India, wind projects are not included in the list of projects that are required to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities. As the project activity under consideration is a wind power generation project, it does not fall under the purview of EIA notification and therefore the EIA study need not be conducted for it.

[17] Reference:- http://envfor.nic.in/legis/eia/so1533.pdf

6 Stakeholders comments:

The feedback received from various stakeholders have served as valuable inputs justifying the Project Proponent's initiative of clean power generation and simultaneous contribution to sustainable development of the region. Various stakeholders directly or indirectly associated with the project activity were approached and appraised about the various aspects of the project activity by the representatives of the project promoters through a stake-holder meeting, as summarised below:

Stakeholders' Consultation Meeting Details	
Date:	24/11/2009
Place	Thandaiyarkulam, Tirunelvelli, Tamil Nadu
Mode of Invitation:	Public Notice and Personal Letters of Invitation to the individual stakeholders
Summarisation of Meeting Agenda and Discussion Points	
1	***Welcome Speech:*** The organisers welcomed the various stakeholders and briefed them on the meeting agenda and the points to be discussed, also highlighting the utility and importance of the exercise.
2	***Introduction to climate change mechanisms (including VCS):*** The organisers explained the various climate change mechanisms: compliance based (Clean Development Mechanism) and voluntary (Voluntary Carbon Standard) to the various stakeholders in the light of global concerns on global warming and climate change. The contribution of renewable energy projects like wind-mills towards solution of such problems by means of GHG abatement as well as sustainable development of the region was also discussed.
3	***Speech by the Project Promoting Entity:*** The representative from the project promoting organisation highlighted their commitment towards clean energy generation and environment protection by means of this diversification from its core area of activity. The pertinent issues of fossil-fuel depletion, environment pollution abatement, energy security and development of the host nation were also discussed. Furthermore, the various beneficial aspects of the project activity towards socio-economic development of the region on a local level and the host country on a national level were highlighted.
4	***Interactive (Question & Answer) Session:*** Upon requests by the stakeholders, the mechanism of environmental pollution and damage from fossil-fuel combustion was explained. Upon being asked, the stakeholders highlighted the various benefits in their lives attributable to the project activity by means of generation of employment and business opportunities as well as the provision of improved infrastructure and superior amenities in the vicinity of their place of dwelling. The stakeholders were also of the opinion that there were no possible negative impacts of the project activity on their lives. Instead, they were of the opinion that more of such projects should be actively promoted on account of associated environmental as well as socio-economic benefits.
5	***Conclusion and Vote of Thanks:*** The stakeholders were thanked for rendering their valuable time and providing crucial comments and suggestions on the project activity that further fortified the commitment of the project proponent in promoting the noble initiative.
Note: Relevant documents relating to stakeholder consultation will be submitted to the Validator during the Validation exercise.	

7 Schedule:

Sl. No.	Activity	Date
1	Purchase Order or Supply Agreement	7th January, 2008
2	Project Commissioning	30th March, 2008
3	Local Stakeholder's Meeting	24th November 2009
4	Appointment of Consultant	17th February, 2010
5	Appointment of Validator	12th March, 2010

8 Ownership:

8.1 Proof of Title:

Requirements of the VCS Project Description corresponding to this section have been stated and addressed below:

- *A legislative right*

Not Applicable

- *A right under local common law*

Not Applicable

- *Ownership of the plant, equipment and/or process generating the reductions/removals*

The ownership of the project promoter of the wind-farms and the WTGs can be established by means of the clearances, approvals and agreements listed in section 1.10 of this document.

- *A contractual arrangement with the owner of the plant, equipment or process that grants all reductions/removals to the proponent*

Not Applicable

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

Requirements of the VCS Project Description corresponding to this section have been stated and addressed below:

Project proponents of projects that reduce GHG emissions from activities that:

- *are included in an emissions trading Program; or*
- *take place in a jurisdiction or sector in which binding limits are established on GHG emissions;*

The host country (*i.e.*, India) of the project activity is a non Annex-I, (*i.e.*, developing) nation as recognised by the Kyoto Protocol of UNFCCC. Hence, ***none*** of the following are applicable in the context of India:

- GHG emission reduction targets or commitments
- Compliance driven Emission Trading Programs
- Voluntary emission trading programs similar to the VCS

This confirms there are no emissions trading programs prevalent in the host country of the project activity under consideration, *i.e.*, India at the time of preparation of the VCS PD.

Shall provide evidence that the reductions or removals generated by the project have or will not be used in the Program or jurisdiction for the purpose of demonstrating compliance. The evidence could include:

- *a letter from the Program operator or designated national authority that emissions allowances (or other GHG credits used in the Program) equivalent to the reductions/removals generated by the project have been cancelled from the Program; or national cap as applicable or;*
- *purchase and cancellation of GHG allowances equivalent to the reductions/removals generated by the project related to the Program or national cap.*

As explained above, the host country, India is a non Annex-I nation under the Kyoto Protocol and does not have GHG emission reduction targets or commitments. This confirms there are no national caps on GHG emissions prevalent in India at the time of preparation of the VCS PD and hence it is not applicable for the project activity.