Voluntary Carbon Standard
Project Description

[Date of the VCS PD]

11/09/2009

[Table of Contents]

1 Description of Project:

1.1 Project title

16.45 MW bundled grid connected renewable energy project in Tamil Nadu, India

Version : 02

Date : 11/09/2009

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 only 16.45 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.

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 36,518 tonnes of Carbon dioxide equivalent.

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

Years	**Annual estimation of emission reductions in tonnes of Co_2e**
2006-07	36,518
2007-08	36,518
2008-09	36,518
2009-10	36,518
2010-11	36,518
2011-12	36,518
2012-13	36,518
2013-14	36,518
2014-15	36,518
2015-16	36,518
Total estimated reductions (tonnes of co_2e)	3,65,180
Total no of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO2 e)	36,518

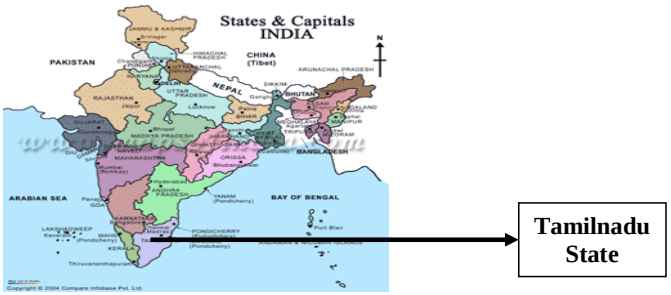
1.4 A brief description of the project:

The project activity generates electricity from wind mills. The capacity of the project is 16.45MW. This project activity is located in Tirunelveli District, Tamilnadu. The project activity established a cluster of 13 nos. of Suzlon and NEG Micon make Wind Electricity Generators (WEGs) of different capacities of 0.75 MW, 1.25 MW and 1.65 MW, aggregating to a total installed capacity of 16.45 MW.

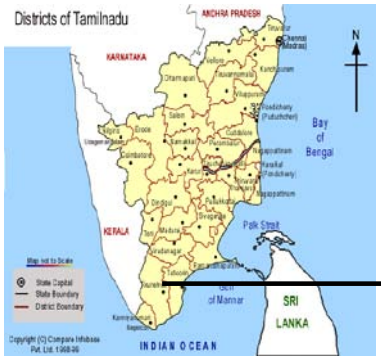
The generated power from this project is supplied to southern Regional grid dominated by the fossil fuel based power Generation. The Generated electricity is being GHG neutral; the annual GHG emission reduction through this project activity is estimated to be 36,518 tonnes of Carbon dioxide equivalent.

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

COUNTRY MAP

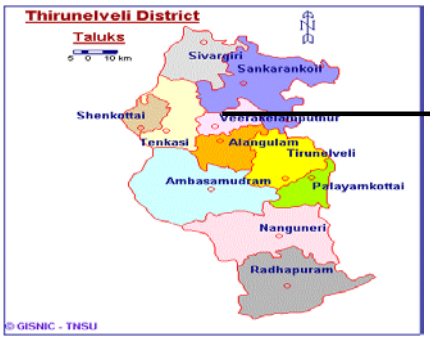


STATE MAP



Tirunelveli District

DISTRICT MAP



Veerakeramputhur Taluka

Reference : http://164.100.167.12/ruralmaps/taluk.php?dcode=04
Taluka: Veerakeramputhur
District: Tirunelveli
The specific coordinates of Suzlon turbines in the project are:

S.No	Name of Investor	Survey No.	HT.Sc.No	Capacity of WTG	Latitude	Longitude
1	Arvind. A.Traders	484/2A	1957	1.25MW	9° 00' 07''	77° 32' 48''
		430/1,2,3B P	1943	1.25MW	8° 59' 39''	77° 32' 22''
		121/2P	2006	1.25MW	8° 59' 11''	77° 31' 07''
		715/1P	1940	1.25MW	8° 59' 15''	77° 33' 23''
		29/2P	2005	1.25MW	8° 59' 24''	77° 31' 06''
		431/3,4B,4C P	1994	1.25MW	9° 00' 12''	77° 32' 25''
2	R.K.Textiles	21 / 3 P	1938	1.25MW	8° 57' 07''	77° 34' 10''

3	Sri Rama Vilas Weaving Factory	435 / 3 P	1981	1.25MW	9° 00' 26''	77° 32' 20''

The specific coordinates of NEG Micon turbines in the project are:

S.No	Name of Investor	Survey No.	HT.Sc.No	Capacity of WTG	Latitude	Longitude
1	R.K.Textiles	120/1A, 115/2B	1520	1.65 MW	8° 58' 44''	77° 28' 07''
2	Asian Handlooms	63/2,3,4,5, 6	1522	1.65 MW	8° 59' 11''	77° 28' 33''
		91/1(P), 2(P)	1524	1.65 MW	8° 59' 05''	77° 28' 57''
3	R. Aswatha	608 / 1,2 P	1697	0.75 MW	8° 58' 46''	77° 26' 51''
4	Allied Textiles	304 / 1 / P	1810	0.75 MW	8° 59' 37''	77° 26' 37''

1.6 Duration of the project activity/crediting period:

- The starting date of the project activity is 06/12/2005 (Commissioning Date for R.K .Textiles 1.65MW WEG. It is the Earliest Commissioning Date of this bundled project activity)
- The starting date of credit period is considered from 28th March 2006. The chosen crediting period is 10 years (28th March 2006 to 27th Mar 2016).

1.7 Conditions prior to project initiation:

There are five regional grids in India namely, Northern, Western, Southern, Eastern and North Eastern regions. All the States in India are connected to one of these five regional grids.The southern regional grid supplies electricity for southern states namely Andhra Pradesh, Karnataka, Kerala,

Tamilnadu and one union territory Pondicherry. The project is located in the state of Tamilnadu and connected to the Southern regional Grid.

The bundled grid connected wind power project located in Tirunelveli district in Tamilnadu and exports the generated electricity to 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 region grid. According to the current scenario in southern regional 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 2006-07

Type of Power Plant	**GWh**	**%**
Thermal Power Plant	117,297	72.70
Hydro Power Plant	38,888	24.11
Nuclear Power Plant	5,142	3.19
Total	**161,327**	**100.00**

Reference:

http://www.cea.nic.in/god/opm/Monthly_Generation_Report/18col_A_08_03/FILE-02.pdf

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

The project will generate 16.45 MW power from 13 Wind Turbine Generator (WTG). The project activity have a cluster of 13 nos. of Suzlon and NEG Micon make WEG of different capacities of 0.75 MW, 1.25 MW and 1.65 MW, aggregating to a total installed capacity of 16.45 MW. 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 36,518 tonnes of Carbon dioxide equivalent.

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 blowing at high speeds has a considerable amount of kinetic energy. When this kinetic energy 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. The technology is a clean technology since there are no GHG emissions associated with the electricity generation.

Table 3: **Technical specifications of WTG**

S.No	**Particulars**	**Technical specification for 1250KW WTG Supplied by** Suzlon	**Technical specification for750KW WTG Supplied by** NEG Micon	**Technical specification for 1650KW WTG Supplied by** NEG Micon
1	Cut In Wind Speed	3m/s	4m/s	3.5m/s
2	Cut out wind speed	22m/s	25m/s	20m/s
3	Hub Height	74m	55m	78 m
4	Gearbox Type	Integrated 3 stage 1 planetary 2 Helical	Planetary – Parallel Axle	Planetary/ Helical Stages

5	Gear Ratio	1: 74.917	1:67.5	1:70.2
6	Rated Power Output	1250KW	750KW	1650KW
7	Tower Type	Tubular Tower	Conical Steel Painted	Conical Tubular
8	Tower Height	74m	53.6m	75.2m
9	No of blades	3	3	3
10	Rotor Diameter	66m	48.2m	82m
11	Brake System	Aerodynamic	Hydraulic	Hydraulic

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 involve in this project have a Power Purchase / Wheeling Agreement. Also, the project proponent has obtained the necessary approvals like NOC from state electricity board and signed Power Purchase Agreement with Tamilnadu Electricity Board (TNEB).

- Lr.No: CE/NCES/EE /WPP/A2/F.M/s Arvind.A.Traders- WEG. No: 569(T)/R.0644/ D398/2006, Dt 23-06-2006.
- Lr.No: CE/NCES/EE /WPP/A2/F.M/s Arvind.A.Traders- WEG. No: 649(T)/R.0645/ D388/2006, Dt 23-06-2006.
- Lr.No: CE/NCES/EE /WPP/A2/F.M/s Arvind.A.Traders- WEG. No: 505(T)/R.0643/ D386/2006, Dt 23-06-2006.
- Lr.No: CE/NCES/EE /WPP/A2/F.M/s Arvind.A.Traders- WEG. No: 578(T)/R.02341/ D532/2006, Dt 30-08-2006.
- Lr.No: CE/NCES/EE /WPP/A2/F.M/s Arvind.A.Traders-NT Noted for Record letter- WEG. No: 141(T)/R.2391/ D497/2006, Dt 25-08-2006.

- Lr.No: CE/NCES/EE /WPP/A2/F.M/s Arvind.A.Traders- NT Noted for Record letter- WEG. No: 142(T)/R.2392/ D555/2006, Dt 04-09-2006.
- Lr.No: SE/NCES/EE /WPP/A1/F.M/s Asian Handlooms- WF/R.06762/ D1232/2005, Dt 22-11-2005.
- Lr.No: SE/TIN/AEE /DVT/AE.2/F. WEG HT.SC.1810/1763/06. DT: 17/04/06.
- Lr.No: SE/NCES/EE /WPP/A1/F.M/s R.K.Textiles- WF/R.06333/ D1224/2005, Dt 22-11-2005.
- Lr.No: SE/TIN/AEE /DVT/AE.2/F. WEG HT.SC.1938/R.3242/06. DT: 26/07/06.
- Lr.No: ACE/TIN/AEE /DVT/AE.2/F. WEG. HT.SC .No:1981/ R.3833/ 2006, Dt 01-09-2006.
- Lr.No: SE/TEDC/TIN /AEE /DVT/AE.1/F. WEG. HT.SC .No:1522/ R.211/ 2006, Dt 19-01-2006.
- Lr.No: SE/TIN/AEE /DVT/AE.2/F. WEG HT.SC.1697/R.1652/06. DT: 12/04/06.

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

The project faces risks that could substantially reduce the project's GHG emission reduction are given below.

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 main purpose of the project activity is to generate electricity from Wind Turbine Generator (WTG).The project activity have a cluster of 13 nos. of Suzlon and NEG Micon make WEG of different capacities of 0.75 MW, 1.25 MW and 1.65 MW, aggregating to a total installed capacity of 16.45 MW. 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 36,518 tonnes of Carbon dioxide equivalent. Hence it is demonstrated that the project is 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).

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):

The project activity has not rejected by any GHG programs.

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

Organization:	Arvind.A.Traders
Street/P.O.Box:	52,5th cross Sengunthapuram
Building:	
City:	Karur
State/Region:	Tamilnadu
Postfix/ZIP:	639002
Country:	India
Telephone:	+91 4324 231515,231717
FAX:	+91 4324 233045, 234333
E-Mail:	arvind@arvindas.co.in
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	T.Balachandran
Department:	
Mobile:	+91 9362233333
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	ABI Energy Consultancy Services Private Limited
Street/P.O.Box:	Sreenivi,No 22 Subramaniyanagar 2nd street,Rengarajapuram,Kodambakkam
Building:	
City:	Chennai
State/Region:	Tamilnadu
Postfix/ZIP:	600024
Country:	India
Telephone:	+91 44 6538 3966
FAX:	+91 44 2480 2416
E-Mail:	info@abienergy.com
URL:	www.abienergy.com
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	K.Vijayarajan

Department:	
Mobile:	+91 94444 81041
Direct FAX:	
Direct tel:	
Personal E-Mail:	vijay@abienergy.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:

Economic Impacts:

- Creates employment opportunities in the project vicinity during erection & commissioning
- Employment creation both temporary and permanent
- Improving the local infrastructure like roads
- Improved power supply

Social Impacts:

- Promotes self employment among the unemployed youth (eg., civil contractors, spare parts shops);
- Connectivity improvements in the local area through improved local transportation;

Environmental Impacts:

The environmental footprint of Wind Turbine Generators is minimal, since:

- Wind is one of the cleanest form of renewable energy and, power generation does not involve any fossil fuels;
- Produces electricity without GHG emissions.
- The materials used in the WTGs are non hazardous in nature;
- Impact on land, air and water is minimum, since there are no discharges or Emissions during the project lifetime;

Technological well being:

There is continuous research and development on the geometry of the wind blades, height of towers, diameters of towers, etc., which augurs well for the technological well being in the development of wind energy to produce clean electricity. Also, the generated electricity from the project activity is connected to the grid. The project activity improves the supply of electricity with clean, renewable wind power while contributing to the regional/local economic development. Wind energy plants provide local distributed generation, and provide site-specific reliability and transmission and distribution benefits including:

- improved power quality;
- reactive power control;
- mitigation of transmission and distribution congestion,

All the above are the contributions of the project activity for the sustainable development.

1.17 List of commercially sensitive information (if applicable):

There was no commercially sensitive information for this project activity.

2 VCS Methodology:

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

Sectoral scope : 1

Methodology : **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

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 Conditions 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-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;	This Project activity generates Electricity from wind power project. Hence this methodology is applicable for this project activity.
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 a new grid connected wind power plant. Hence, no capacity expansion or retrofit of the plant is envisaged.
In case of hydro power plants, one of the following conditions must apply:	This is a new wind power

➢ The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or ➢ The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; or ➢ The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	project hence not applicable.

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

As demonstrated above the project activity meets the applicable criteria of ACM 0002. Hence, the Approved Consolidated Methodology – ACM 0002 can be applied for the project activity.

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

	Source	**Gas**		**Justification/Explanation**
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.

Project Activity	CO2 emissions from combustion of fossil fuels for electricity Generation in Solar thermal power plants and geo thermal power plants.	CO2	Excluded	This is a grid connected wind power project. There is no CO2 emission from this project activity.
		CH_4	Excluded	Not applicable.
		N_2O	Excluded	Not applicable.

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

Identification of 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
D is the Debt component of the total investment
tc is the corporate tax rate
b is the cost of debt

Rate of return of an Equity

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

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 2004-2005 and 7.34% for the financial year 2005-2006.

* http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/86531.pdf
Annual Report, Reserve Bank of India page number 253

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 detailed calculation of CAGR for the individual project activity is given in the annexure.
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 (_**e**) = 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
2. Gujarat Industries
3. CESC
4. NLC
5. BFUL
6. Reliance
7. NTPC

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) is calculated individually for each project promoters based on the investment decision date of the project activity Individual bench mark(WACC)calculation for all the project promoters are shown in the individual excel sheets are submitted to DOE for validation. The summary of the each bench mark calculation are presented in the below table.

Project Activity	Arvind.A.Traders	R.Aswathaa	Asian Handlooms	Allied Textiles	Sri Rama Vilas	R.K. 1.25 MW	R.K. 1.65 MW
Date of Investment decision	07/04/2006	23/01/2006	16/08/2005	04/01/2006	12/04/2006	07/04/2006	12/08/2005
Staring Date of the project activity	26/04/2006	18/02/2006	24/09/2005	30/01/2006	10/07/2006	27/04/2006	24/09/2005
Market History Period	01/02/1999 to 31/03/2006	01/02/1999 to 31/12/2005	01/02/1999 to 31/07/2005	01/02/1999 to 31/12/2005	01/02/1999 to 31/03/2006	01/02/1999 to 31/03/2006	01/02/1999 to 31/07/2005
Expected Market Return**(Rm)** CAGR	23.42%	21.27%	19.84 %	21.27 %	23.42 %	23.42 %	19.84 %
Risk Free Return **(Rf)**	7.34%	6.11%	6.11 %	6.11 %	7.34 %	7.34 %	6.11 %
Market Risk Premium **(Rm – Rf)**	16.08%	15.16%	13.73 %	15.16 %	16.08 %	16.08 %	13.73 %
Beta **(β)**	1.23	1.25	1.28	1.25	1.23	1.23	1.28
Return on equity **Ri = *Rf* + (β) *(Rm - Rf)***	27.14%	25.12%	23.63 %	25.01 %	27.14 %	27.14 %	23.63 %
Debt**(D)**, Equity **(E)**, Total Investment **(I)**, Corporate Tax(**tc**)	D = 2904.00 E = 786.86 I = 3690.86 tc = Nill	D = 217.00 E = 123.67 I = 340.67 tc = Nill	D = 1396.00 E = 482.50 I = 1878.50 tc = Nill	D = 215.00 E = 130.45 I = 345.45 tc = Nill	D = 488.00 E = 122.80 I = 610.80 tc = Nill	D = 450.00 E = 157.77 I = 607.77 tc = Nill	D = 700.00 E = 253.77 I = 953.77 tc = Nill
Cost of Debt **(b)** (BPLR)	10.5 %	10.5 %	10.5 %	10.5 %	10.5 %	10.5 %	10.5 %
WACC =**(E/I)*Ri + D/I * b * (1-tc/100)**	**14.05 %**	**15.81 %**	**13.87 %**	**15.98 %**	**13.84 %**	**14.82 %**	**13.99 %**

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Calculation and comparison of financial indicators

Calculation of IRR and the comparison of financial indicators are provided in a separate sheet.

At the time of investment decision the project promoters considered generation given by the WEG supplier for their investment decision. Hence the estimated average annual generation from the purchase order was considered for IRR calculation.

Promoter	Project IRR	
	IRR % without VER Revenue	IRR % with VER Revenue
Allied Textiles	11.63	13.77
Arvind Traders	10.98	12.47
Asian Handloom	10.85	12.11
R. Aswatha	10.80	13.73
Sri Rama Vilas Weaving Factory	10.88	12.56
R. K. Textiles (1.65 MW)	10.32	11.86
R. K. Textiles (1.25 MW)	10.92	12.42

The following assumptions are made for estimation of IRR for the project activity.

Description	AAT	Aswatha	Asian H.L	Allied Tex	Sri Rama	R.K.Textiles	Source
WTG Capacity	6*1250KW	750KW	2*1650KW	750 KW	1250 KW	1250 & 1650 KW	Purchase order
Cost per WTG INR	6,05,00,000	3,38,40,000	9,31,56,350	3,21,95,000	6,05,01,620	6,05,00,344 9,46,12,375	Purchase order
O & M charges	11,00,000	4,50,000	8,25,000	4,50,000	11,00,000	11,00,000 8,25,000	Purchase order
Escalation on O & M	5.00%	7.50%	5.00%	7.50%	5.00%	5.00%	Purchase order
Tariff INR	2.70	2.70	2.70	2.70	2.70	2.70	PPA with TNEB
Interest Rate	10.00%	10.50%	9.00%	11.00%	10.50%	10.00% 9.00%	Bank sanction letter
Moratorium (Months)	6	6	6	6	6	6	Bank sanction letter
Repayment term (Months)	84	72	60	66	84	84	Bank sanction letter
Insurance Premium INR	1,13,166	2,00,000	3,94,500	2,00,000	79,000	1,69,500	Premium policy letter
Debt : Equity Ratio	20:80	25:75	25:75	25:75	20:80	26:74	Bank sanction letter

The excel sheet of the cash flow submitted to the DOE.

Sensitivity Analysis

As per the EB 41 Annex 45 Based on the Guidance on the Assessment of Investment Analysis, Sensitivity analysis was derived. Sensitivity analysis has been carried out to identify the attractiveness of the project activity to reasonable variations in the critical assumptions. The scenarios considered for the purpose of sensitivity analysis are ±10 % increase in generation. ±10% increase in tarrif and ±10 % increase in Project cost. The actual project cost is taken for the purpose of calculating the Project IRR so it is enough to consider generation and Tariff in sensitivity analysis.

The Internal Rate of Return (IRR) for all this wind mills without considering the revenues from the VERs, which is below the respective bench mark rate . 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.

The results of the cash flow analysis are given below.

Promoter	Benchmark %	Project IRR%					
		without VER Revenue	with 10 % increase in Generation	with 10 % decrease in Generation	10 % increase in Tariff	10 % decrease in Tariff	IRR % with VER Revenue
Allied Textiles	15.98	11.63	13.42	9.72	13.44	9.70	13.77
Arvind.A. Traders	14.05	10.98	12.77	9.09	12.78	9.07	12.47
Asian	13.87	10.85	12.36	9.26	12.37	9.24	12.11

Handloom							
R. Aswatha	15.81	10.80	12.63	8.81	12.81	8.60	13.73
Sri Rama Vilas Weaving Factory	13.84	10.88	12.71	8.94	12.71	8.94	12.56
R. K. Textiles (1.65 MW)	13.99	10.32	11.83	8.72	11.85	8.70	11.86
R. K. Textiles (1.25 MW)	14.82	10.92	12.72	9.00	12.73	8.98	12.42

b) Institutional barriers

The wind power policy of the Tamilnadu state government was neither consistent, nor conducive for the investors in the state for promotion of private sector investment. Additionally, the state government never allowed third party sale of power within the state, leaving only the options of captive consumption (through wheeling and banking) and sale to the grid. The state government also kept the power purchase price (tariff) much lower than other states and lower than the recommended tariff by MNRE, whereas the banking and wheeling charges are higher than other states. This tariff issue also discouraged private sector investment in clean technologies. Such power policies of the state government impediments implementation of clean power projects. A comparison of the Tamil Nadu wind power policy with other state government policies is summarized in a table below:

State	Wheeling charges	Banking charges	Buy-Back	Third Party Sale	Capital Subsidy
Andhra Pradesh	2 %	12 months	INR 2.25/kwh (Escalation 95-96) Presently Rs 3.37	Not allowed	NIL
Tamilnadu	**5 %**	**5 % for 12 months**	INR **2.90/kwh (No escalation)**	**Not allowed**	**NIL**
Karnataka	30 %	2 % every month for 12 months	INR 3.40/kwh	Allowed to HT Consumers	Same as for other industries
Kerala	2 %	6 months	To be agreed mutually	-	15 %(max Rs. 5 lakhs)
Uttar Pradesh	2 %	12 months	INR 2.25/kwh(5 % Escalation from 95-96)	Allowed	Same as for other industries
West Bengal	2 %	6 months	To be decided case to case basis	Not allowed	-
Gujarat	4 %	6 months	INR 3.32/kwh	Not allowed	-
Madhya Pradesh	2 %	2 %for 12 months	Present Rs3.90/kwh	Allowed	Same as for other industries
Maharashtra	2 %	2 % for 12 months	INR 3.50/kwh	Allowed	30 %(max Rs 20 lakhs per project)
Rajasthan	2 %	2 % for 12 months	Present INR 3.32 /kwh.	Allowed	-

Source: http://www.indianwindpower.com/potential.html#top (as on: 31.06.2006)

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.

Total installed capacity of Southern Regional Electricity Grid as on March 31, 2005

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).

http://cea.nic.in/

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:

Sectoral scope : 1

Methodology : **ACM0002** – "Approved Consolidated Baseline Methodology for grid connected electricity generation from renewable sources"

Version : 10

Reference

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

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 WTGs is supplied to the grid.
- 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
- ✓ 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.

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

- Purpose of monitoring

The purpose of monitoring of 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 (CEA) - 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;
  Data is monitored continuously and recording will be done on monthly basis for entire crediting period.

- 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:	**$EG_{facility,y}$**
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year y. Net quantity of electricity generation supplied by the project activity to the grid = Export of net electricity measured by the energy meter - Import of electricity measured by the energy meter (Both export and import value are measured by the single energy meter.)
Source of data to be used:	TNEB Monthly Statement.
Value of data applied for the purpose of calculating expected emission reductions	39,396
Description of measurement methods and procedures to be applied:	Monitoring: Trivector meter will be used for monitoring Data Type: Measured Frequency: Continuously measured Recording: Monthly from joint meter Archiving Policy: Paper &

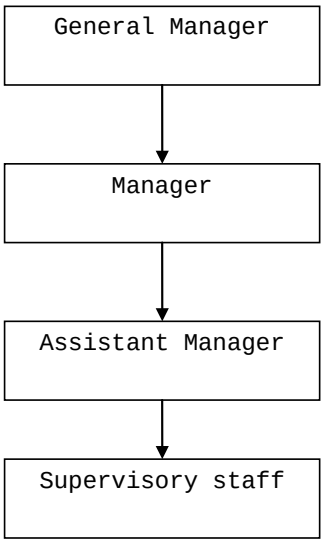
	Electronic Responsibility: Project Head would be responsible for regular calibration of the meter. Calibration Frequency: Once in three year. The accuracy class of the all energy meters are 0.5.
QA/QC procedures to be applied:	The project revenue is based on the net units displaced as measured by main 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 check 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

For the purpose of monitoring, the project participant has entered into an operation and maintenance agreement with the supplier of the machines NEG Micon(India)Private Ltd and Suzlon Energy Ltd. As per the provisions of the contract, all the parameters associated with performance of the

WEG, safety in operation, scheduled maintenance service records, breakdowns and other running repair records are maintained by the supplier.

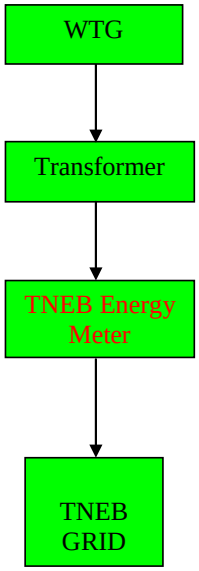
The operation and maintenance structure with respect to the implementation of the project has been given below. The operators also record monthly energy output of each WTG and prepare reports on the performance of wind farm indicating turbine wise production.



Metering:

The delivered Energy shall be metered by the TNEB at the high voltage side of the step up transformer installed at the project site. 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 check this data and hence ensure consistency.



Quantity of net electricity generation exported to the grid by the project plant is measured by the Trivector energy meter. Each WEG is connected to an individual energy meter and others WTG are not connected in this meter. The above line diagram shows the metering arrangement for each WTG. This meter installed at the grid interconnection point after the step up transformer, hence there is no loss in the net electricity generation exported to the grid. This energy meter records the electricity generated on a continuous basis.

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
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 WTGs. Also, as per the contract, a monthly generation report is made available to the WTG 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.

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 WTGs is supplied to the grid.
- The project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.

The calculation for Emission Reductions has been explained below.

Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

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)

EFgrid, CM,y = Combined margin CO2 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" (tCO2/MWh)

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)

$EG_{facility,y}$ = 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

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 y (tCO_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 CO_2 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 CEA[1] data base for the Southern Grid (for the years 2005-06, 2006-07 and 2007-08) the value is 0.998157296 tCO_2e/ MWh

Year	2005-06	2006-07	2007-08	Total
Emission(tCO_2)	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 (tCO_2 / 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

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 EFBM,y **ex-ante** based on the most recent

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

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 EFBM,y must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, EFBM,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 (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$\Sigma EG_{m,y} * EF_{EL,m,y}$$

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

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(tCO_2)	22,550,310
Net generation(MWh)	31,613,000
Build Margin Emission Factor (tCO_2 / 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} = 0.75and w_{BM} = 0.25

EF_{OM} - 0.998157296tCO_2/MWh

w_{OM} - 0.75

EF_{BM} - 0.71331778 tCO2/MWh

w_{BM} - 0.25

EFy = 0.75*1.00 + 0.25*0.71

Baseline emission factor will be (EFy) = **0.92694742 t**CO2/MWh

The emission factor (EFy) is fixed and it is same for the entire crediting period.

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

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 ($EF_{CO2\ elec}$) as follows:

BE_y = EG_Y* *EFy*

Where:

EFy = Baseline emission factor

= 0.92694742 tCO_2/MWh

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

EG_Y = Net electricity supplied to the southern regional grid.

S.No	Company	WEG Capacity in MWh	Estimated Gross Generation in KWh
1	M/s. Arvind.A.Traders	6*1.25	18000000
2	R.Aswatha	0.750	1800000
3	Asian Handlooms	1.650	8400000
4	Allied Textiles	0.750	1800000
5	Sri Ramavilas Weaving Factory	1.250	3000000
6	R.K.Textiles	1.650	4200000
7	R.K.Textiles	1.250	3000000
	Total		40200000
	Electrical loss Total Net generation in MWh		2% 39,396

EGy = 39,396 MWh/year

BE_y = *39,396*0.92694742*

= 36,518 tCO2/year

Baseline emission (BE_y) = 36,518 tCO2/year

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

Project Emissions (LEy)

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 CDM 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

$ER_Y = BE_Y - PE_Y - LE_Y$

ER_Y-Emission reduction per year by the project activity tCO2/year

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

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

ER_Y = 36,518-0-0
= 36,518 tCO2/year

Year	Estimation of Project activity Emissions (tCO_2e)	Estimation of Baseline Emissions (tCO_2e)	Estimation of Leakage (tCO_2e)	Estimation of overall emission Reductions (tCO_2e)
2006–2007	0	36,518	0	36,518
2007–2008	0	36,518	0	36,518
2008–2009	0	36,518	0	36,518
2009–2010	0	36,518	0	36,518

Year	Estimation of Project activity Emissions (tCO_2e)	Estimation of Baseline Emissions (tCO_2e)	Estimation of Leakage (tCO_2e)	Estimation of overall emission Reductions (tCO_2e)
2010–2011	0	36,518	0	36,518
2011–2012	0	36,518	0	36,518
2012–2013	0	36,518	0	36,518
2013–2014	0	36,518	0	36,518
2014–2015	0	36,518	0	36,518
2015–2016	0	36,518	0	36,518
Total Tonnes of CO_2				3,65,180

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:

All the WTGs of this project activity were supplied by Suzlon and NEG Micon. The project promoters signed

an operation and maintenance contract with Suzlon and NEG Micon. The project promoters conducted a stakeholder consultation meeting on 29th November 2007 at project site in Tirunelveli District, with the local people and residents of the neighbouring villages, Local employees, Representative of TNEB, Social workers active in the local region.The project promoter and WTG supplier explained the various features, benefits and the eco-friendly nature of the project. In that meeting project promoter distributed the questionnaire to all participants and there is no negative comment received from the stakeholders. The local village people also agreed that due to this project activity the employment opportunities have increased. The project proponent has already established good relationship with local people who ensure co-operation for the successful and continuous operation of this project. The local people also agreed that their infrastructure facility like road and transportation was improved due this project activity. There is no negative comment received from the stakeholders.

7 Schedule:

Chronological plan

Details	AAT	RA	AHL	AT	SRV	RKT
Loan Sanction letter from Bank	8-Jun-06	18-Apr-06	17-Dec-05	4-May-06	3-May-06	17/11/2005 15/9/2006
Purchase order or Invoice for plant equipment	26-Apr-06	18-Feb-06	24-Sep-05	30-Jan-06	10-Jul-06	27-04-2006 24/9/2005
Power Purchase Agreement [PPA] with TNEB	14-Jul-06	28-Mar-06	22-Dec-05	31-Mar-06	29-Aug-06	14-07-2006 6/12/2005

O&M Agreement with WEG Manufacture	3-Oct-07		20-Sep-06	15-Feb-07	10-Oct-06	16-05-2008 20/9/2006
Commissioning Date	14/7/2006, 14/7/2006, 26/7/2006, 16/09/2006, 20/09/2006, 20/09/2006	27-Mar-06	22/12/2005 27/12/2005	31-Mar-06	29-Aug-06	14/7/2006 6/12/2005
Agreement with ABI Energy	15-June 2008	15-June 2008	15-June 2008	15-June 2008	15-June 2008	15-June 2008
Agreement with DOE	15-Nov-08	15-Nov-08	15-Nov-08	15-Nov-08	15-Nov-08	15-Nov-08

Frequency of Monitoring : Hourly measured

Recording of monitored data: Monthly from joint meter

Project Life time : 20 years

Duration of crediting period : 10 years fixed

The PP will monitor all 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:

The Commissioning certificates of all the WEGs and Bundling agreement between project participants and the Bundling Organisation are considered as the evidence for the proof of title of the project activities. The same are provided to DOE for validation.

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

Not applicable