



Voluntary Carbon Standard
Project Description

23-09- 2009

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1 Description of the Project:

1.1 Project title

Bundled Wind power project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (TASMA-V1)

Version : 01

Date : 23/09/2009

1.2 Type/Category of the project

As per the Voluntary Carbon Standard (VCS-2007.1), the Project falls under UNFCCC Clean Development Mechanism.

As per applied approved consolidated methodology, ACM 0002, Version 10, the project type and category is as below:

Project Type : Renewable Energy Project

Category : “Grid connected electricity generation from Renewable sources”

The project activity is a grouped project, consisting of 109 Wind Turbine Generators (WTGs) installed in different passes (Aralvaimozhi, Senkottah and Palghat passes) located in the State of Tamil Nadu, India.

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

This project activity falls under ‘projects’ group and involves 51.595 MW wind energy generation which reduces approximately 82064 tCO₂e per year. The generated power from this project activity is supplied to the southern regional grid of India, dominated by the fossil fuel based power plants.

Table-1: Estimated amount of emission reductions over crediting period (From 1st April 2006 to 31st March 2016)

Years	Annual estimation reductions in tonnes of CO ₂ e
2006-07	82064
2007-08	82064
2008-09	82064
2009-10	82064
2010-11	82064
2011-12	82064
2012-13	82064
2013-14	82064
2014-15	82064

2015-16	82064
Total estimated reductions in tonnes of CO₂ e	820640
Total No of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO₂e)	82064

1.4 A brief description of the project:

Purpose of the project activity: The project activity is a grouped Wind power project in Tamil Nadu, India, co-ordinated by Tamil Nadu Spinning Mills Association (referred as TASMA-V1). The intent of the Project Activity is to reduce GHG emission and promote sustainable development by use of renewable energy (Wind) for generation of power by bringing together a number of investors with small power requirements to invest into wind turbines. In the absence of the project activity, the equivalent amount of electricity would have been generated by the power plants connected with the southern grid which is predominantly based on fossil fuel.

Project Scenario: The project activity involves the installation of WTGs which generates approximately 88.53 GWh of Power. The Project activity thus reduces the anthropogenic emissions of greenhouse gases (GHGs) in to the atmosphere associated with the equivalent amount of electricity generation from renewable and cleaner energy source i.e. Wind. The electricity thus generated is already being supplied to the Southern regional grid. All the 109 WTGs involved in this project have commissioned and connected with the southern regional grid. The electricity thus generated is being used in one of the following manners:

1. Export the entire energy to the southern grid
(Or)
2. Wheel the required energy for captive consumption and banking the surplus energy or exporting the surplus energy to the grid.

The baseline scenario of the project activity would be the same as that of the pre-project scenario i.e. drawing power from the grid connected fossil fuel intensive power plants as per the ACM0002 methodology.

Contribution of the project activity to sustainable development:

Ministry of Environment and Forests, Government of India has suggested that social well being, economic well being, environmental well being and technological well being are the four indicators for sustainable development in its host country approval eligibility criteria for Clean Development Mechanism (CDM) projects¹. This criteria can also be adopted for VCS.

The project activity contributes to sustainable development in the following manner.

I) Social well being

The project activity generates 804 GWh of power per year from clean and renewable source (wind). The districts of Kanyakumari, Tirunelveli and Coimbatore of Tamilnadu where the WTGs are located now, had no proper road connectivity prior to the project commencement. It is only after the installation of the windmills, there is improvement in road connectivity in these areas. These roads are being used by the local villagers. The feedback from the local people, points to the positive impact of the project. The project will also aid the State electricity grid in meeting out their electricity demand. The local residents near the project sites are getting employment and new business opportunities are growing due to this project activity.

II) Economic well being

The lands purchased for the wind farms are mostly barren lands and are located in the remote areas. After commencement of this project activity, there is an increase in the value of these lands which would have otherwise fetched lower revenue. The local residents are also getting jobs as a result of the project activity. There is an increase in the business opportunities for the local people in establishing small shops and allied activities. In addition to the above, there are some rural and infrastructural developments around the wind farms.

III) Environmental well being

The project activity generates clean energy without any GHG emissions which is commonly associated in the field of electricity generation. Hence, the project related

¹ http://cdmindia.nic.in/host_approval_criteria.htm

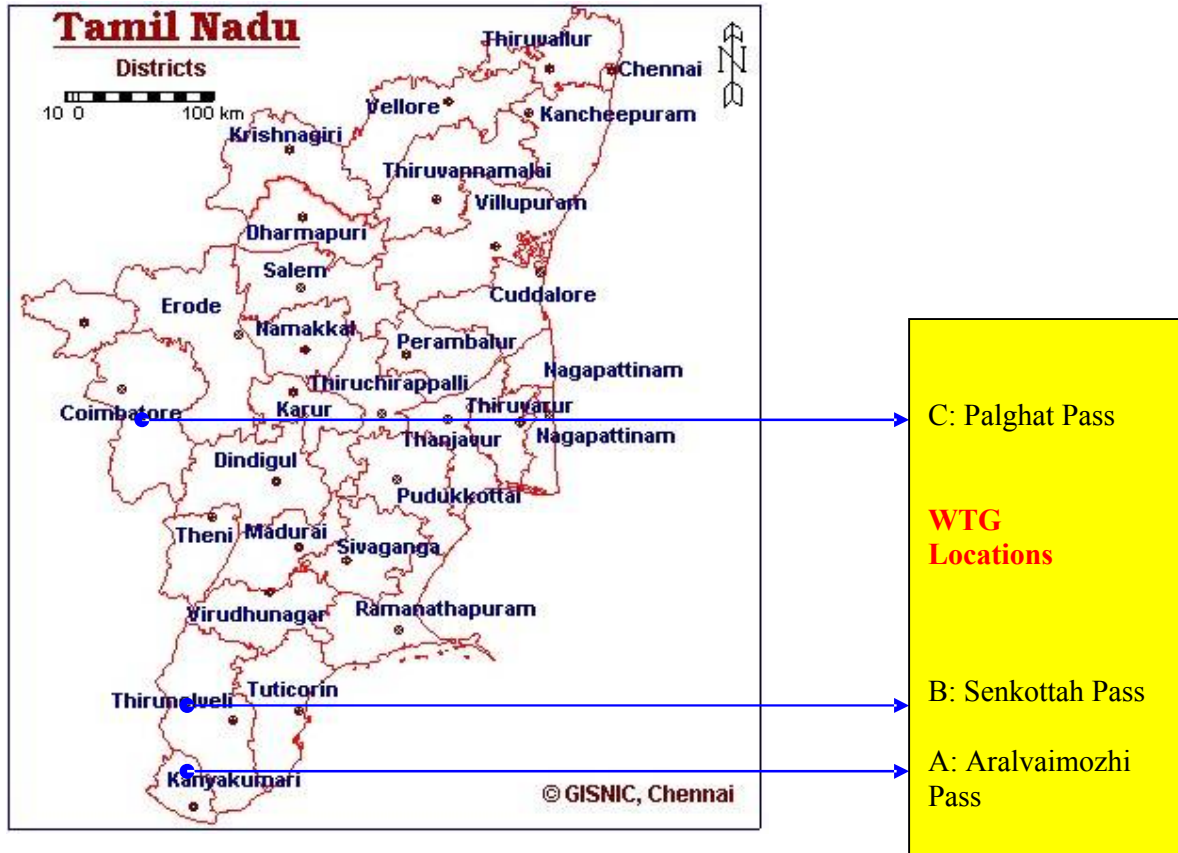
GHG emissions are nil for the project activity, as it uses natural energy (wind) as the only source for the purpose of electricity generation.

IV) Technological well being

All the WTGs in the project activity are from well known International Manufacturers with latest technology. This will further demonstrate the development of new technologies in harnessing the renewable energy and will promote further percolation of developed technology throughout the world. The clean renewable electricity thus generated is being supplied to the respective grid to meet out the demands.

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

The map below shows the geographical location of the project sites. All these sites are identified as potential locations for the wind electricity generation by the Ministry of New and Renewable Energy (MNRE), Govt. of India. The details of the individual WTGs under the project activity like Capacity, unique High Tension Service Connection (HTSC) number and Global Positioning System are presented in Appendix-1 at the end of VCS PD.



1.6 Duration of the project activity/crediting period:

The starting date of the project activity is 5th March 2002. (Based on the earliest commissioning date of the Wind Mills in the group)

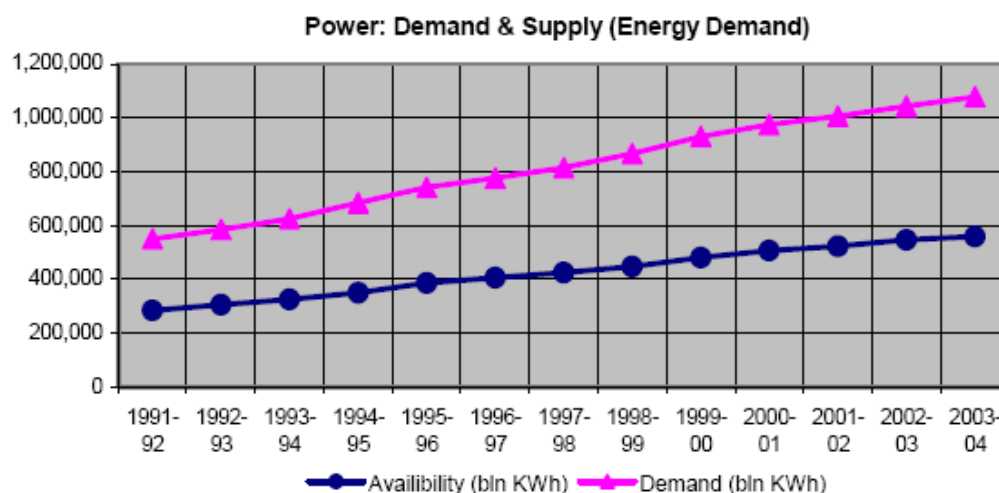
The crediting period starts from 01/04/2006

The starting date of credit period is considered from 1st April 2006. The chosen crediting period is 10 years (from 1st April 2006 to 31st March 2016).

1.7 Conditions prior to project initiation:

Power generation, supply and demand scenario in India²:

A total of 123,014 MW capacity of Power Generation was installed in India till 2004-05. In 2003-04, the demand for energy was increased by 2 percent which accounts to a shortfall of 559 billion kWh, while peak demand rose to 84,574 MW. In the period 1992-93 to 2003-04, the energy demand for electricity increased at a CAGR (compounded annual growth rate) of around 6 per cent, from 305 billion kWh to 559 billion kWh. During the same period, supply increased at a CAGR of around 6 per cent. As a result, the energy shortage grew from 25 billion kWh (8.33 per cent) in 1992-93 to 40 billion kWh in 2003-04 (7.15 per cent).



As the figure shows, India has constantly been plagued with a demand supply gap in the Power sector. Such a gap is a major hindrance to the growth of a developing economy like India. The Government of India set up the Kohli Committee under Mr. Udes

² <http://cii.in/documents/September2005-IEPU.pdf>

Kohli to estimate the investment required in the sector over the tenth and eleventh plans to bridge this demand-supply gap.

In spite of significant growth in electricity generation over the years, the shortage of power continues to exist in India primarily on account of growth in demand for power, outstripping the growth in generation and generating capacity addition.

Therefore in the absence of the project activity, equal amount of electricity would have been generated by the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansion connected to the grid.

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

The project activity generates electricity, using renewable source of energy (wind) which is a clean source of electricity generation. In the absence of the project, the energy would have been drawn from the grid which is predominantly fossil fuel based generation. Hence the project displaces the fossil fuel based generation. Thus the project activity achieves GHG emission reduction by employing a cleaner technology to generate electricity.

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

Technology:

Wind energy generation is a clean technology for production of electricity, with no emission of Green House Gases.

The project activity has employed Horizontal Axis WTGs of different capacities. All the WTGs deployed in the project activity are from well-known international manufacturers. All these machines are type tested and approved by the Ministry of New and Renewable Energy (MNRE), Government of India.

The Technical Components of WTG are as follows:

Main Tower	-Metallic tower of height ranging from 45 m to 80 m
Nacelle	- Houses, Main shaft, Gearbox and Generator
Main shaft	- Rotated by the Blade connected to gearbox/generator
Gearbox	- To step up Generator RPM (not used in some models)
Generator	- Induction Type generators
Blade	- Fibre blades to take off at wind speeds from 2.5 m /sec to 4 m /sec
Hub	- Connects, the blade and main shaft and houses the brakes

A unit system of WTG, consisting of the above subsystems works in conduction with, LT line and HT line. The turbine generates power at 400 to 690 volts, which is stepped up to 11/22/33 KV by the local transformers kept at EB yard near the windmill. The HT transmissions are connected to service 110 KV/230 KV substations provided by TNEB. Metering equipment is electronic multipurpose meter of accuracy class 0.5% required for the project. The main meter shall be installed and owned by TNEB and the LCS (Local Control System) meter shall be installed and maintained by the owner of the project i.e. the main meter at EB yard which is under control of TNEB and another

meter is located at the control panel of WTGs. The TNEB personnel every month, records the reading of the main meter in the presence of Site In-charge.

The choice of capacity of the WTG was based on,

- The present and future power requirements of the mill owners.
- The Availability, lead time and cost of WTGs with the suppliers
- Wind Characteristics and the locations

The project activity involves the installation of 109 WTGs with the following capacity distributions.

Table: 1

Capacity Wise Details			
SL. NO	CAPACITY (KW)	NO.OF MACHINES	TOTAL CAPACITY (MW)
1	225	37	8.325
2	230	3	0.690
3	250	17	4.250
4	330	1	0.330
5	350	4	1.400
6	500	16	8.000
7	600	5	3.000
8	750	12	9.000
9	800	2	1.600
10	850	1	0.850
11	1250	10	12.500
12	1650	1	1.650
	TOTAL	109	51.595

The sub projects covered by this project activity involves the following makes of WTGs

Table: 2

MAKE WISE DETAILS				
SL. NO	MAKE	CAPACITY (KW)	NO.OF MACHINES	TOTAL CAPACITY (MW)
1	NEPC	225	24	5.400
2	Southern Wind Farms Ltd.,	225	1	0.225
3	VESTAS RRB	225	12	2.700
4	ENERCON	230	3	0.690
5	Chiranjeevi Wind Energy Ltd.,	250	2	0.500
6	PIONEER WINCON	250	15	3.750

7	ENERCON	330	1	0.330
8	SUZLON	350	4	1.400
9	VESTAS RRB	500	16	8.000
10	ENERCON	600	1	0.600
11	SUZLON	600	2	1.200
12	VESTAS RRB	600	2	1.200
13	NEG MICON/VESTAS	750	12	9.000
14	ENERCON	800	2	1.600
15	PIONEER ASIA WIND TURBINES	850	1	0.850
16	SUZLON	1250	10	12.500
17	NEG MICON/VESTAS	1650	1	1.650
	TOTAL		109	51.595

The wind turbines have an average lifetime of 20 years.

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

The wind power project does not require compliance of any local laws and regulations. However, the NOC has to be obtained from TNEB. PPA/WA has to be executed with TNEB and all these requirements have been complied with.

Table 6: Relevant applicable laws & regulations and Compliance status of the project activity

Regulations	Compliance status
NOC from TNEB	Complied
Power Purchase Agreement with TNEB	Complied
Wheeling agreement	Complied

The project proponent has conducted discussions with members of the local population. The local population welcomes the project due to various benefits such as employment, development of infrastructure in the area and improvement in their standards of living.

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

The risks that may substantially affect the project's GHG emission reductions are

- Wind availability
- Grid availability
- Machine availability (repair & maintenance)

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 primarily aims at displacement of grid electricity in which majority of power is generated from fossil fuels like coal. Therefore the aim of the project activity is to reduce GHG emissions instead of 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).

The project so far has not created any other form of environmental credit (renewable energy certificates). This project has not been considered for CDM registration and an exclusive VCS project.

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

The project activity has approached only VCS 2007.1 Standard GHG Program and hence this is not applicable.

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

Table 7: Roles and Responsibilities of the Project Proponent

Project Proponent	Roles & Responsibilities
Tamil Nadu Spinning Mills Association (TASMA)	• To ensure that the project activity is in compliance with all the local laws and regulations applicable to the project activity. • It is under the purview of their duty to ensure that parameters are monitored efficiently and the records are maintained in a proper manner, so that it eases the validation/verification procedures.

Table 8: Contact Information of the project proponents

Organization:	Tamilnadu Spinning Mills Association (TASMA)
Street/P.O.Box:	Door No 24, 11th Cross Street, Thiruvalluvar Nagar
Building:	Spencer Compound
City:	Dindigul
State/Region:	Tamil Nadu
Postfix/ZIP:	624 003
Country:	India
Telephone:	+91 451 2433637 / +91 451 2428756 / +91 451 2431513
FAX:	+91 451 2421467
E-Mail:	dispa@rediffmail.com , tasma_dispa@yahoo.co.in
URL:	www.tasma.in
Represented by:	K.Venkatachalam
Title:	Chief Advisor
Salutation:	Mr.
Last Name:	Karuppaih
Middle Name:	
First Name:	Venkatachalam
Department:	All
Mobile:	+91 9842133318 / +91 94433 69858
Direct FAX:	+91 451 2421467
Direct tel:	+91 451 2431513
Personal-Mail:	kvmasterminds@gmail.com

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

The project qualifies all the requirements of GHG programme including CDM and VCS programme. The project does not perceive any risk related to quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental or geographic.

The project participants have obtained all clearances from the necessary relevant Authorities. 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, operation & maintenance.
- 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, hotels, restaurants, security personnel etc.,)
- 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 forms 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 nil, since there are no discharges or Emissions during the project lifetime.

Technological Impacts:

There are continuous research and development on the geometry of the wind blades, height of towers, diameters of towers etc., which improves 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 is no commercially sensitive information which has been excluded from the public version of the VCS PD 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:**

The project activity uses approved consolidated baseline and monitoring methodology: **ACM0002**.

Title: – “Consolidated Baseline Methodology for grid connected electricity generation from renewable sources”, Version 10 (EB 47), Sectoral scope: 1

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

Table 11 Tools applicable to the project activity

Title	Tool for the demonstration and assessment of additionality
Version	5.2
Dated	26 th August 2008
Reference	http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

Title	Tool to calculate the emission factor for an electricity system
Version	1.1
Dated	29 th July 2008
Reference	http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

Approved methodology ACM 0002 “Grid connected electricity generation from Renewable sources”, version 10, has been considered as the appropriate methodology for this project activity because,

Table 12: Justification for applicable methodology i.e. ACM0002.

S.No.	Applicability conditions of ACM0002	Project activity conditions	Remark
1	The project activity is the installation or modification / retrofit 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.	The project activity has installed wind turbine generators for generation of electricity that use renewable energy source (wind.)	The applicability condition is met.
2	In case of hydro power plants: - The project activity is implemented in an existing reservoir, with no change in the volume of the 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 is not a hydro power plant.	Not relevant for the present project activity.
3	The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available	The project activity is connected to the southern grid of India. Hence, its boundary is clearly identifiable and characteristics are available from the records of Central Electricity Authority, Government of India (www.cea.nic.in).	The applicability condition is met.

4	Applies to grid connected electricity generation from landfill gas to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001)	The project activity does not involve electricity generation from landfill gas	Not relevant for the present project activity
5	5 years of historical data (or 3 years in the case of non hydro project activities) have to be available for those project activities where modification/retrofit measures are implemented in an existing power plant	The project activity is installation of new wind turbine generators and does not involve modification/retrofit	Not relevant for the present project activity

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

As per the methodology, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the VCS project power plant is connected to i.e. it includes all the power plants connected to the southern grid. The schematic diagram of the project boundary is shown below.

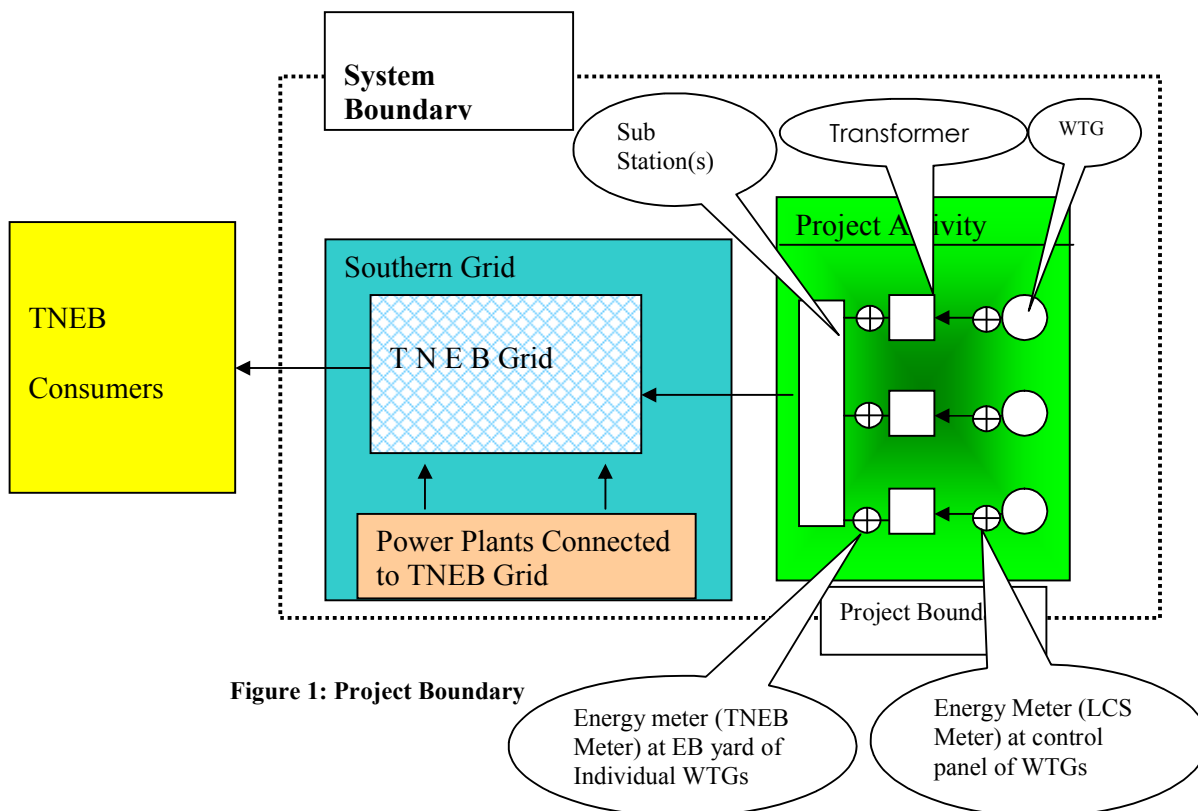


Figure 1: Project Boundary

Table 13: Sources and Gases Included in the Project Boundary

Source		Gas	Included?	Justification/ explanation
Baseline	GHGs emissions from electricity generation by existing fuel mix in the southern grid that is displaced due to the project activity	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source, excluded for simplification. This is conservative.
		N ₂ O	No	Minor emission source, excluded for simplification. This is conservative.
Project activity	Electricity generation by wind turbine generators	CO ₂	No	As per methodology ACM 0002, wind energy project does not create any GHG emissions.
		CH ₄	No	The project activity is renewable energy project which does not create any emissions.
		N ₂ O	No	The project activity is renewable energy project which does not create any emissions.

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

Baseline scenario description

The Indian electricity system is broadly divided into two grids, the new Integrated Northern, Eastern, Western and North Eastern Grids (NEWNE) and the Southern Grid, as per the following Table No.14. Each grid covers several States. As the grids are interconnected, there is inter-state and inter- regional exchange. A small power exchange also takes place with the neighboring countries, Bhutan and Nepal.

Table 14: Geographical scope of the regional electricity grids³

<i>Northern Eastern Western North Eastern</i>				<i>Southern</i>
<i>Haryana</i>	<i>Bihar</i>	<i>Gujarat</i>	<i>Assam</i>	<i>AP</i>
<i>HP</i>	<i>Jharkand</i>	<i>MP</i>	<i>Manipur</i>	<i>Karnataka</i>
<i>JK</i>	<i>Orissa</i>	<i>Chhattisgarh</i>	<i>Meghalaya</i>	<i>Kerala</i>
<i>Rajasthan</i>	<i>WB</i>	<i>Maharashtra</i>	<i>Nagaland</i>	<i>Tamil Nadu</i>
<i>UP</i>	<i>D.V.C</i>	<i>Goa</i>	<i>Tripura</i>	<i>Lakshadweep</i>
<i>Uttaranchal</i>	<i>A&N</i>	<i>D.N.H</i>	<i>Arunachal Pradesh</i>	<i>Pondicherry</i>

³ CO₂ Baseline Database for the Indian Power Sector, User Guide, Version 3.0, December 2007

<i>Chandigarh</i>	<i>Sikkim</i>	<i>Daman&Diu</i>	<i>Mizoram</i>	
<i>Delhi</i>				

For the purpose of identifying the appropriate baseline scenario to any project, it is required that the “project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints”. This implies that the grid emission factors are most appropriately calculated at the level of the regional grids. As the project activity is in Tamil Nadu which is under the Southern region, the Southern regional grid is identified as the appropriate project electricity system and all the baseline calculations are made accordingly.

In the absence of the present project activity, the quantum of Electricity now delivered to the grid, would have otherwise been generated by the operation of the grid connected power plants of the southern grid, which would have reflected in the Operating Margin (OM). Further, the project activity would have prevented addition of new generation sources, which would have reflected in the Build Margin (BM) also. Thus the reflection in OM & BM will automatically reflect in the Combined Margin (CM) of the project activity as discussed in Section - 4.2 of the PD. Hence, it is clear that the present project activity considerably reduces GHG emissions to the applicable extent.

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 additionality is demonstrated based on the following test:

Test 1- The project test:

Step 1: Regulatory Surplus

The project activity has installed wind based electricity generators to a capacity of 51.595 MW. There is no mandatory law or regulation which enforced the Project Participants to adopt the wind electricity generation. Project Participants has been issued with all required regulatory clearances before commissioning. Thus, the project activity is consistent with the current laws as there is no mandatory regulation on the choice of the technology for generating power.

Step 2: Implementation barriers

The barrier faced by the project activity is Investment barrier and the same is demonstrated through Investment analysis as below.

Investment analysis

The project faces capital or investment return constraints that could be overcome by the additional revenues associated with the generation of VCUs.

The project promoter used benchmark analysis to compare the investment analysis. For benchmark analysis, the Project Internal Rate of Return (Project IRR) of the project activity has been used to assess the financial attractiveness of the project activity. The IRR of any investment activity is one of the most commonly used tools to establish the viability and the financial feasibility of the project.

Choice of Benchmark value:

Since it is a predominant investment decision in non core business, the PP was particularly interested in the return of the investment. Hence project IRR was selected as the financial indicator to assess the attractiveness of the project.

As per guidance on Assessment of Investment analysis, version 02, annex 45 of EB 41, it 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. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented.”*

As per Sub-step 2b of Additionality tool, version 5.2, *“When applying benchmark analysis, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. Only in the particular case where the project activity can be implemented by the project participant, the specific financial/economic situation of the company undertaking the project activity can be considered.”*

Project IRR, being nothing but the return earned by the project, has to be compared with a benchmark or cut-off rate to determine the adequacy of the return. PP has chosen WACC as the benchmark. *WACC alone* represents the weighted average of the costs of various sources of financing in the financial structure of the project. 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 the erosion in the value of investment. Therefore, no other benchmark is more suitable than WACC in cases where project IRR is used to demonstrate the Additionality.

TASMA has decided to bundle the WTGs installed between 2002 & 2007 and hence the WACC has been calculated for each year.

The WACC for the subsequent years has been calculated as demonstrated below:

$$WACC = CoE * \{E / (E+D)\} + CoD_{\text{post tax}} * \{D / (E+D)\}$$

Where:

CoE – Cost of equity

CoD – Cost of Debt

CoE – Cost of Equity:

The Capital Asset Pricing Model (CAPM) approach is a generally accepted methodology for determining the Cost of Equity. CAPM is based on the portfolio theory of finance in which risks are classified into:

- Systematic risk - risk applicable to the market as a whole, such as inflation, tax rises, interest rates, etc.
- Specific risk - residual risk unique to an individual firm or a small group of companies that form a subset of the market.

The theory stipulates that specific risks can be eliminated through diversification and hence, only systematic risks determine the return expectation of investors. The basis of CAPM is the relationship between risk and return. Whilst there has been considerable debate on the strength of the risk/return relationship, evidence indicates that there is a strong linear and positive relationship over the long term, which can be expressed by the following formula⁴

$$E(r_e) = r_f + \text{Equity Beta } (\beta) * [E(r_m) - r_f]$$

Where:

$E(r_e)$ - the expected rate of return on equity (cost of equity)

r_f is the risk-free rate of return (e.g. return on government bonds)

$E(r_m)$ - the expected rate of return on a market portfolio

Equity Beta (β) - coefficient reflecting the volatility (risk) of the stock relative to the market, which measures the systematic risk of the stock

The **Risk free rate (r_f)** has been taken from the long term government bond rates at the time of the investment decision of the project activity (sub Bundle) in 2002 to 2007. The average interest rate on Central Government date Securities i.e. bond rate during year 2002-07 is given in below table:

Years	Risk Free rate ⁵
2001-02	8.99%
2002-03	7.57%
2003-04	7.60%
2004-05	6.37%
2005-06	7.57%
2006-07	8.22%

⁴ *Cost of Capital for Central Sector Utilities by Crisil Advisory Services*

⁵ <http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/80303.pdf>

The **Market Risk Premium** ($E(r_m) - r_f$), as measured and applied in practice, is the premium above the risk-free rate of return that investors expect to earn on a well-diversified portfolio of equities.

The **expected rate of return on a market portfolio** ($E(r_m)$) has been calculated as the compounded annual growth rate of the market portfolio. In calculating market risk premium, it is usual to use an established stock market index as a proxy for the market portfolio. In India, a choice of possible indices are available – BSE 30, BSE 100, S&P CNX 500, Nifty, etc.

Choice of stock market index will also be considerably influenced by the availability of historical data. In this regard, BSE 30 has the advantage of having the longest history and data is available for 20 years. The data on other indices, viz. S&P CNX 500 and Nifty, are available only since 1991. Hence BSE Sensex has been considered for calculating the Expected market return at the time of taking decision of project activity. The Expected market return has been estimated for year 2001-02 to 2006-07 on the basis of average of each months return and is given in the below table:

Years	Expected Market Return [$E(r_m)$] ⁶
2001-02	16.81%
2002-03	16.09%
2003-04	16.74%
2004-05	17.19%
2005-06	18.14%
2006-07	19.10%

Equity 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 of equity 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.

As the project activity involves the wind power generation, so the beta has to be taken from the listed companies involved in the wind power generation. But as there is no listed companies whose core business is wind power generation, so the beta value has been considered for the listed companies who are involved in the similar business i.e. power generation. The following are listed companies whose beta value available at the time of investment decision during 2001-02 to 2006-07 is given in the below table:

S. No.	Year	Power generating Company	Beta Value
1	2001-02	TATA power	1.46
2		CESC	1.00
		Average	1.23

⁶ The worksheet will be submitted to DOE for validation

1	2002-03	TATA Power	1.13
2		CESC	1.18
		Average	1.16
1	2003-04	Tata Power	1.04
2		CESC Ltd	2.89
3		Reliance Energy/Reliance Infra	0.63
4		BF Utilities	2.83
		Average Beta value	1.85
1	2004-05	Tata Power	2.03
2		CESC Ltd	1.21
3		Reliance Energy/Reliance Infra	0.90
4		BF Utilities	2.59
		Average Beta value	1.69
1	2005-06	Tata Power	1.11
2		CESC Ltd	1.34
3		Reliance Energy/Reliance Infra	1.10
4		BF Utilities	1.39
		Average Beta value	1.24
1	2006-07	Tata Power	0.76
2		CESC Ltd	0.57
3		Reliance Energy/Reliance Infra	0.93
4		BF Utilities	3.7
		Average Beta value	1.49

The **Cost of Debt** has been considered as *Prime Lending Rate (PLR)* at the time of investment decision of the project activity. The PLR during 2001-02 to 2006-07 (at the time of conceptualization of the project activity of all sub-bundles) is given by Reserve Bank of India (RBI) in below table:

Year	Cost of Debt⁷
2001-02	12.00%
2002-03	11.5%
2003-04	10.25%
2004-05	10.25%
2005-06	10.25%

⁷ <http://www.rbi.org.in/scripts/PublicationsView.aspx?id=9581>

2006-07	12.25%
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The **Debt Equity ratio** as per the Wind Power policy norms has been considered as 70:30.

The WACC as a Benchmark calculated during 2001-02 to 2006-07 is given in the below table:

Year	Benchmark	Comments
2001-02	13.64%	This benchmark is for the WTGs whose decision has been taken in 2002
2002-03	12.75%	This benchmark is for the WTGs whose decision has been taken in 2003
2003-04	14.53%	This benchmark is for the WTGs whose decision has been taken in 2004
2004-05	14.55%	This benchmark is for the WTGs whose decision has been taken in 2005
2005-06	13.36%	This benchmark is for the WTGs whose decision has been taken in 2006
2006-07	15.91%	This benchmark is for the WTGs whose decision has been taken in 2007

Calculation and comparison of financial indicators

TASMA has experience due to its interaction with many of its members invested in WTGs earlier and with manufacturers. The investment analysis has been done considering the past experience of TASMA. In August 2003, TASMA had decided to appoint an investment consultant to make the investment analysis on wind mill and prepare a suitable investment guideline to the intended investors on WTGs, who are the members of TASMA. For the time being, till the investment guideline comes in to effect, TASMA had suggested⁸ the members that they might take investment decisions based on the guidelines provided by TASMA which was again based on the reports of Indian Wind Directory. The financial indicator namely Internal Rate of Return has been calculated by considering all the relevant costs (including, the investment cost and the operation and maintenance cost) and revenues (excluding CER revenues, but including subsidies/fiscal incentives where applicable).

The below table of assumptions considered for WTGs installed in 2002 and 2003:

Capacity of machines in MW	Different sizes	
Total Project Cost per MW (Rs. In Millions)	45.0	Indian wind directory 2002 ⁹

⁸ Minutes of meeting dated 23/08/2003 will be submitted to DOE

⁹ The copy of relevant pages is submitted to DOE

Operations		
Plant Load Factor - 1st to 20th year from TNERC Guidelines	20.00%	Indian wind directory 2002
Banking charges (for 20% of total electricity banking)	5.00%	http://www.nepcindia.com/images/goverpolicy/policytneb.doc
Wheeling charges	5.00%	http://www.nepcindia.com/images/goverpolicy/policytneb.doc
Operation & Maintenance Cost with an escalation of 10% every year after 10 years	1.00%	Indian wind directory 2002
Derating (after 5 years)	5%	Indian wind directory 2002
Generation tax (in paise/unit)	10	
Insurance charges	0.50%	
Loan Processing Charges(including service tax and cess) % of the Loan taken	1.12%	IREDA Loan guidelines
Tariff		
Electricity saving - Rs/kWh	3.67	Electricity Bills
Sale to Grid	2.70	
Project Cost	Rs Million	
Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc.		
Total Project Cost	67.50	
Loan processing charges	0.53	
Total project cost including Loan processing charges	68.03	
Means of Finance		
Own Source	30%	
Term Loan	70%	
Terms of Loan		
Interest Rate	For year	

	2001-02 - 14.00% For year 2002-03 – 14.00%	<u>Indian wind power directory-2002</u>
Tenure	10 Years	
Moratorium	12 Months	
Income Tax Depreciation Rate (Written Down Value basis)		
on Wind Energy Generators	80%	
On other Assets	15%	
Book Depreciation Rate (Straight Line Method basis)		
On Wind	4.50%	
Book Depreciation up to (% of asset value)	90%	
Income Tax		As per IT rules
Income Tax rate	30%	
Minimum Alternate Tax	7.5%	
Surcharge	2.5%	
Cess	0%	

The following table illustrates the parameters used for the investment analysis for each size of WTG installed in 2004.

Parameter		Unit	References
Installed Capacity	All Sizes	MW	
Capital cost per MW	45	Million INR/MW	Investment guidelines for TASMA members - TASMA minutes of meeting ¹⁰
Debt: Equity	70:30	-	Same as above
O&M Costs	1.25	Percentage	Investment guidelines for TASMA members - MoM dated 23/08/2003
Plant Load Factor	15	Percentage	Same as Above
Banking charges	5%	of energy banked	Same as Above
Wheeling Charges	5	Percentage	Same as above
Book Depreciation Rate (Straight Line Method basis)			
Civil Works	4.5	Percentage	Draft Discussion Paper on “Tariff

¹⁰ Minutes of meeting dated 23/08/2003 will be submitted to DOE.

VCS Project Description

Plant and Machinery	4.5	Percentage	Related Issues for Non Conventional Energy Sources” by TNERC
Book Depreciation up to (% of asset value)	90	Percentage	

Later on in 2004, the Financial Consultant has been appointed and in December 2004, the appointed Financial Consultant has submitted the report on Investment guideline for the members of TASMA investing on WTGs. The report proposed the capacity wise cost of WTGs considering the past variation in the price trends of WTGs. The report also proposed the Pass wise PLF for each WTGs Size.

The following table illustrates the parameters used for the investment analysis for each size of WTGs from 2005 onwards.

Parameter		Unit	References
Installed Capacity	All sizes	MW	
Capital cost per MW		Crore INR/MW	Investment guidelines from Financial consultant. The Capacity wise Project cost is attached in Appendix 2
Debt: Equity	70:30	-	Investment guidelines from Financial consultant
O&M Costs	1.25	Percentage	Investment guidelines from Financial consultant
Plant Load Factor	19.94	Percentage	It has been arrived on the basis of weighted average considering Investment guidelines from Financial consultant. The pass wise PLF are provided in Appendix 2
Banking charges	5%	of energy banked	Investment guidelines from Financial consultant

Wheeling Charges	5	Percentage	Investment guidelines from Financial consultant
Book Depreciation Rate (Straight Line Method basis)			
Civil Works	4.5	Percentage	Draft Discussion Paper on “Tariff Related Issues for Non Conventional Energy Sources” by TNERC
Plant and Machinery	4.5	Percentage	
Book Depreciation up to (% of asset value)	90	Percentage	

The Project IRR calculated on the basis of above mentioned assumptions:

Year	Project IRR		Benchmark
	Range of IRR without Revenue	Range of IRR with VCU Revenue	
2002	1.74%-10.98%	2.37%-11.69%	13.64%
2003	0.87%-6.73%	1.26%-7.43%	12.75%

2004	1.61%-7.44%	2.16%-7.92%	14.53%
2005	3.22%-11.74%	3.72%-12.34%	14.55%
2006	0.53%-10.24%	0.93%-10.79%	13.36%
2007	3.52%-6.32%	3.93%-6.74%	15.91%

The Project IRR of the project activity is shown in the above table and it is found that it is coming below the Benchmark as mentioned in the above table.

It is evident that without VCU revenue the Project activity is not financially viable. Hence the project is additional.

Sensitivity Analysis

To substantiate the robustness of the results obtained above the sensitivity analysis has been conducted. As per guideline provided by EB in meeting no. 41 annex 45 the criteria for choosing the sensitivity analysis parameter is:

Guidance: Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets

The following parameters which can affect 20% of the total cost or revenue are:

1. **Plant Load Factor (PLF)**
2. **Project Cost**
3. **O&M Cost**

The sensitivity analysis was carried on project IRR varying the O&M Cost and PLF by $\pm 10\%$ following the guideline provided by EB in meeting no. 41 annex 45.

Since, the tariff for the WTGs is a fixed one throughout its lifetime; sensitivity analysis has not been done on tariff basis.

The result of the project is presented in table below:

A sensitivity analysis has been carried out to identify the attractiveness of the project activity to reasonable variations in the critical assumptions (shown separately). The scenarios considered for the purpose of sensitivity analysis are $\pm 10\%$ increase in generation. The effect of these variations on the IRR is summarized below:

Description	Project IRR without VCU revenue	
Year	Base IRR	IRR with 10 % increase in Generation
2002	1.74%-10.98%	2.87%-12.5%
2003	0.87%-6.73%	2.67%-8.18%
2004	1.61%-7.44%	2.71%-8.73%
2005	3.22%-11.74%	4.24%-13.18%
2006	0.53%-10.24%	1.4%-11.6%
2007	3.52%-6.32%	4.57%-7.5%

Description	Project IRR without VCU revenue	
Year	Base IRR	IRR with 10 % decrease in Project Cost
2002	1.74%-10.98%	2.99%-12.68%
2003	0.87%-6.73%	2.85%-8.34%
2004	1.61%-7.44%	2.87%-8.85%
2005	3.22%-11.74%	4.35%-13.34%
2006	0.53%-10.24%	1.5%-11.75%
2007	3.52%-6.32%	4.68%-7.62%

Description	Project IRR without VCS revenue	
Year	Base IRR	IRR with 10 % decrease in O&M cost
2002	1.74%-10.98%	1.95%-11.13%
2003	0.87%-6.73%	1.97%-6.96%
2004	1.61%-7.44%	1.96%-7.77%
2005	3.22%-11.74%	3.43%-11.9%
2006	0.53%-10.24%	0.77%-10.38%
2007	3.52%-6.32%	3.72%-6.54%

The Internal Rate of Return (IRR) for all these wind mills without considering the revenues from the VCUs, which is below the Bench mark rate mentioned in above table (Benchmark used for comparison of the IRR). However, the IRR improves while considering the VCU revenues. Thus, it is evident that VCU revenue will definitely help the project to overcome certain barriers primarily associated with the additional investment with regards to the supply of power to the distribution grid.

Step 3: Common Practice

The source of power generation in the southern regional grid was analysed and the total installed capacity of southern regional grid as on March 31, 2003 was 28451.76 MW as tabled below:

Power Plant	Total Installed Capacity in MW	%
Hydro	10012.84	35.19
Coal	13182.50	46.33

Gas	2516.40	8.84
Diesel	939.32	3.30
Wind	1020.70	3.59
Nuclear	780.00	2.74
Total	28451.76	100.00

The above table clearly depicts that wind energy for power generation was not very actively being used in southern regional grid for power generation; hydro and thermal power were the most preferred sources of power generation in this region. Wind energy comprised only 3.59% of the total installed capacity compared to 35.19 % of hydro and 46.33% of thermal. Thus, investing in wind energy was not a common practice in this region.

(Source: <http://www.powermin.nic.in/reports/pdf/ar02-03.pdf>)

3 Monitoring:

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

The project activity falls under the purview of the approved VCS methodology ACM0002 “*Consolidated methodology for grid-connected electricity generation from renewable sources*”.

Table 20

Methodological details

Sectoral scope	01
Methodology Applicable	ACM0002
Version	10
Dated	Valid from 11 th June 2009
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, Version 1.1
- ✓ Tool for the demonstration and assessment of Additionality, Version 5.2

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

Purpose of monitoring:

The purpose of monitoring procedure is to record the real and measurable emission reduction in an efficient way which results in availing the revenues that accrues from the project activity. Hence, TASMA is responsible for the monitoring/calculation of actual credible emission reduction in the most transparent and relevant manner.

Types of data and information to be reported, including units of measurement (Origin of the data):

The Key records that will be maintained are:

- Project Activity Matrix giving all ID details
- Monthly Working Details of WTGs
- Monthly Generation Details
- VCUs Computed on a yearly basis
- Calibration Certificates for the main energy Meters

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

TASMA will be responsible to calculate the emission figures. Calculation of emission figures will be based on the recorded generation for a period and the emission factor recorded in the VCS PD.

The generation registered by the main meter alone will hold well for the purpose of billing as long as the error in the main meter is within the permissible limits. The calibration of the main meter will be the responsibility of the TNEB. The calibration of the main meter will be done as per the procedure set out by CEA/TNERC.

If, on any occasion, it is found that the main meter is beyond permissible limit of error, TNEB will be informed about it and TNEB will make necessary efforts to correct the meter and recalibrate the same. During the time when the main meter is not functioning, the same will be replaced with a spare meter and the faulty meter will be sent to the Meter Relay Testing (MRT). The MRT in turn will remove the chip and send it to the meter manufacturer for retrieving the generation recorded. The retrieved reading will be used for billing.

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

The monthly meter reading of main meter is being taken jointly by the Parties (TNEB and site-incharge of the WTG owner) on the fixed day of the month. At the conclusion of meter reading on each occasion, an appointed official of the TNEB shall sign the meter card provided for this purpose and the said entries will be verified by the site-incharge. The main meter reading recorded will be the units of electricity generated. Emission reduction calculation is based on the main meter reading.

Monitoring roles and responsibilities:

- TASMA will be responsible to calculate the emission figures. Calculation of emission figures will be based on the recorded generation for a period and the emission factor recorded in the VCS PD.
- Changes in Project boundary in any event will be monitored through the Regional Representatives of TASMA and recorded by TASMA.
- All documents will be numbered and identified along with retention periods.
- Each WTG which is part of the project activity will be uniquely identified. The ID number will have the following structure:

Company ID+ WTG ID - as provided by TASMA
- The site-incharge will be responsible for operation and maintenance of wind mill.
- Data capturing will be done using controlled format.
- In each site, minimum communication facilities such as telephone or wireless or mobile phone is provided.

Managing data quality:

- The monitoring activity will be centrally executed by TASMA.
- The systems and procedures maintained to implement the monitoring plan/data collection will be done using the above said procedures set up by TASMA.

Table 21: Details of parameter to be monitored

Data Variable	Data unit	Measured/ Calculated/ Estimated	Recording frequency	Party responsible
EG _y	MWh	Measured	Monthly	TASMA

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

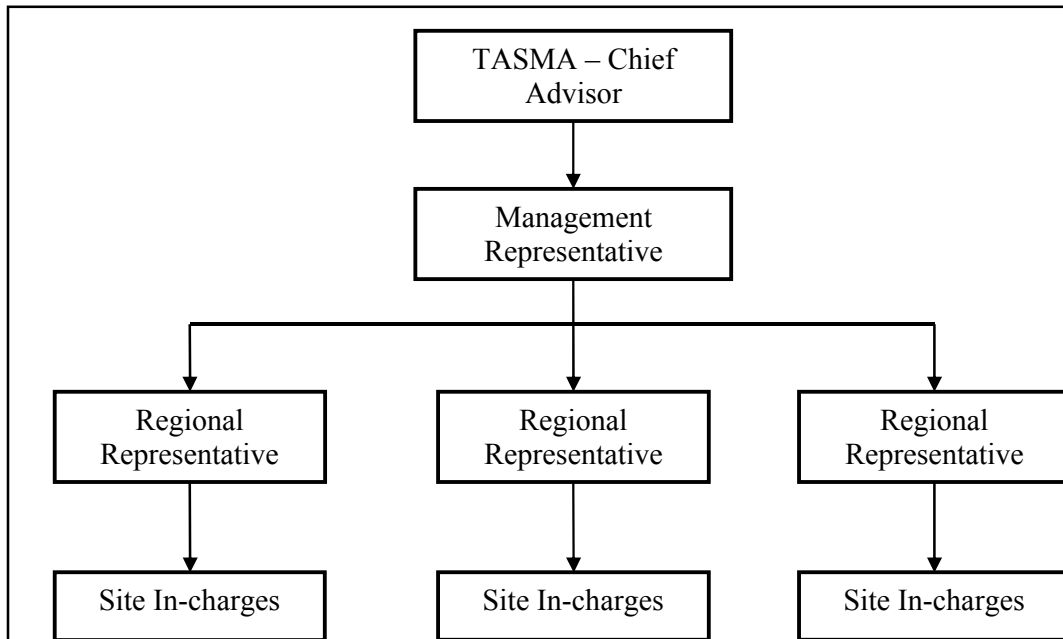
Table 22

Data / Parameter:	EG _y
Data unit:	MWh
Description:	Net electricity supplied to the grid
Source of data to be used:	TNEB statement
Value of data applied for the	The total generation considered for 10 years: 885314

purpose of calculating expected emission reductions	MWh The total generation considered as average per year: 88531 MWh
Description of measurement methods and procedures to be applied:	Measured by 0.5 Class Meter – (accuracy $\pm 0.5\%$) Net generation = (Export- Import) To be certified by TNEB Statement Monthly Measurement by TNEB.
QA/QC procedures to be applied:	QA/QC of Monitoring Equipment Calibration procedure: Main meter is calibrated by the TNEB as per guidelines provided by CEA/TNERC
Any comment:	Data will be archived during the whole crediting period + 2 years

3.4 Description of the monitoring plan

The monitoring activity will be centrally executed by TASMA. The organization for monitoring will be as follows:



The Management Structure for monitoring emission reductions would provide for:

- Operation and Maintenance
 - Maintenance of Meters and Calibration
 - Calculation of Emission Figures
 - Local Environmental Care
 - Changes in project boundary
 - Documents and Records
 - Periodic Review meetings
- TASMA through the project members will appoint a site in-charge for each site with the responsibility of operation, maintenance and safety of WTGs.
 - The Project Sponsor / Project members will abide by all regulatory and statutory requirements as prescribed under the State and Central laws and regulations
 - The generation from the WTGs will be monitored by LCS meters attached with the wind mill and also by the main meter which is owned by TNEB.
 - TNEB meter shall meet the Indian and regional electricity authority's standards (CEA) (with set calibration schedules).
 - The generation for the purpose of emission reduction calculation will be based on the TNEB meter, which is a statutory body.

- All the monitoring data will be recorded and kept under safe custody of the site in-charge
- Also any change within the project boundary, will be recorded and informed to TASMA.

Measurement Frequency:

Frequency of measurement by TNEB – Once in a month

Frequency of measurement by Site In charge – Once a month along with TNEB official Calibration of the Energy Meter - This is carried out by TNEB (As per CEA / TNERC norms)

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

As per the applied approved methodology ACM0002 (Version 10) Emission Reductions are calculated as:

$$ER_y = BE_y - PE_y - L_y$$

Where:

- ER_y - Emission reductions in year y (t CO₂e/yr)
- BE_y - Baseline emissions in year y (t CO₂e/yr)
- PE_y - Project emissions in year y (t CO₂e/yr)
- LE_y - Leakage Emissions in year y (t CO₂e/yr)

Baseline Emissions:

The baseline emissions include only CO₂ emissions from electricity generation in Fossil fuel fired power plants that are displaced due to project activity, calculated as follows:

$$BE_y = (EG_y - EG_{\text{baseline}}) \times EF_{\text{grid,CM,y}}$$

Where:

- BE_y = Baseline emissions in year y (tCO₂/yr)
- EG_y = Electricity supplied by the project activity to the grid (MWh)
- EG_{baseline} = Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). As it is a new power plants this value is taken as zero
- EF_{grid,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”

According to the Tool to calculate the emission factor for an electricity system, version 1.1, EF_{grid,CM,y} i.e. baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following below steps. Calculations for this combined margin are based on data from an official source and are made publicly available.

As per “**Tool to calculate the emission factor for an electricity system**”, **version-1.1**, the steps followed to calculate Combined margin of Southern regional grid are as follows:

Step 1: Identify the relevant electric power system:

Historically, the Indian power system was divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covered several states. Since August 2006, however, all regional grids except the Southern Grid have been integrated and are operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids will be treated as a single grid and is being named as NEWNE grid from FY 2007-08 onwards for the purpose of CO₂ Baseline Database.

Table 1 Geographical scope of the two electricity grids

NEWNE Grid				Southern Grid
Northern	Eastern	Western	North-Eastern	Southern
Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar & Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Pondicherry
Punjab	Andaman-Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttarakhand				

The proposed project is located in the state of Tamilnadu and will be feeding the electricity in the Southern regional grid. Therefore the proposed project would have impact on all the generation facilities in this grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. 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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

- Simple OM, or
- Simple adjusted OM, or
- Dispatch data analysis OM, or
- Average OM.

Due to non-availability of archived dispatch data in the public domain for the NEWNE grid, 'Dispatch Data Analysis' (1c) has not been chosen, though it should be the first methodological choice.

As per Tool to calculate emission factor of an electricity system, version-1.1, the simple operating margin (Simple OM) can be used only if low-cost/must-run resources constitute less than 50% of total grid generation in (a) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

From the available information published by CEA “CO₂ database for Indian Power sector”, it can be seen from the table below that low cost/must run sources for Southern regional Grid accounts for less than 50% of the total generation in the last five years. Hence the Simple OM method has been used to calculate the Operating Margin Emission factor applicable.

Table 2 All India Region wise generating installed capacity (MW) of power utilities including allocated shares in joint and central sector utilities (As on 31 July 2009)

SL. NO.	REGION	THERMAL				Nuclear	HYDRO (Renewable)	R.E.S.@ (MNRE)	TOTAL
		COAL	GAS	DSL	TOTAL				
1	Northern	19087.95	3531.19	12.99	22632.13	1180.00	13425.15	1766.37	39003.65
2	Western	26335.18	7748.22	17.48	34100.88	1840.00	7448.50	4023.62	47413.00
3	Southern	16982.50	4150.20	939.32	22072.02	1100.00	10993.18	7047.90	41213.10
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	79208.88	16385.61	1199.75	96794.24	4120.00	36916.76	13242.41	151073.41

Captive Genrating capacity connected to the Grid (MW) = 19509.49

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

Step 3. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low cost/must-run power plants / units, using the following equation:

$$EF_{OM,y} = [\sum_{ij} F_{ij,y} * COEF_{ij}] / [\sum_j GEN_{j,y}] \dots \dots \dots (3)$$

Where $F_{ij,y}$ and $COEF_{ij}$ are the fuel consumption and associated carbon coefficient of the fossil fuel i consumed by power plant j in the grid in year(s) y . $GEN_{j,y}$ is the electricity generation by power plant j connected to the grid excluding zero- or low-operating cost sources in year(s) y .

As per ACM0002 version 10, the OM emission factor can be calculated using *ex ante* generation-weighted average of the most recent 3 years for which data is available or using *ex post* generation data in the year in which the project generation occurs. The OM emission factor is calculated using *ex ante* generation weighted average of the most recent 3 years (2005-06, 2006-07 and 2007-08) and hence does not require yearly monitoring of the OM emission factor. The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO₂ Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India.

Step 4. Identify the cohort of power units to be included in the build margin (BM)

The database of Carbon Dioxide Emission from the power sector in India published by CEA has calculated the build margin in accordance with the Grid Tool, as the average emissions intensity of the 20% most recent capacity additions in the grid based on net

generation. Depending on the region, the build margin covers units commissioned in the last five to ten years.

Step 5. Calculate the build margin emission factor

The Build Margin emission factor $EF_{BM,y}$ is calculated ex-ante based on the most recent information available on plants already built. The Build Margin emission factor $EF_{BM,y}$ is given as the generation weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most recent 20% of the generating units built (summation is over such plants specified by k). The most 20% of the generating units built recently is used for build margin emission factor calculation.

Step 6. Calculate the combined margin (CM) emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_y = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

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 (%)

For wind and solar projects, ACM0002 allows the usage of the default weights as follows:

$$w_{OM} = 0.75 \text{ and } w_{BM} = 0.25.$$

The details of calculation of OM, BM and CM are shown in Emission reduction calculation Sheets.

Project Emissions:

The project generates by the installation of wind turbines and hence there is no project emission from the project activity.

$$PE_y = 0$$

Leakage Emissions:

There is no leakage involved in the project activity.

$$L_y = 0$$

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

Base Line Emissions: (BE_y)

According to ACM0002, Baseline Emission is calculated by the following formula.

$$BE_y = EG_y * EF_y$$

Baseline emission factor (combined margin)

$$\begin{aligned} EF_y \text{ (tCO}_2\text{e/MWh)} &= w_{OM} * EF_{OM,y} \text{ (tCO}_2\text{e/MWh)} + w_{BM} * EF_{BM,y} \text{ (tCO}_2\text{e/MWh)} \\ &= 0.75 * 0.998157296 + 0.25 * 0.71331778 \\ &= 0.92694742 \text{ t CO}_2\text{e/MWh} \end{aligned}$$

Annual electricity supplied to the grid by the Project

EG_y = Electricity supplied by the project activity to the
Grid (MWh)

$$EG_y = 51.595 \times 8760 \times 19.59\% = \text{MWh} = 88531 \text{ MWh}$$

$$BE_y = 88,531 \times 0.92694742 = 82064 \text{ tCO}_2\text{e}$$

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

Project Emissions: (PE_y)

According to ACM0002, there is no project emission for grid connected wind based power generation. Hence in this case it is considered as

$$PE_y = 0 \text{ tCO}_2\text{/year}$$

Where,

PE_y is the Project Emission for the year.

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

Emissions Reduction: (ER_y)

For a given year, the emission reductions contributed by the project activity (ER_y) is calculated as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where,

BE_y	-	Base Line Emission for the year 'y'
ER_y	-	Emission reductions for the year 'y'
PE_y	-	Project Emissions for the year 'y'
L_y	-	Leakage for the year 'y'

The emission reductions will be calculated based on actual net electricity supplied to the grid, using the baseline emission factor presented above.

$$ER_y = BE_y = 82064 \text{ tCO}_2\text{e}$$

5 Environmental Impact:

As per the prevailing local /host country laws no environmental impact assessment is required, (the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated September 14, 2006), 38 activities are required to undertake environmental impact assessment studies. The details of these activities are available at <http://envfor.nic.in/legis/eia/so1533.pdf>.

However the project participant has carried out Aspect and Impact analysis of all the activities of the project and concluded that there is no negative environmental impact due to the project activity and wind energy is one of the cleanest sources of energy.

6 Stake holder's comments:

The local stakeholders have already been contacted for the first & second bundled CDM projects of TASMA. For this project also, a questionnaire survey was conducted covering the people living in the villages nearby the site.

The basic points covered in the questionnaire are given below:

Sl No	Questions
1.	What do you think about the environment in your locality?
2.	Is your environment affected by the wind mill?
3.	Is your TV Reception affected by the Windmill?
4.	Does the project affect the livelihood?
5.	Does the project improve the livelihood?
6.	Has employment increased due to the project?
7.	Is there Noise problem due to the wind mill?
8.	Is there water problem due to the windmill?
9.	Is there Vibration problem due to the windmill?
10.	Is there any problem with respect to construction?
11.	Does the wind mill affect the migration of birds?
12.	Does the wind mill affect the grazing of cattle?
13.	What are the benefits from the wind Mill?
14.	Comments and suggestions :(if any)

Summary of the comments received

The overall opinion expressed through the questionnaire was based on the experience of the local stake holders with the already existing windmills. The overall response was that the impact of windmills in the locality will be of positive nature.

The summary analysis of questionnaire survey is presented below:-

Sl No	Question	Response By Majority of respondents
1.	What do you think about the environment in your locality?	Very Good
2.	Is your environment affected by wind mill?	Not at all affected
3.	Is your TV Reception affected by Windmill?	Not at all affected
4.	Does the project affect the livelihood?	Not at all affected
5.	Does the project improve livelihood?	Good Improvement

6.	Has employment increased due to the project?	Good Improvement
7.	Is there any Noise problem due to wind mill?	Not at all
8.	Is there any water problem due to windmill?	Not at all
9.	Is there any Vibration problem due to windmill?	Not at all
10.	Is there any problem with respect to construction?	Not at all
11.	Does the wind mill affect the migration of birds?	Not at all
12.	Does the wind mill affect the grazing of cattle?	Not at all
13.	What are the benefits from the wind Mill?	Good Benefits
14.	Comments and suggestions :	• Plantation to be considered • Approach roads should not affect water catchments • Provide employment for locals
15.	Any other Points for consideration	• Many good suggestions were given which are already been taken care / will be considered in future also.

Report on how due account was taken of any comments received

The responses are categorised as positive and negative based on the comments. The positive responses indicate that respondent feels that the project activity will lead to overall good for the society.

All of the individual respondents are of the view that the project activity is of good to them and the society. It has added to the electricity generation of the state grid without causing any pollution.

No negative comments were not received that required follow up action. The original sheet shown and a copy given.

7 Schedule:

Table: 28 Chronological plans

<i>Parameter</i>	<i>Date/period</i>
<i>Start date of the project activity</i>	<i>5th March 2002</i>
<i>Project termination</i>	<i>31st March 2026</i>
<i>Project lifetime</i>	<i>20 years</i>
<i>Agreement with the DOE</i>	<i>11th November 2008</i>
<i>VCS PD completion</i>	<i>23rd September 2009</i>
<i>Begin VCS Validation</i>	<i>1st October 2009</i>
<i>Monitoring frequency by TNEB & Site In-charge</i>	<i>Monthly</i>
<i>Reporting frequency to TASMA by Regional Representative</i>	<i>Once in three months</i>

8 Ownership:

8.1 Proof of Title:

The Commissioning certificate issued by the TNEB for all the WTGs is the vital evidence for the proof of title of the sub-project owners. Also, an authorization letter is given by each individual sub project owner to TASMA to deal with the processes. The above said documents are provided to the DOE for verification.

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

>> Not applicable

Appendix-1– WTG Identification, Location and HTSC Number

COMP. CODE NO	NAME OF THE MILLS / COMPANIES	WTG NO	CAPACITY (in KW)	HTSC. NO	LATITUDE (N)			LONGITUDE (E)		
					Deg	Min	Sec	Deg	Min	Sec
V001	Anugraha Valve Casting Ltd	1	1250	493	8	13	23	77	39	44
V002	Arun Excello Urban Infrastructure Pvt. Ltd.,	1	225	546	8	12	37	77	34	42
V002	Arun Excello Urban Infrastructure Pvt. Ltd.,	2	225	547	8	12	52	77	34	41
V003	Arunachala Gounder Textile Mills Pvt. Ltd.,	1	600	597	10	53	56	77	14	56
V003	Arunachala Gounder Textile Mills Pvt. Ltd.,	2	600	2496	8	14	45	77	44	47
V004	Classic Spinning Mills Pvt. Ltd.,	1	225	314	10	54	35	77	18	2
V004	Classic Spinning Mills Pvt. Ltd.,	2	225	314	10	55	4	77	18	0
V004	Classic Spinning Mills Pvt. Ltd.,	3	225	314	10	55	11	77	18	4
V004	Classic Spinning Mills Pvt. Ltd.,	4	225	314	10	54	58	77	17	54
V004	Classic Spinning Mills Pvt. Ltd.,	5	225	314	10	55	4	77	17	53

VCS Project Description

V004	Classic Spinning Mills Pvt. Ltd.,	6	500	258	10	56	50	77	19	6
V004	Classic Spinning Mills Pvt. Ltd.,	7	500	625	10	56	50	77	19	6
V005	Classic Wind Farms	1	225	255	10	53	49	77	9	24
V005	Classic Wind Farms	2	225	255	10	53	38	77	9	22
V005	Classic Wind Farms	3	500	259	10	56	42	77	19	9
V005	Classic Wind Farms	4	500	627	10	53	38	77	9	22
V005	Classic Wind Farms	5	500	626	10	53	49	77	9	24
V006	Deffree Engineering (P) Ltd.,	1	800	1059	10	41	43	77	26	16
V007	Dhanalakshmi Controls & Equipments	1	225	726	10	40	38	77	21	37
V008	Frontier Processing Mills	1	500	1723	8	24	26	77	34	10
V009	Jayakrishna Flour Mills Pvt. Ltd.,	1	225	477	8	13	56	77	34	14
V009	Jayakrishna Flour Mills Pvt. Ltd.,	2	225	518	8	13	55	77	34	23

VCS Project Description

V009	Jayakrishna Flour Mills Pvt. Ltd.,	3	225	623	8	13	59	77	34	54
V009	Jayakrishna Flour Mills Pvt. Ltd.,	4	225	781	8	13	52	77	34	49
V009	Jayakrishna Flour Mills Pvt. Ltd.,	5	225	782	8	13	59	77	33	54
V009	Jayakrishna Flour Mills Pvt. Ltd.,	6	225	1463	8	14	13	77	33	5
V009	Jayakrishna Flour Mills Pvt. Ltd.,	7	225	1769	8	14	21	77	33	7
V010	K.G. Entertainment Company (P) Ltd.,	1	350	1328	10	36	19	77	19	16
V011	Kaleesuvari Refinery Pvt. Ltd.,	1	500	609	8	18	4	77	34	58
V011	Kaleesuvari Refinery Pvt. Ltd.,	2	600	603	8	18	11	77	34	38
V012	Lakshmi Narayan Govrishankar Enterpriser Pvt. Ltd.,	1	500	561	10	56	3	77	15	46
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	2	250	663	10	56	58	77	15	13
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	3	250	664	10	56	59	77	15	5
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	4	250	665	10	56	55	77	15	6

VCS Project Description

V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	5	250	666	10	56	4	77	15	58
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	6	250	252	10	56	57	77	15	21
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	7	250	252	10	56	2	77	15	20
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	8	250	252	10	56	6	77	15	18
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	9	250	260	10	56	3	77	15	12
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	10	250	261	10	56	3	77	15	4
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	11	250	444	10	56	10	77	15	15
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	12	250	445	10	56	9	77	15	7
V012	Lakshminarayan Gourishanker Enterprises Pvt. Ltd.,	13	500	516	10	56	58	77	15	51
V013	Lotus Agency	1	750	1956	9	28	1	77	18	20
V014	M.S. Raja Transports (Wind Mill Division)	1	800	1063	10	42	59	77	27	15
V015	Poombukar Process	1	225	592	10	40	16	77	19	48

VCS Project Description

V016	Poomer Hosieries	1	225	984	10	40	20	77	19	53
V017	Power System Ltd., Link Pvt.	1	230	281	7	55	40	11	47	49
V018	Prime Tex	1	225	574	8	13	50	77	36	45
V018	Prime Tex	2	225	574	8	13	46	77	36	41
V018	Prime Tex	3	225	552	8	13	55	77	36	46
V018	Prime Tex	4	225	552	8	13	53	77	36	34
V018	Prime Tex	5	225	552	8	13	49	77	36	31
V018	Prime Tex	6	225	320	10	40	46	77	20	11
V018	Prime Tex	7	225	318	8	40	55	77	20	10
V019	Rangasayee Alloy Castings	1	230	407	10	36	28	77	18	44
V019	Rangasayee Alloy Castings	2	350	1203	10	36	28	77	18	44
V020	S.N.Q.S. International	1	330	1180	10	36	19	77	24	35

VCS Project Description

V021	S.S.K. Textiles	1	600	58	10	56	58	77	15	41
V021	S.S.K. Textiles	2	250	446	8	14	27	77	35	53
V022	Santhi Casting Works	1	500	608	8	14	18	77	35	36
V023	Seyad Home Industries Pvt. Ltd.,	1	500	607	8	12	44	77	33	51
V024	Seyad Shariat Finance Ltd.,	1	225	645	8	13	0	77	34	27
V025	Seyadu Beedi Company	1	500	417						
V026	Shanmugapriya Textiles Pvt. Ltd.,	1	750	536	8	15	35	77	39	12
V027	Shriram City Union Finance Ltd.,	1	1250	584	8	15	36	77	39	30
V027	Shriram City Union Finance Ltd.,	2	1250	585	8	15	46	77	39	10
V027	Shriram City Union Finance Ltd.,	3	1250	586	8	58	43	77	20	55
V028	Shriram Investments Ltd.,	1	750	640	8	58	59	77	20	53
V028	Shriram Investments Ltd.,	2	750	641	8	58	49	77	20	54

VCS Project Description

V028	Shriram Investments Ltd.,	3	750	641	8	58	41	77	20	54
V028	Shriram Investments Ltd.,	4	750	641	8	58	50	77	20	56
V028	Shriram Investments Ltd.,	5	750	641	8	58	58	77	20	56
V028	Shriram Investments Ltd.,	6	750	641	8	58	46	77	20	43
V028	Shriram Investments Ltd.,	7	750	641	8	58	46	77	20	10
V028	Shriram Investments Ltd.,	8	750	642	10	42	44	77	27	52
V029	SNQS International Socks Pvt. Ltd.,	1	230	290	10	41	51	77	21	45
V030	Soundararaja Mills Ltd.,	1	1250	862	8	10	15	77	39	45
V030	Soundararaja Mills Ltd.,	2	1250	888	8	9	54	77	39	5
V030	Soundararaja Mills Ltd.,	3	1250	889	8	9	53	77	39	22
V030	Soundararaja Mills Ltd.,	4	1250	890	8	9	59	77	39	42
V031	SRG Apparels Private Ltd.,	1	225	575	8	13	56	77	36	37

VCS Project Description

V031	SRG Apparels Private Ltd.,	2	225	575	8	13	52	77	36	58
V031	SRG Apparels Private Ltd.,	3	225	554	8	13	46	77	36	38
V031	SRG Apparels Private Ltd.,	4	225	554	8	13	38	77	36	37
V031	SRG Apparels Private Ltd.,	5	225	554	8	13	57	77	36	37
V031	SRG Apparels Private Ltd.,	6	225	319	10	40	50	77	19	59
V031	SRG Apparels Private Ltd.,	7	225	319	10	40	58	77	19	59
V032	Sri Alamelu Ammal Mills India Pvt. Ltd.,	1	600	63						
V033	Sri Senthilandavar Cotton Mills Pvt. Ltd.,	1	750	519	9	0	17	77	33	33
V034	Sri Venkatram Spinners Pvt. Ltd.,	1	1650	1683	8	12	7	77	40	33
V035	Sugavaneswara Spinning Mills Pvt. Ltd.,	1	1250	2273	8	12	53	77	33	36
V036	Super Spinning Mills Ltd.,	1	1250	611	8	13	7	77	34	17
V037	Suresh Textiles	1	250	613	10	55	49	77	19	59

VCS Project Description

V038	T.E.S. Fathu Rabbani	1	225	447	8	18	7	77	33	18
V039	T.E.S. Naina Mohamed	1	225	754	10	45	11	77	21	54
V040	The Prem Dyeing Works	1	500	424	8	24	42	77	34	8
V041	The United Yarn Processors	1	500	1224	8	24	34	77	34	9
V042	Thriveni Earth Movers Pvt. Ltd.,	1	225	1470	10	56	39	77	30	47
V043	Unifront Driers	1	500	1715	10	41	21	77	23	21
V044	Unifront Textiles Processors Pvt. Ltd.,	1	500	1763	10	41	14	77	23	30
V045	V.R. Foundries	1	850	602	10	55	45	77	13	47
V046	Veena Fabrics Pvt. Ltd.,	1	250	1257	10	55	59	77	13	41
V046	Veena Fabrics Pvt. Ltd.,	2	250	1244	10	40	24	77	18	37
V047	Vetal Hi-Tech Industries	1	250	267	10	36	30	77	19	28
V048	Vetal Textiles & Electronics Pvt. Ltd.,	1	250	266	8	12	6	77	36	41
V049	Victus Dyeings	1	750	384	10	56	36	77	15	37

VCS Project Description

V050	Vigneshkumar Spinning Mills Pvt. Ltd.,	1	350	2201	8	57	21	77	26	45
V050	Vigneshkumar Spinning Mills Pvt. Ltd.,	2	350	1315						
		109	51.595							

Appendix- 2 – WTG capacity wise Project Cost and Pass wise PLF as per Investment guidelines for 2005 onwards

	Proposed Cost in lakhs /MW for different size WTGs			
Capacity in KW	Make	2005	2006	2007
225	NEPC, SWFL, VESTAS RRB	525	551	579
230	ENERCON	525	551	579
250	CWEL, PIONEER WINCON, SRIRAM EPC LTD	475	499	524
330	ENERCON	525	551	579
350	SUZLON	475	499	524
500	VESTAS RRB	600	630	662
600	ENERCON, SUZLON, VESTAS RRB	575	604	634
750	NEG MICON/ VESTAS, NEPC, VESTAS	525	551	579
800	ENERCON	600	630	662
850	PIONEER ASIA WIND TURBINES	575	604	634
1250	SUZLON	600	630	662
1500	SUZLON			650
1650	VESTAS, NEG MICON/VESTAS	650	683	717

	PLF in percentage		
Capacity in MW	Aralvaimozhi Pass (A)	Shencottah Pass (B)	Palghat Pass (C)
0.225	23.61%	20.04%	17.48%
0.230	22.81%	20.26%	16.74%
0.250	20.98%	18.64%	15.40%
0.330	19.84%	16.98%	14.18%
0.350	18.71%	16.01%	13.37%
0.500	27.45%	21.68%	20.49%
0.600	24.32%	20.03%	19.48%
0.750	22.39%	18.59%	17.91%
0.800	27.73%	21.88%	20.52%
0.850	26.84%	20.58%	21.14%
1.250	26.04%	21.00%	20.88%
1.500	25.50%	20.59%	20.77%
1.650	29.79%	22.93%	23.43%

Source: Investment guidelines

Appendix- 3**Baseline Information**

Variable	Data Source
EG _y – Electricity generated	Records maintained by project proponent
Parameter	Data Source
EF _{OM, y} - Build Margin Emission Factor (tCO ₂ /MWh)	CEA Data, version 04 www.cea.nic.in
EF _{BM, y} = Operating Margin Emission Factor (tCO ₂ /MWh)	CEA Data, version 04 www.cea.nic.in
EF _y – Grid Emission Factor	Calculated as the weighted average of the operating margin and build margin

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2002-03	2003-04	2004-05	2005-06	2006-07
North	26.1%	28.1%	26.8%	28.1%	27.1%
East	7.5%	10.3%	10.5%	7.2%	9.0%
South	18.3%	16.2%	21.6%	27.0%	28.3%
West	8.2%	9.1%	8.8%	12.0%	13.9%
North-East	45.8%	41.9%	55.5%	52.7%	44.1%
India	16.3%	17.1%	18.0%	20.1%	20.9%