

# GRID CONNECTED WIND POWER PROJECT IN TAMIL NADU.

Document Prepared By CLP Wind Farms (India) Private Limited

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<b>Prepared By</b>	CLP Wind Farms (India) Private Limited
<b>Contact</b>	<p>Address: 15<sup>th</sup> Floor, Oberoi Commerz, Off Western Express Highway, Goregaon (East), Mumbai – 400 063 India</p> <p>Telephone: +91 - 22 - 6758 8888</p> <p>Email: <a href="mailto:carbon@clpindia.in">carbon@clpindia.in</a></p> <p>Website: <a href="http://www.clpindia.in">www.clpindia.in</a></p>

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## PROJECT DETAILS

### 1.1 Summary Description of the Project

The Project has been implemented by CLP Wind Farms (India) Private Limited (“CLP”) in the state of Tamil Nadu. The Wind Turbine Generators (“WEG”) have been supplied by Vestas Wind Technology India Private Limited (“Vestas”). Vestas will be responsible for technology and equipment supply, as well as the operation and maintenance of the WEGs. The Project activity involves generation of electric power using Wind Energy Generators (WEG). The objective of the project activity is to commission and operate a wind farm of 24.75 MW (“the Project”) in the Tamil Nadu state in India. The Project is supplying the power generated from this project activity to the state electricity distribution company /grid which is a part of Southern regional grid of India.

### 1.2 Sectoral Scope and Project Type

The project activity is considered under zero-emissions ‘grid-connected electricity generation from renewable sources’ with capacity in excess of 15 MW (limit for small scale project). Therefore as per the scope of the project activity enlisted in the ‘list of sectoral scopes and related approved baseline and monitoring methodologies’, the project activity may principally be categorized in Scope Number 1, Sectoral Scope - Energy industries (renewable/ non-renewable sources).

### 1.3 Project Proponent

Contact Information of Participants in the Project Activity:

<b>Organization:</b>	CLP Wind Farms (India) Private Limited
<b>Street/P.O.Box:</b>	Off Western Express Highway, Goregaon (East),
<b>Building:</b>	15th Floor, Oberoi Commerz,
<b>City:</b>	Mumbai
<b>State/Region:</b>	Maharashtra.
<b>Postfix/ZIP:</b>	400 063
<b>Country:</b>	India
<b>Telephone:</b>	+91 - 22 - 6758 8888
<b>FAX:</b>	+91 - 22 - 6758 8811
<b>E-Mail:</b>	<a href="mailto:carbon@clpindia.in">carbon@clpindia.in</a>

<b>URL:</b>	<a href="http://www.clpindia.in">www.clpindia.in</a>
<b>Represented by:</b>	Dipjay Sanchania
<b>Title:</b>	Head – CDM
<b>Salutation:</b>	Mr.
<b>Last Name:</b>	Dipjay
<b>Middle Name:</b>	
<b>First Name:</b>	Sanchania
<b>Department:</b>	Business Development – Renewables
<b>Mobile:</b>	
<b>Direct FAX:</b>	+91 - 22 - 6758 8811
<b>Direct tel:</b>	+91 - 22 - 6758 8840
<b>Personal E-Mail:</b>	<a href="mailto:carbon@clpindia.in">carbon@clpindia.in</a>

#### 1.4 Other Entities Involved in the Project.

No other entities are involved in the project.

#### 1.5 Project Start Date

02/07/2010, being the date of commissioning of first WEG installed under the project activity.

#### 1.6 Project Crediting Period

The crediting period start date is 02/07/2010. The project proponent has chosen a 10 years renewable crediting period. Hence, the first crediting period for the project activity is from 02/07/2010 to 01/07/2020. The project proponents is undertaking the same project activity under CDM<sup>1</sup> however VCU's shall be claimed only till the day before the date of registration of the project under CDM.

<sup>1</sup> <http://cdm.unfccc.int/Projects/Validation/DB/QEJVYBH36RERGDA2GCQSJDVCZH1DK8/view.html>

## 1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project	✓
Mega-project	

Years	Estimated GHG emission reductions or removals (tCO <sub>2</sub> e)
2 July 2010 to 1 July 2011	54,105
2 July 2011 to 1 July 2012	54,105
2 July 2012 to 1 July 2013	54,105
2 July 2013 to 1 July 2014	54,105
2 July 2014 to 1 July 2015	54,105
2 July 2015 to 1 July 2016	54,105
2 July 2016 to 1 July 2017	54,105
2 July 2017 to 1 July 2018	54,105
2 July 2018 to 1 July 2019	54,105
2 July 2019 to 1 July 2020	54,105
<b>Total estimated ERs</b>	541,050
<b>Total number of crediting years</b>	10
<b>Average annual ERs</b>	54,105

*\*VCUs will be claimed till the crediting start date of CDM for this project activity.*

## 1.8 Description of the Project Activity

The Project has been implemented by CLP in the state of Tamil Nadu. The WEG have been supplied by Vestas. Vestas will be responsible for technology and equipment supply, as well as the operation and maintenance of the WEGs. The project activity involves generation of electric power using WEG. The objective of the Project is to commission and operate a wind farm of 24.75 MW; and supply the power generated from this project to the state electricity distribution company / grid which is a part of Southern regional grid of India.

### Nature of Project

The Project entails the installation and operation of 15 numbers of Vestas make V-82 type WEGs. Each of these WEGs is having a rated capacity of 1.65 MW. The power generated from the Project is supplied to Tamil Nadu Electricity Board (“TNEB”) through Kamachipuram S/S 110 kV / 33-22kV substation. CLP is selling this power to TNEB under their long term Power Purchase Agreement (“PPA”) with TNEB. Project life is expected as 20 years.

### Project technology

Technical specifications of the WEGs used in the project activity are as below,

**Table: Technical Specification of WEGs**

TECHNICAL DESCRIPTION	SPECIFICATION
Rotor Diameter	82 m
Hub Height	78 m
Air Brake	Full blade pitch by three separate hydraulic pitch cylinders.
Nominal Revolutions	14.4 rpm
Rated voltage	690V
<b>Generator</b>	
Type of generator	Asynchronous water cooled
Rated power output	1650 kW
<b>Rotor</b>	
No of blades	3
Swept area	5,281 m <sup>2</sup>
<b>Control</b>	
Type	Microprocessor-based monitoring of all turbine functions with the option of remote monitoring. Output regulation and optimization via Active-Stall
<b>Operational Data</b>	
Cut- in wind speed	3.5 m/s
Nominal wind speed	13 m/s
Cut-out wind speed (10 minutes)	20 m/s
<b>Gearbox</b>	
Type	Planetary/helical stages

**Contribution to greenhouse gas (GHG) emissions reduction**

The Project harnesses wind energy to generate and supply electricity to the Southern regional grid, which is predominantly connected fossil fuel based power plants. Hence, the Project displaces similar amount electricity that would have been generated from non-renewable fossil fuel based power plants connected on same grid. The Project thereby leads to reduction in emission of GHGs associated with fossil fuel based electricity generation and enables sustainable economic and environmental development.

**1.9 Project Location**

The Project is spread across Jangalpatti, Poomalaikundu, & Seepalakottai villages in Theni & Uttamaplayam taluka of Theni district of Tamil Nadu state in India. The nearest railway station and airport from Project activity site is Madurai, which is approximately 75 km from the project site.

The Project is (all 15 WEGs) located in Theni District, Tamil Nadu, India. The details of the physical location of the project activity are presented in Annexure 01.

## 1.10 Conditions Prior to Project Initiation

The Project is supplying power to the Southern regional electricity grid which is dominated by fossil fuel fired thermal power stations. The grid is also experiencing power deficit and hence the addition of wind energy generation is helping in avoiding excessive GHG emissions by supplying similar amount of power from other grid connected power plants and meeting the requirement of power demand. .

Since, the Project is connected to Southern grid, the baseline for the Project is the emissions that would have occurred by the operation of grid connected power stations and by the addition of new generating stations in the Southern grid in absence of the Project.

The Project is a renewable power generation facility which does not emit any kind of GHG emissions. Hence the Project activity has not been implemented to create GHG emissions for the purpose of the subsequent removal or destruction of GHG emissions.

## 1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Renewable energy projects are not mandated in India by any enforced law or other regulatory framework. However, for guidance on voluntary wind energy based electricity generation, there are policies introduced/incentives declared by the state governments. These policies have been considered for the project activity and are available at:

<http://www.windpowerindia.com>

For the implementation of the Project, the project participants has obtained land lease deeds/sale deeds and has secured TNEB clearance for commissioning of the WEGs in the state of Tamil Nadu.

## 1.12 Ownership and Other Programs

### 1.12.1 Proof of Title

As evidence to Proof of Title for the emission reduction achieved by the Project, project proponent would like to present:

- Sale deed of the land and land lease documents on which the WEGs are commissioned.
- Power Purchase Agreements with the state electricity utility for sale of electricity from the Project.

### 1.12.2 Emissions Trading Programs and Other Binding Limits

The WEGs included in the Project are located at Tamil Nadu state of India. India, as a non Annex 1 country to Kyoto Protocol, is not bound by the protocol or neither have any national caps or trading scheme wherein renewable project like this can participate in trading of emission certificate.

### 1.12.3 Participation under Other GHG Programs

As of now, the Project activity is undergoing validation under CDM<sup>2</sup>

### 1.12.4 Other Forms of Environmental Credit

The Project is not generating any other forms of environmental credit. A letter from the project proponent is submitted to the validator to demonstrate that the project has not created another form of environmental credit.

### 1.12.5 Projects Rejected by Other GHG Programs

Not applicable.

## 1.13 Additional Information Relevant to the Project

### Eligibility Criteria

Not applicable as the project activity is not a grouped project activity.

### Leakage Management

Not applicable as wind based electricity generation is not associated with any kind of leakages. Also, as per ACM0002 Version 13.0.0, no leakage has been considered for the calculation of emission factor.

### Commercially Sensitive Information

The documents provided to the DoE do not contain any commercially sensitive information.

### Further Information

#### Legislative

- There is no legal or regulatory requirement for setting up wind power projects.

#### Technical

- Increased interest in wind energy projects will further push R&D efforts by technology providers to develop more efficient and better equipment in future.

#### Economic

- The project activity requires temporary and permanent, skilled and semi-skilled manpower at the wind farm; this will create additional employment opportunities.

<sup>2</sup> <http://cdm.unfccc.int/Projects/Validation/DB/QEJVYBH36RERGDA2GCQSJDVCZH1DK8/view.html>

- The generated electricity will be fed to the Southern regional grid through the local grid, thereby improving grid frequency and availability of electricity to the local consumers (villagers & sub-urban habitants), which will provide new opportunities for industries and other economic activity to be setup in the area resulting in greater local employment and overall development.

## Sectoral

- The project activity falls under Sectoral Scope 1, Energy Industries (Renewable/Non-Renewable Sector).
- The project activity is Greenfield renewable grid connected generation facility that will displace electricity from grid connected generating stations.

## Social

- The project activity has led to the development of supporting infrastructure such as road network etc., in the wind farm location, which also provides better access for the local population.
- Use of a renewable source of energy reduces dependence on imported fossil fuels variation thereby leading increased energy security.

## Environmental

- The project activity involves use of renewable energy source for electricity generation instead of fossil fuel based electricity generation, thereby reducing emission reductions.
- Being a renewable resource, using wind energy to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment and contributes towards environmental wellbeing.

## 2 APPLICATION OF METHODOLOGY

### 2.1 Title and Reference of Methodology

The approved consolidated baseline and monitoring methodology ACM0002 (Version 13.0.0, EB67)<sup>3</sup>, has been used to determine the baseline emissions and emission reduction due to the project activity. The title of this baseline methodology is “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”.

The other UNFCCC documents referred are as below

- Tool for the demonstration and assessment of additionality (Version 06.0.0, EB 65)

<sup>3</sup> <http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT>

- Tool to calculate the emission factor for an electricity system (Version 02.2.1, EB 63)
- Guidance on assessment of investment analysis ( 05, EB 62)

## 2.2 Applicability of Methodology

This methodology is applicable to grid-connected renewable power generation project activities under the following conditions:

**Table: Justification for the Choice & Applicability of the Methodology**

S.N.	Applicability conditions of ACM0002	Project under consideration
1.	This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The project activity is installation of wind power plant at locations where no renewable power plant was operated prior to the implementation of the project activity (green-field plant).
2.	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;	The present project activity involves new installation of wind power plant/unit.
3.	In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter $EG_{P,J,y}$ ): 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 addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	Not applicable as the project activity is development of new wind power generation project.

S.N.	Applicability conditions of ACM0002	Project under consideration
4.	<p>In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m<sup>2</sup> all the following conditions must apply:</p> <ul style="list-style-type: none"> <li>• The power density calculated for the entire project activity using equation 5 is greater than 4 W/m<sup>2</sup>;</li> <li>• Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project<sup>1</sup> that collectively constitute the generation capacity of the combined power plant;</li> <li>• Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>• Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m<sup>2</sup>, is lower than 15 MW;</li> <li>• Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m<sup>2</sup>, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.</li> </ul>	<p>Not applicable as the project activity involves electricity generation by development of a wind power generation project.</p>
5.	<p>The methodology is not applicable to the following:</p> <ul style="list-style-type: none"> <li>• 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;</li> <li>• Biomass fired power plants;</li> <li>• A hydro power plant<sup>4</sup> that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m<sup>2</sup>.</li> </ul>	<p>The project activity does not involve any of the given criteria.</p>

<sup>4</sup> Project participants wishing to undertake a hydroelectric project activity that result in a new reservoir or an increase in the existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

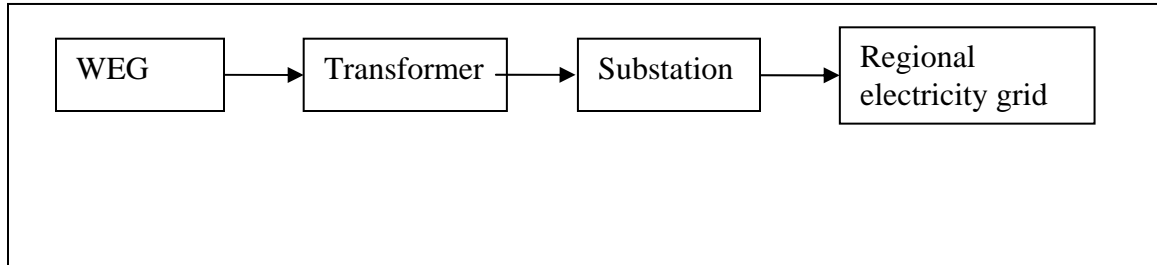
S.N.	Applicability conditions of ACM0002	Project under consideration
6.	In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	The project activity involves the installation of a new wind power plant. Hence, this criterion is not relevant to the project activity.

In light of the above discussion it can be stated that the present project activity is in compliance with the applicability condition stipulated in the approved consolidated baseline and monitoring methodology ACM0002, Version 13.0.0.

### 2.3 Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO <sub>2</sub>	Yes	Main emission source
		CH <sub>4</sub>	No	Minor emission source
		N <sub>2</sub> O	No	Minor emission source
		Other	NA	NA
Project	Electricity generation from the wind power Project	CO <sub>2</sub>	No	Wind energy generation does not have any direct GHG emissions.
		CH <sub>4</sub>	No	Wind energy generation does not have any direct GHG emissions.
		N <sub>2</sub> O	No	Wind energy generation does not have any direct GHG emissions.
		Other	NA	NA

In the project activity, each WEG is connected to its transformer yard, which also houses the energy meter used for measuring the electricity exported to the state grid. The same meter is used for billing purposes. A schematic representation of the project boundary has been provided below:



## 2.4 Baseline Scenario

The Project is located in the state of Tamil Nadu, which is a part of Southern regional electricity grid of the Indian electricity system. Generated power from the project activity will be exported to the Southern regional electricity grid.

### Identification of the baseline scenario

In accordance with ACM0002, if the Project 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*” (version 02.2.1, EB 63).

### Baseline scenario description

The Indian electricity system is divided into two grids, the Integrated Northern, Eastern, Western, and North-Eastern regional grids (NEWNE) and the Southern grid. 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 neighbouring countries Bhutan and Nepal.

For the purpose of calculating the emission reductions achieved by the project activity, the approved methodology ACM0002 version 13.0 requires setting of project boundary “The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system<sup>4</sup> that the CDM project power plant is connected to.” 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 forms part of the Southern grid. Hence, Southern grid is the appropriate project electricity system.

The baseline emissions and emission reductions from the project activity are estimated by multiplying the amount of electricity exported by the project activity to the Southern grid with the

emission factor of the Southern grid calculated as the combined margin (CM) of the operating margin (OM) and build margin (BM) emission factors.

The key variables / parameters and data sources used to determine baseline emission are presented below:

Variable	Data Source
$EG_{P,J,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y	The electricity supplied to the grid would be taken from the Joint Meter Reading Report carried out at the TNEB meter located near each WEG
Parameter	Data Source
$EF_{grid,OM,y}$ = Operating Margin (OM) Emission Factor of Southern Regional Electricity Grid	The CO <sub>2</sub> Baseline Database for the Indian Power Sector - Ministry of Power: Central Electricity Authority (CEA) Version 7
$EF_{grid,BM,y}$ = Build Margin (BM) Emission Factor of Southern Regional Electricity Grid	The CO <sub>2</sub> Baseline Database for the Indian Power Sector - Ministry of Power: Central Electricity Authority (CEA) Version 7
$EF_{grid,CM,y}$ = Combined margin CO <sub>2</sub> emission factor of the grid connected power generation in year y	Calculated as the weighted average of the operating margin and build margin

## 2.5 Additionality

The Project is generating electricity from wind for which there is no GHG emission. The generated electricity is supplied to TNEB. Thus the power generated in the Project is actually displacing the electricity generated from the fossil fuels in the Southern Grid. In case the Project would not have been there, the same amount of electricity would have been generated from the power plants connected to the grid of which majority of the power plants are based on fossil fuels. Thus the Project is replacing the anthropogenic GHG emission from the fossil fuel based power plant connected to the state electricity grid.

### **Demonstrating the project additionality**

According to decision 17/CP.7 para 43, a project will be defined additional if the anthropogenic GHG emissions from the source are reduced below that would have occurred in the absence of

the registered project activity. Within the scope of the adopted baseline methodology, the additionality of the project activity has been demonstrated and assessed using the latest version of the “Tool for the demonstration and assessment of additionality<sup>5</sup>” (Version 06.0.0, EB 65). The tool prescribes the following steps for proving additionality of a project.

**Step 1. Identification of alternatives to the project activity consistent with current laws and Regulations**

Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

**Sub-step 1a. Define alternatives to the project activity:**

Alternative(s) that provide outputs or services similar to that of the project activity (i.e. electricity generation) available to the project participants or similar project developers include:

- a. The Project is not undertaken as a CDM project activity.
- b. Continuation of the current situation where no project activity is undertaken

**Alternative 1: The Project is undertaken without being considered as a CDM project activity**

In this alternative, the proposed project activity is implemented (without additional benefits from carbon credits) and connected to the TNEB Grid, which is a part of the Southern regional electricity grid, and displaces an amount of electricity equivalent to the generation mix of the Southern regional electricity grid. Wind power being a clean source of energy would not result in any GHG emissions due to implementation of the candidate project activity. This is a realistic and credible alternative to the project activity. However, without carbon credit benefits, the project is not financially viable as indicated in the investment analysis section below. Therefore this option is not considered most plausible baseline option.

**Alternative 2: Continuation of the current situation where no project activity is undertaken**

This is the continuation of the current situation. In this regard please find below the percentage contribution of thermal power plants to the total installed capacity in Southern region and also in the state of Tamil Nadu as on 28<sup>th</sup> February, 2009<sup>6</sup>

	Total installed capacity (MW)	Thermal (MW)	Thermal as percentage of total installed capacity
Southern Region	40130.20	21267.92	53%
Tamil Nadu	14088.85	6957.87	49.38%

<sup>5</sup> Source: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.pdf>

<sup>6</sup> [http://www.cea.nic.in/archives/exec\\_summary/feb09.pdf](http://www.cea.nic.in/archives/exec_summary/feb09.pdf)

This is considered as the most plausible option as this is the status quo situation and faces no barriers.

***Sub-step 1b. Consistency with mandatory laws and regulations:***

All the above alternatives are consistent with current laws and regulations and there are no legal and/or regulatory requirements that prevent the Alternatives from occurring.

*Outcome of step 1*

Alternatives to the project activity have been identified in the section above and none of these alternatives are prohibited by laws and regulations.

**Step 2. Investment analysis**

*Determine whether the proposed project activity is not:*

- (a) The most economically or financially attractive; or*
- (b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).*

The Methodological Tool “Demonstration and assessment of additionality” (Version 06.0.0) states that project participants may choose to apply Step 2 (Investment analysis) or Step 3 (Barrier analysis) to demonstrate the additionality of the project. In the present scenario, only Step 2 is used to demonstrate the additionality of the project.

***Sub-step 2a: Determine appropriate analysis method***

Benchmark analysis has been chosen as the appropriate analysis method since the baseline for the project activity is supply of electricity from the grid. This is also in accordance with Paragraph 19 of the Guidance on the Assessment of Investment Analysis Version 5 that says “*If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.*”

***Sub-step 2b: Option III. Apply benchmark analysis***

The Equity IRR was found to be the most appropriate financial indicator for assessment of the feasibility of the project activity. The internal rate of return (IRR) is a very common capital budgeting metric used by firms to decide whether they should make investments in a particular project activity. It is defined as the annualized effective compounded return rate which can be earned on the invested capital or the discount rate that makes the net present value of the investment's income stream total to zero. Hence it is an indicator of the efficiency or quality of an investment.

The project proponent had carried out an estimation of the costs involved in the project activity and the revenues that it would be expected to generate over its operational lifetime. Based on these estimates, the Equity IRR for the project activity was found to be very low, indicating it to be not economically or financially attractive for the project proponent. However, the project proponent decided to implement the project only after taking carbon credit revenue into consideration that improves the Equity IRR.

**Benchmark**

Since benchmark approach is being applied, the section on Selection and Validation of Appropriate Benchmarks of Guidelines on the Assessment of Investment Analysis Version 5 has been referred which states that “Required/expected returns on equity are appropriate benchmarks for an equity IRR”. Therefore, expected return on equity is being used as a benchmark.

Further, the guideline states that “In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market”. Since the project could be developed by an entity other than the project participant, the benchmark is calculated based on parameters that are standard in the market.

Additionally, the guideline also states that “If the benchmark is based on parameters that are standard in the market, the cost of equity should be determined either by: (a) selecting the values provided in Appendix A; or by (b) calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors.”

Accordingly, the cost of equity is being determined as the value provided in Appendix A. However, as per paragraph 7 of the appendix to the guidelines, the default values provided in the appendix are real term values that can be converted to nominal values by adding the inflation rate.

The default value for expected return on equity for energy industry in India in real term rates as per appendix to the Guidelines on the assessment of investment analysis is 11.75%.

The medium-term inflation forecast from Reserve Bank of India which is the central bank of the host country is 4.25%.<sup>7</sup>

Therefore, the expected return on equity in nominal terms is 11.75% + 4.25% = 16.00%.

**Investment Analysis:**

**IRR Analysis**

The IRR analysis carried out in accordance with the *Guidance on the Assessment of Investment Analysis* Version 05.

The assumptions used for the carrying out the IRR analysis of the Project are as shown below:

Particulars	Value	Unit	Source/Remarks
No. of wind turbines	15	Nos	Installed capacity
Capacity of each WEG	1.65	MW	Offer Letter from Vestas dated 12-05-2009
Capacity of the project	24.75	MW	Calculated
Net generation	60.33	GWh	Wind Assessment Report
Project cost	1425.00	INR Million	Offer Letter from Vestas dated 12-05-2009
Plant Load Factor	27.82	%	Calculated
Debt	70%	%	As per para 7.5 of Wind tariff order of TNERC dated 20-3-2009

<sup>7</sup> <http://rbidocs.rbi.org.in/rdocs/notification/PDFs/76972.pdf>; - can be found on Page No.34, Para No.98

Equity	30%	%	As per para 7.5 of Wind tariff order of TNERC dated 20-3-2009
Debt	997.50	INR Million	Calculated
Equity	427.50	INR Million	Calculated
Interest rate	11.50%	%	RBI Prime Lending Rate ( <a href="http://www.rbi.org.in/scripts/WSSView.aspx?Id=13953">http://www.rbi.org.in/scripts/WSSView.aspx?Id=13953</a> )
Debt Repayment tenure	10	Years	As per para 7.6 of Wind tariff order of TNERC dated 20-3-2009
Moratorium	0	Year	As per para 7.6 of Wind tariff order of TNERC dated 20-3-2009
Operation and Maintenance (4 <sup>th</sup> year) per WEG	1.50	INR Million/WEG	Offer Letter from Vestas dated 12-05-2009
Operation and Maintenance (4 <sup>th</sup> year)	22.5	INR Million	Calculated
Escalation in O & M (from 5th Year onwards)	5%	%	Offer Letter from Vestas dated 12-05-2009
Service tax on O & M fees	12.36%	%	As per prevailing tax rates for FY 07-08 ( <a href="http://www.servicetax.gov.in/st-proc-home.htm">http://www.servicetax.gov.in/st-proc-home.htm</a> )
Insurance premium	2.11	INR Million/Yr	Quotation for insurance premium dated 05 Jun 2009
Tariff	3.39	Rs/kWh	TNERC Tariff Order / PPA
Depreciation Rate (Book)	5.28%	%	Companies Act, 1956 ( <a href="http://www.fastfacts.co.in/resources/DepCoAct.rtf">www.fastfacts.co.in/resources/DepCoAct.rtf</a> )
IT Depreciation Rate	80.00%	%	Appendix IA of Income Tax Act Rules ( <a href="http://law.incometaxindia.gov.in/DIT/File_opener.aspx?page=ITRU&amp;schT=rul&amp;csId=4a23cee1-1818-45d6-ab19-f155e08ed789&amp;rNo=&amp;sch=&amp;title=Taxmann-Direct Tax Laws">http://law.incometaxindia.gov.in/DIT/File_opener.aspx?page=ITRU&amp;schT=rul&amp;csId=4a23cee1-1818-45d6-ab19-f155e08ed789&amp;rNo=&amp;sch=&amp;title=Taxmann-Direct Tax Laws</a> )
Income tax rate	33.99%	%	Income Tax Act for FY 07-08 ( <a href="http://www.apcca.com/Attach/incomtax.xls">www.apcca.com/Attach/incomtax.xls</a> )
MAT rate	11.33%	%	Income Tax Act for FY 07-08 ( <a href="http://www.apcca.com/Attach/incomtax.xls">www.apcca.com/Attach/incomtax.xls</a> )
Salvage Value	10%	%	As per para 7.10 of TNERC tariff order dated 20-03-2009

***Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):***

The Equity Internal Rate of Return for the Project is **7.98%** hence; it can be clearly observed that the returns from the project activity do not exceed the benchmark of **16.00%**. Thus the project activity on its own is clearly not a financially viable option and hence the revenue from carbon credits is essential to make the project activity a financially viable venture.

***Sub-step 2d: Sensitivity analysis (only applicable to Options II and III):***

As per Step 2d of the Methodological Tool “*Demonstration and assessment of additionality*” Version 06.0.0, a sensitivity analysis is to be carried out to show whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The results of the sensitivity analysis are detailed below:

<b>Base case</b>	<b>7.98%</b>		<b>Comments</b>
<b>Variable Parameter</b>	<b>Decrease</b>	<b>Increase</b>	
	<b>10%</b>	<b>10%</b>	
<b>Energy Generation</b>	<b>4.82%</b>	<b>11.16%</b>	The energy generation has been determined based on the analysis conducted by third party engineering consultants, Hydro Tasmania. Any significant increase in energy generation is not envisaged, however, even in the extreme case of an increase of 10% in energy generation, it can be observed that the IRR does not cross the benchmark. The project would become non additional if Net Generation goes up by 24.4%
<b>Project Cost</b>	<b>11.08%</b>	<b>5.51%</b>	The project cost primarily comprises of the cost of civil works and plant and machinery which is unlikely to decrease significantly. Even with a decrease of 10% in the project cost, it can be observed that the IRR does not cross the benchmark. The project would become non additional if Project cost goes down by 21.5%
<b>Tariff</b>	<b>4.82%</b>	<b>11.16%</b>	<i>The Tariff has been fixed as per the TNERC Tariff Order dated 20-3-2009</i> The project proponent has also signed a Power Purchase Agreement with TNEB for this purpose and any change in the tariff is unlikely. The project would become non additional if Tariff of Tamilnadu goes up by 24.4%
<b>O&amp;M</b>	<b>8.36%</b>	<b>7.59%</b>	<i>The variation in the cost of Operations and Maintenance does not affect the Equity IRR by a significant margin due to its low value.</i> The project would become non additional if O&M cost goes down by 252%

**Step 4. Common practice analysis**

**Sub-step 4a: Analyze other activities similar to the proposed project activity:**

Over the years there have been two different regulatory / investment regimes in the state of Tamil Nadu for wind power projects.

**Regime 1 – Central regime (MNES policy)**

- Projects installed prior to September 2001
- Wind power projects were governed by MNES policy with tariff set at Rs. 2.25 per unit for the base year 1994-95 with a 5% annual escalation, wheeling and banking charges of 2%, etc.

**Regime 2 – State regime (TNEB and TNERC policies / orders)**

- Projects installed after September 2001
- Wind power projects were governed by (a) TNEB order of 2001 with fixed tariff of Rs. 2.70 per unit, wheeling and banking charged of 5%, etc. (b) TNERC order of 2006 with fixed tariff of Rs. 2.9 per unit, etc.

The different tariffs under regime 1 and regime 2 are presented below:

Electricity tariff (Rs/kWh)	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Average
<b>REGIME 1</b>											
MNES Policy <sup>8</sup>	3.60	3.72	3.83	3.94	4.05	4.17	4.28	4.39	4.50	4.62	4.11
<b>REGIME 2</b>											
TNEB order 2001 <sup>9</sup>	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
TNERC Order 2006 <sup>10</sup>	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90

The capacity of the project activity is 24.75 MW, therefore similar capacity projects +/- 50% is calculated as 12.375 MW to 37.125 MW. The candidate CDM project activity is a large scale project and hence an analysis of all private wind farm owners with an installed capacity in range of 12.375 MW to 37.125 MW, in the state of Tamil Nadu, under the Regime 2 i.e. after September 2001, has been presented below.

<sup>8</sup> Rs.2.25 for 1994-95 and 5% annual escalation thereafter

<sup>9</sup> Rs.2.70 for 2001 fixed for next 10 years

<sup>10</sup> Rs. 2.90 for 2006, fixed for next 10 years

Name of Owner <sup>11</sup>	Capacity MW in the Regime 2 <sup>12</sup>	CDM <sup>13</sup>	Web-links and Explanation
Ambika Cotton Mills Ltd.	15.400	Registered	<a href="http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view">http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view</a>
Arvind A Traders	19.350	Registered	<a href="http://cdm.unfccc.int/Projects/DB/DNV-CUK1174976416.26/view">http://cdm.unfccc.int/Projects/DB/DNV-CUK1174976416.26/view</a>
Bannari Amman Spinning Mills Ltd.	23.400	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/FYPAQ52NJB35JZRDUICOGVD36E6S33/view.html">http://cdm.unfccc.int/Projects/Validation/DB/FYPAQ52NJB35JZRDUICOGVD36E6S33/view.html</a>
Best & Co.	25.000	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/4R4NBZ8HU31NRZMNMQAMH37GJN07926/view.html">http://cdm.unfccc.int/Projects/Validation/DB/4R4NBZ8HU31NRZMNMQAMH37GJN07926/view.html</a>
CPCL	17.600	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/178HZLVK21QHH5Y3SZI88Q1O865IMB/view.html">http://cdm.unfccc.int/Projects/Validation/DB/178HZLVK21QHH5Y3SZI88Q1O865IMB/view.html</a>
DLF Home Developers Ltd	34.500	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/34CAG54CUL49MILW9S0SKWCWU38SSX/view.html">http://cdm.unfccc.int/Projects/Validation/DB/34CAG54CUL49MILW9S0SKWCWU38SSX/view.html</a>
Grace Infrastructure (P) Ltd.	31.000	Rejected	<a href="http://cdm.unfccc.int/Projects/DB/RWTUV1248957594.87/view">http://cdm.unfccc.int/Projects/DB/RWTUV1248957594.87/view</a>
K S Oils Ltd.	16.000	SSC	<a href="http://cdm.unfccc.int/Projects/Validation/DB/R01Z1KZJ4OCWUOYTK0KE0BCFT9JYIM/view.html">http://cdm.unfccc.int/Projects/Validation/DB/R01Z1KZJ4OCWUOYTK0KE0BCFT9JYIM/view.html</a>
KPR Mill Pvt. Ltd.	33.170	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/YKCHA6D5FCSE03JMVP8UXJWRMDBC8/view.html">http://cdm.unfccc.int/Projects/Validation/DB/YKCHA6D5FCSE03JMVP8UXJWRMDBC8/view.html</a>
Lakshmi Machine Works Ltd	23.000	Validation Terminated	<a href="http://cdm.unfccc.int/Projects/Validation/DB/MFHV5EFC9PJIZQ16ZPUQ3ZYQ5JUBNI/view.html">http://cdm.unfccc.int/Projects/Validation/DB/MFHV5EFC9PJIZQ16ZPUQ3ZYQ5JUBNI/view.html</a>
Loyal Textile Mills Ltd	20.450	Validation Terminated	<a href="http://cdm.unfccc.int/Projects/Validation/DB/ED7XENPZW06ZNTMVUOXKQXEGZMUZV/view.html">http://cdm.unfccc.int/Projects/Validation/DB/ED7XENPZW06ZNTMVUOXKQXEGZMUZV/view.html</a>
Muthoot Fincorp Ltd.	18.750	SSC	<a href="http://cdm.unfccc.int/Projects/Validation/DB/0KH0IO3K9P0Z86DVCHDOHQ7XBZH58S/view.html">http://cdm.unfccc.int/Projects/Validation/DB/0KH0IO3K9P0Z86DVCHDOHQ7XBZH58S/view.html</a>
NEG-Micon (I) P. Ltd.	16.650		
Powerica	16.500	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/XIBTKKDPMONX9RG3T5ZNWM6GWRWMRL/view.html">http://cdm.unfccc.int/Projects/Validation/DB/XIBTKKDPMONX9RG3T5ZNWM6GWRWMRL/view.html</a>
Premier Fine Yarns Pvt. Ltd.	22.850	SSC	<a href="http://cdm.unfccc.int/Projects/Validation/DB/JOJ2B6K3O92EEUAFD3OGYLE03TNZ7I/view.html">http://cdm.unfccc.int/Projects/Validation/DB/JOJ2B6K3O92EEUAFD3OGYLE03TNZ7I/view.html</a>

<sup>11</sup> The data on private wind farm owners with greater than 15 MW installed capacity has been taken from <http://www.windpowerindia.com/statpriv.html>.

<sup>12</sup> The capacity of installations under the Regime 2, i.e. commissioned after September 2001 and before the project start date, in the state of Tamil Nadu, has been sourced from the Directory of Indian Windpower 2009.

<sup>13</sup> The CDM status of the projects has been taken from the CDM pipeline in <http://cdm.unfccc.int>, MoEF site and other publicly available sources.

Premier Spg & Wvg Mills Pvt. Ltd	16.250	SSC	<a href="http://cdm.unfccc.int/Projects/Validation/DB/J0J2B6K3O92EEUAFD3OGYLE03TNZ7I/view.html">http://cdm.unfccc.int/Projects/Validation/DB/J0J2B6K3O92EEUAFD3OGYLE03TNZ7I/view.html</a>
Rasi Seeds (P) Ltd.	16.250	SSC	<a href="http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view">http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view</a>
Sapthagiri Distilleries	21.000	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/ZSGOS9T3629EQQBKKJ8S3S5KQCSR9/view.html">http://cdm.unfccc.int/Projects/Validation/DB/ZSGOS9T3629EQQBKKJ8S3S5KQCSR9/view.html</a>
Shanmugavel Group	25.500		
Soundararaja Mills Ltd.	33.850	SSC	<a href="http://cdm.unfccc.int/Projects/Validation/DB/LO3RUNJBAVPC94GWP0N3IPQZM866Y0/view.html">http://cdm.unfccc.int/Projects/Validation/DB/LO3RUNJBAVPC94GWP0N3IPQZM866Y0/view.html</a>
Super Wind Project Pvt Ltd	25.000	Under Validation	<a href="http://cdm.unfccc.int/Projects/Validation/DB/AHUI0REM07Y5YXH4DKL26CAYNWPR2U/view.html">http://cdm.unfccc.int/Projects/Validation/DB/AHUI0REM07Y5YXH4DKL26CAYNWPR2U/view.html</a>
Suzlon Infrastructure Limited	17.500	SSC	<a href="http://cdm.unfccc.int/Projects/Validation/DB/01HFZ32O165S7S2CESB81LQ0C46PYL/view.html">http://cdm.unfccc.int/Projects/Validation/DB/01HFZ32O165S7S2CESB81LQ0C46PYL/view.html</a>
TCS Textiles Ltd.	20.750	SSC	<a href="http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view">http://cdm.unfccc.int/Projects/DB/TUEV-SUED1173364563.43/view</a>
Vishal Export Overseas Ltd	29.275		The WEGs have been installed by the company in its existing name with an intent to avail tax benefits for existing businesses. Thus, the project has a different investment climate from that of PP - an Independent Power Producer (IPP) that has established an SPV, CLP Wind Farms (India) Pvt. Ltd. and has no intention of claiming tax benefits for any existing businesses.

It can be seen all private wind farm installations, in the similar regulatory and investment climate as that of the project activity and with similar capacity in the state of Tamil Nadu, are in CDM/VCS pipeline.

**Sub-step 4b Discuss any similar options that are occurring:**

There are no similar projects that are occurring without CDM/VCS as can be seen from analysis done under sub-step 4(a). Therefore substep 4(b) is not applicable.

As per para 47 of “Tool for the demonstration and assessment of additionality” Version 06.0.0, for measures that are listed in paragraph 6, following steps have to be considered to supplement common practice analysis:

*Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.*

The capacity of the project activity is 24.75 MW, therefore +/- 50% is calculated as 12.375 MW to 37.125 MW.

*Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number  $N_{all}$ . Registered CDM project activities and projects activities undergoing validation shall not be included in this step;*

As per paragraph 5 of “Tool for the demonstration and assessment of additionality”, applicable geographical area covers the entire host country as a default. In accordance with the above guidelines, host country (i.e. India) has been considered as the applicable geographical area as a default.

$N_{all}$  = All the power plants in the applicable output range in the applicable geographical area. Thus for the proposed project activity this will include all the power plants in the range from 12.375 MW to 37.125 MW commissioned in India before the start date of the proposed project activity (19 March 2010 as per definition in the CDM guidelines) and not registered / under validation under any GHG program.

The total number of power plants in the applicable output range = 258

Category of Power plants	No. of Projects <sup>14</sup>
Thermal	96
Hydro	151
Wind	0
Nuclear	0
Solar	0
Biomass	11
<b>Total (<math>N_{all}</math>)</b>	<b>258</b>

Therefore  $N_{all}$  =258

*Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number  $N_{diff}$ .*

<sup>14</sup> All the data has been sourced from CEA Co2 database version 7.0 (source:<http://cdm.unfccc.int/Projects/Validation/DB/49HF24EMEQCY7ULDARG7G3MD6KM5Y/view.html>)

$N_{diff}$  = All the power plants with technologies different from that of the proposed project activity in the applicable output range in the applicable geographical area. Hence for the proposed project activity, this will include all the power plants in the applicable range commissioned in India before the start date of the proposed project activity and use technologies different from wind energy technology for power generation as will be used by the proposed project activity.

The  $N_{diff}$  value is thus arrived at as tabulated below:

Category of Power plants	No. of Projects <sup>15</sup>
Thermal	96
Hydro	151
Nuclear	0
Solar	0
Biomass	11
<b>Total (<math>N_{diff}</math>)</b>	<b>258</b>

Step 4: Calculate factor  $F=1-N_{diff}/N_{all}$  representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

Factor F as calculated above is 0.

and,  $(N_{all} - N_{diff}) = 0$

Since the factor F is less than 0.2 and  $N_{all}-N_{diff}$  is less than 3, the proposed project activity is not a common practice within the power sector in the applicable geographical area.

Therefore the project activity is not a common practice.

## 2.6 Methodology Deviations

Not applicable

## 3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 3.1 Baseline Emissions

According to the approved methodology ACM0002 (Version 13.0.0) Emission Reductions are calculated as

<sup>15</sup> All the data has been sourced from CEA CO<sub>2</sub> database version 7.0 (source:<http://cdm.unfccc.int/Projects/Validation/DB/49HF24EMEQCY7ULDARG7G3MD6KM5Y/view.html>)

$$ER_y = BE_y - PE_y \text{ ..... Equation 11 of ACM0002}$$

Where:

- ER<sub>y</sub> Emission reductions in year y (tCO<sub>2</sub>e/yr)
- BE<sub>y</sub> Baseline Emissions in year y (tCO<sub>2</sub>e/yr)
- PE<sub>y</sub> Project Emissions in year y (tCO<sub>2</sub>e/yr)

**Estimation of Baseline Emissions**

Baseline emissions include only CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \text{ ..... Equation 6 of ACM0002}$$

Where:

- BE<sub>y</sub> Baseline emissions in year y (tCO<sub>2</sub>)
- EG<sub>PJ,y</sub> 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)
- EF<sub>grid,CM,y</sub> Combined margin CO<sub>2</sub> 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” (tCO<sub>2</sub>/MWh)

Since the project activity is grid connected green-field renewable (wind) energy generation project at a site where no renewable power plant was operated prior to implementation of the project activity therefore:

$$EG_{PJ,y} = EG_{facility} \text{ ..... Equation 7 of ACM0002}$$

Where

- EG<sub>PJ,y</sub> 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)
- EG<sub>facility,y</sub> Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

**Determination of baseline emission factor (EF<sub>grid,CM,y</sub>)**

According to the tool to calculate the emission factor of an electricity system; the baseline emission coefficient will be determined using the following steps:

**STEP 1: Identify the relevant electricity system**

The Indian electricity system is divided into two regional grids, NEWNE and SR Grid. Each grid covers several states. As the regional grids are interconnected, there is inter-state and inter-regional exchange. A small power exchange also takes place with neighboring countries like Bhutan and Nepal.

Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPC) provides a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets its demand with its own generation facilities and also with allocation from power plants owned by the Central Sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the Central Sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. The regional grid thus represents the largest electricity grid where power plants can be dispatched without significant constraints and thus, represents the “project electricity system” for the Project. As the Project is located in state of Tamil Nadu which is connected to the Southern Region Grid is the “project electricity system”.

**STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).**

In accordance with the Option I of step 2 of the latest “Tool to calculate the emission factor for an electricity system, Version 2.2.1”<sup>16</sup>, only grid power plants have been included in the calculation of the to calculate the operating margin and build margin emission factor.

**STEP 3: Select a method to determine the operating margin (OM)**

According to the tool the calculation of the operating margin emission factor is based on one of the following methods:

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch data analysis OM, or
- (d) Average OM.

Any of the four methods can be used, however, the simple OM method (option a) can only be used if low cost/ must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

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<sup>16</sup> for [http://cdm.unfccc.int/EB/050/eb50\\_repan14.pdf](http://cdm.unfccc.int/EB/050/eb50_repan14.pdf)

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the two grids in India for the last five years is as follows<sup>17</sup>:

**Table B.8: Generation Profile of NEWNE & SR Grid**

	2006-07	2007-08	2008-09	2009-10	2010-11	Average
NEWNE	18.5%	19.0%	17.4%	15.9%	17.6%	<b>17.7%</b>
SR	28.3%	27.1%	22.8%	20.6%	21.0%	<b>24.0%</b>
<b>India</b>	20.9%	21.0%	18.7%	17.1%	18.4%	<b>19.2%</b>

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the SR Grid is less than 50 % of the total generation. Hence the Simple OM method can be used to calculate the Operating Margin Emission factor.

The project proponents choose an ex ante option for calculation of the OM with a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS PD to the validator for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

**STEP 4: Calculate the operating margin emission factor according to the selected method**

The simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub>e emissions per unit net electricity generation (tCO<sub>2</sub>e/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. The simple O&M may be calculated by any of the following two options:

- Option A: Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

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 CO<sub>2</sub> Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the “Tool to calculate the

<sup>17</sup> CO<sub>2</sub> Baseline Database for the Indian Power Sector – Central Electricity Authority version 7  
[http://cea.nic.in/planning/c%20and%20e/database\\_publishing\\_ver7.zip](http://cea.nic.in/planning/c%20and%20e/database_publishing_ver7.zip)

emission factor for an electricity system”. We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

The CEA database uses the option B i.e. data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit, to calculate the OM of the different regional grids.

The simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{\text{grid,OMsimple,y}} = \Sigma (EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}$$

Where:

- $EF_{\text{grid,OMsimple,y}}$  Simple operating margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/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<sub>2</sub> emission factor of power unit m in year y (tCO<sub>2</sub>/MWh)
- m All power units serving the grid in year y except low-cost / must-run power units
- y Either the three most recent years for which data is available at the time of submission of the VCS PD to the DOE for validation (ex-ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The emission factor of each power unit m has been determined using Option B1

$$EF_{EL,m,y} = (\Sigma FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}) / EG_{m,y}$$

Where:

- $EF_{EL,m,y}$  CO<sub>2</sub> emission factor of power unit m in year y (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  Amount of fossil fuel type i consumed by power 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<sub>2</sub> emission factor of fossil fuel type i in year y (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- m All power units serving the grid in year y except low-cost / must-run power units
- i All fossil fuel types combusted in power unit m in year y
- y Either the three most recent years for which data is available at the time of submission of the VCS PD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

**STEP 5: Calculate the build margin (BM) emission factor**

The build margin emissions factor is the generation-weighted average emission factor of all power units  $m$  during the most recent year  $y$  for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = (\sum EG_{m,y} \times EF_{EL,m,y}) / \sum EG_{m,y}$$

Where:

- $EF_{grid,BM,y}$  Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/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<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  Power units included in the build margin
- $y$  Most recent historical year for which power generation data is available

The CO<sub>2</sub> emission factor of each power unit  $m$  ( $EF_{EL,m,y}$ ) is determined as per the procedures given in step 3 (a) for the simple OM, using options B1 using for  $y$  the most recent historical year for which power generation data is available, and using for  $m$  the power units included in the build margin.

**STEP 6: Calculate the combined margin (CM) emissions factor**

The emission factor  $EF_{grid,CM,y}$  of the grid is represented as a combination of the Operating Margin (OM) and the Build Margin (BM). Considering the emission factors for these two margins as  $EF_{grid,OM,y}$  and  $EF_{grid,BM,y}$  then the  $EF_{grid,CM,y}$  is given by:

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

Where:

- $EF_{grid,BM,y}$  Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EF_{grid,OM,y}$  Operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $w_{OM}$  Weighting of operating margin emissions factor (%)
- $w_{BM}$  Weighting of build margin emissions factor (%) (where  $w_{OM} + w_{BM} = 1$ ).

According to ACM0002 the weights for OM and BM are 0.75 and 0.25 respectively.

Using the values for operating and build margin emission factor provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is **0.8969 tCO<sub>2</sub>e/MWh**.

**Details of Baseline data:**

Data of Operating and Build Margin for the three financial years from 2008-09 to 2010-11 has been obtained from -

**The CO<sub>2</sub> Baseline Database for the Indian Power Sector<sup>18</sup>**

Ministry of Power: Central Electricity Authority (CEA)

Version 7

Dated: January 2012

**3.2 Project Emissions**

The Project involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 13.0.0, there will be no project emissions from the Project.

**PE<sub>y</sub> = 0**

**3.3 Leakage**

As per ACM0002 Version 13.0.0, no leakage has been considered for the calculation of emission factor.

**3.4 Summary of GHG Emission Reductions and Removals**

Years	Estimated baseline emissions or removals (tCO <sub>2</sub> e)	Estimated project emissions or removals (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Estimated net GHG emission reductions or removals (tCO <sub>2</sub> e)
2 July 2010 to 1 July 2011	54,105	0	0	54,105
2 July 2011 to 1 July 2012	54,105	0	0	54,105
2 July 2012 to 1 July 2013	54,105	0	0	54,105
2 July 2013 to 1 July 2014	54,105	0	0	54,105
2 July 2014 to 1 July 2015	54,105	0	0	54,105
2 July 2015 to 1 July 2016	54,105	0	0	54,105
2 July 2016 to 1 July 2017	54,105	0	0	54,105
2 July 2017 to 1 July 2018	54,105	0	0	54,105
2 July 2018 to 1 July 2019	54,105	0	0	54,105
2 July 2019 to 1 July 2020	54,105	0	0	54,105
<b>Total</b>	541,050	0	0	541,050

<sup>18</sup> The detailed excel sheet is available at:  
[http://cea.nic.in/planning/c%20and%20e/database\\_publishing\\_ver7.zip](http://cea.nic.in/planning/c%20and%20e/database_publishing_ver7.zip)

## 4 MONITORING

### 4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	<b>EF<sub>grid,OM,y</sub></b>																	
Data unit:	tCO <sub>2</sub> e/MWh																	
Description:	Operating Margin (OM) Emission Factor of Southern regional electricity grid																	
Source of data:	The CO <sub>2</sub> Baseline Database for the Indian Power Sector - Ministry of Power: Central Electricity Authority (CEA) Version 7.																	
Value applied:	<table border="1"> <thead> <tr> <th>Year</th> <th>Simple operating margin of Southern regional grid (tCO<sub>2</sub>e/MWh)</th> <th>Net electricity generation in the year (MWh)</th> </tr> </thead> <tbody> <tr> <td><b>2008-09</b></td> <td>0.9729</td> <td>121471.25</td> </tr> <tr> <td><b>2009-10</b></td> <td>0.9415</td> <td>134716.87</td> </tr> <tr> <td><b>2010-11</b></td> <td>0.9419</td> <td>137387.26</td> </tr> <tr> <td colspan="2">Generation weighted average Operating Margin emission factor in the last three years</td> <td>0.9513</td> </tr> </tbody> </table>			Year	Simple operating margin of Southern regional grid (tCO <sub>2</sub> e/MWh)	Net electricity generation in the year (MWh)	<b>2008-09</b>	0.9729	121471.25	<b>2009-10</b>	0.9415	134716.87	<b>2010-11</b>	0.9419	137387.26	Generation weighted average Operating Margin emission factor in the last three years		0.9513
Year	Simple operating margin of Southern regional grid (tCO <sub>2</sub> e/MWh)	Net electricity generation in the year (MWh)																
<b>2008-09</b>	0.9729	121471.25																
<b>2009-10</b>	0.9415	134716.87																
<b>2010-11</b>	0.9419	137387.26																
Generation weighted average Operating Margin emission factor in the last three years		0.9513																
Justification of choice of data or description of measurement methods and procedures applied:	Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with "Tool to calculate the emission factor for an electricity system"																	
Any comment:	Operating margin emission factor is fixed ex-ante throughout the crediting period.																	

Data Unit / Parameter:	<b>EF<sub>grid,BM,y</sub></b>
Data unit:	tCO <sub>2</sub> e/MWh

Description:	Build Margin (BM) Emission Factor of Southern regional electricity grid
Source of data:	The CO <sub>2</sub> Baseline Database for the Indian Power Sector - Ministry of Power: Central Electricity Authority (CEA) Version 7.
Value applied:	0.7339 tCO <sub>2</sub> /MWh for the year 2010-11
Justification of choice of data or description of measurement methods and procedures applied:	The Build Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with "Tool to calculate the emission factor for an electricity system"
Any comment:	Build margin emission factor is fixed ex-ante throughout the crediting period.

Data Unit / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO <sub>2</sub> e/MWh
Description:	Combined Margin (CM) Emission Factor of Southern regional electricity grid
Source of data:	The CO <sub>2</sub> Baseline Database for the Indian Power Sector - Ministry of Power: Central Electricity Authority (CEA) Version 7.
Value applied:	<p>Computed using the following formula</p> $EFCO2,grid,y = WOM * EF_{grid,OM,y} + WBM * EF_{grid,BM,y}$ $EFCO2,grid,y = 0.75 * 0.9513 + 0.25 * 0.7339 = 0.8969$ <p>Combined margin CO<sub>2</sub> 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"</p>
Justification of choice of data or description of measurement methods and procedures applied:	This is in accordance with the latest version of the applicable methodology, and the "Tool to calculate the Emission Factor for an Electricity System"

Any comment:	Combined margin emission factor is fixed ex-ante throughout the crediting period.
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**4.2 Data and Parameters Monitored**

Data Unit / Parameter:	$EG_{PJ,y}$
Data unit:	MWh (Mega-watt hour)
Description:	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y
Source of data:	The electricity supplied to the grid would be taken from the Joint Meter Reading Report carried out at the TNEB meter located near each WEG.
Description of measurement methods and procedures to be applied:	The net electricity supplied to the grid is measured by the main meters (export and import values) installed by TNEB at the metering point near each WEG. The Total Net Electricity supplied to TNEB grid by the project activity is the summation of Net Electricity supplied by individual 15 WEGs of the project activity
Frequency of monitoring/recording:	The meter readings at the Metering Point are undertaken every month jointly by the representatives of the State Grid/ TNEB and Vestas representative for the previous month. The meter readings are jointly certified by representatives of the State Grid/ TNEB and Vestas. The project proponent has installed Real Time TOD Meters with online reading features at the Metering Point
Value applied:	Annual electricity supplied to the grid by the Project = 60,325 MWh (currently estimated)
Monitoring equipment:	The project proponent has installed two identical

	<p>0.5s accuracy class Trivector Meters, referred as main and check meters.</p> <p>These meters are located at the foot of the turbine on 33kv outgoing feeders. ( Metering Point)</p> <p>Reading of the main meter is taken for the billing purpose, while the same is getting cross checked using the check meter.</p> <p>The metering equipments (main and check) are duly approved, tested and sealed by TNEB in the presence of the parties involved (TNEB and Vestas).</p>
<p>QA/QC procedures to be applied:</p>	<p>The quantity of net electricity supplied will be cross-verified from the invoice raised to TNEB by the project proponent.</p> <p>The TNEB carries out the calibration, periodical testing, sealing and maintenance of meters in the presence of Vestas representative. The frequency of meter testing is once in 3 year. All meters are tested at the Metering Point.</p>
<p>Calculation method:</p>	<p>Measured Quantity</p>
<p>Any comment:</p>	<p>The data will be archived for crediting period + 2 years.</p>

### 4.3 Description of the Monitoring Plan

The approved large scale methodology ACM0002 (Version 13.0.0), stipulates the monitoring of the net electricity generation supplied by the project plant/unit to the grid.

Each of the 15 WEGs considered in the Project has Main and Check meters installed on the 33kv outgoing feeder for metering of electricity produced/ consumed by the WECs. Both of these Main and Check meters are identical in terms of technical specification.

The meter readings at the Metering Point (main meter and check meter) are undertaken every month jointly by the representatives of the TNEB and Vestas representative for the previous month and it is certified by representatives of TNEB.

The TNEB carries out the calibration, periodical testing, sealing and maintenance of meters in the presence of Vestas representative. The frequency of meter testing is once in 3 year. All meters are tested at the Metering Point.

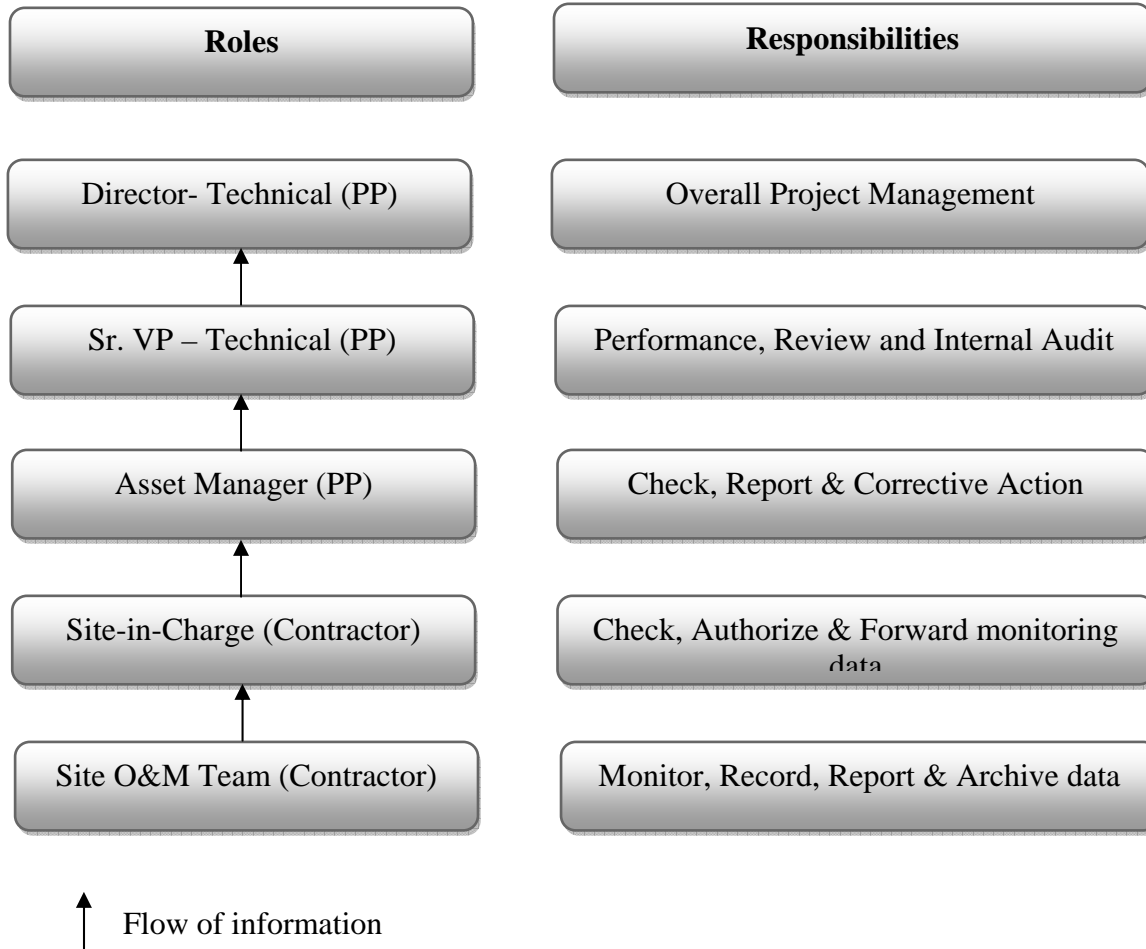
### **Metering procedure**

The generated electricity is measured through a two step procedure wherein the first metering is carried out at the micro-processor based controller (Local Control System) specially designed to control the WEG. The primary function of the LCS is to ensure that all the components of the WEG remain fully operational under all conditions. In order to meet this requirement, it is necessary to monitor wind speed, wind direction, temperature, rotational speeds, electricity generated, voltage etc. The LCS display and keyboard enable control of all WEG functions. The electricity generation details will be displayed in the LCS. The monitoring of all these wind turbines is done from a common monitoring station as a part of central monitoring system. The system consists of a state- of- the- art controlling and monitoring and well trained staff personnel of O&M contractor, Vestas, are always present on site to monitor various parameters of power generation and deal with any problems related to generation, transmission or maintenance.

The second metering is carried out at TNEB meter located near each WEG. This is the metering point wherein the Joint Meter Reading (JMR) is carried out every month in presence of the representatives of the project proponent & the state electricity utility (TNEB). This JMR is used for calculation of the amount of electricity supplied to the grid against which the utility makes the payment to the project proponent. The JMR gives both the “export” and “import” of the electricity to/ from the Southern grid. There is a single meter which gives both the export and import values, this metered reading would give value net of line losses (negligible since metering/JMR point is very close to the WEG) and auxiliary consumption.

### **Project management structure**

The representatives of Operations and Maintenance contractor (Vestas), will record the readings and prepare daily generation reports of all the WEGs. The primary recording of the electricity fed to the electricity grid will be carried out jointly at the TNEB meter located near each WEG. The operations and maintenance structure for the project activity is as follows:



**Procedures for handling data uncertainty:**

- a- In case main meter is faulty- check meter is used to calculate the electricity exported to the grid. Main meter is immediately replaced by a new meter and meter reading from the replaced meter is used thereafter.
- b- In case the check meter is faulty- The check meter is immediately replaced. The emission reduction calculation would not be affected as reading from main meter is used to calculate the net electricity exported to the grid.
- c- In case error is identified during annual accuracy testing- If during the annual tests, the meter is found to be beyond the permissible limits of error, the meter shall be immediately calibrated and replaced, if necessary. The error that is identified in the annual accuracy testing would be applied to all the readings of electricity exported as indicated in the credit note from the state utility from the date of last accuracy testing. Billing for the period thereafter shall be as per the calibrated meter.

The Project Management team of CLP receives the data from both the sources and keeps track of project activity which reduces the carbon emission reductions.

## 5 ENVIRONMENTAL IMPACT

As per the Schedule 1 of the EIA notification dated 01/12/2009<sup>19</sup>, given by the Ministry of Environment and Forests under the Environment (Protection) Act 1986, the proposed project does not fall under the list of activities requiring EIA. The project activity involves implementation and operation of wind energy generators to generate electrical energy. The implementation of project activity does not result in burning of fossil fuel and will thus not contribute towards environmental degradation or any other such adverse impact on environment.

## 6 STAKEHOLDER COMMENTS

CLP invited the local stakeholders through public notices well in advance of the date of the meeting. The notices/invitation letters were sent to the stakeholders on 01/02/2010. Public Notice was displayed at various locations. The stakeholder meeting was organised on 18/02/2010 from 4:30 pm onwards at Middle school in the village nearby to the project site, in presence of representatives of Vestas and the project proponent.

Around 46 stakeholders from nearby villages were present for the meeting. No adverse comment was received from the local stakeholders. The queries raised by stakeholders during the meeting and the response given by project proponent in the following table:

<b>S.N.</b>	<b>Questions raised</b>	<b>Name of stakeholder / Village</b>	<b>Answer by CLP and Vestas</b>
1.	What are the factors affecting Global warming and the bad effects thereon?	Mr. S. Suresh Kumar, Poomalaikundu Village	The major factors causing global warming is unnatural increase in CO <sub>2</sub> and other greenhouse gases level in the atmosphere. The major ill effects of the global warming are the increase in the average ambient temperature level, increase in the sea water level, changes in the weather conditions etc.
2.	Will the project help in improving the	Mr.Karuppiah,	The electricity generated by the

<sup>19</sup> <http://moef.nic.in/downloads/rules-and-regulations/3067.pdf>

<b>S.N.</b>	<b>Questions raised</b>	<b>Name of stakeholder / Village</b>	<b>Answer by CLP and Vestas</b>
	electricity supply to the villagers/village school?	Poomalaikundu Village	project activity is fed into the Tamil Nadu State Electricity grid which is then distributed across the state.
3	Do the wind turbines cause any sound pollution	Mrs. Thavamani, Poomalaikundu Village	The intensity of sound generated by the wind turbines is maximum at the hub height but it is not threatening to humans or other living beings, as the noise generated is within permissible limits. There are also adequate sound dampeners provided in each wind turbine.
4	Will other projects like this also be erected in this region	Mr.Velusamy, Poomalaikundu Village	The project site at Theni district in Tamil Nadu is a very good site for development of wind power projects, Vestas would be developing similar wind projects for other companies apart from CLP.
5	Will the installation of wind farm affect the rainfall in the region?	Mrs. P. Vasuki, Poomalaikundu Village	It has been scientifically proven that wind turbines have no impact on rainfall pattern. Wind turbines only extract energy from running wind and cause no other side effects.
6	Does the installation of wind farm affect the ground water level in the nearby villages?	Bhaskar, Kandamannur Village	No, the wind farm installed in the region does not affect either ground water level or drinking water quality of area nearby to the project site.
7	Why & who buys the wind turbine generators?	Mrs. T. Anitha, Teacher, NPV School	The representative of Vestas explained that Wind Turbines are bought by investors for the reason that they are inclined towards

<b>S.N.</b>	<b>Questions raised</b>	<b>Name of stakeholder / Village</b>	<b>Answer by CLP and Vestas</b>
			their commitment to produce green / pollution free energy.
8	Does the project affect the grazing of cattle?		It does not affect the cattle grazing as. Also, there was no prohibition by the project officials in allowing villagers for taking their domestic animals for grazing.

## Annexure 01

Details of physical location of the project activity are presented below:

Sr. No.	Loc No.	Village	District	HTSC No.	DOC	Latitude	Longitude
1	TPK 221	Poomalaikundu	Theni	WEG T 110	2-Jul-2010	N9°52'46.15"	E77°26'10.50"
2	TPK 130	Poomalaikundu	Theni	WEG T 129	29-Jul-2010	N9°53'52.07"	E77°25'37.12"
3	TPK 58	Poomalaikundu	Theni	WEG T 127	29-Jul-2010	N9°54'52.23"	E77°26'16.84"
4	TJP 247	Jangalpatti	Theni	WEG T 135	29-Jul-2010	N9°53'19.14"	E77°28'54.39"
5	TJP 391	Jangalpatti	Theni	WEG T 133	29-Jul-2010	N9°52'32.08"	E77°28'35.14"
6	TPK 520	Poomalaikundu	Theni	WEG T 124	29-Jul-2010	N9°54'45.33"	E77°27'59.91"
7	TPK 603	Poomalaikundu	Theni	WEG T 126	29-Jul-2010	N9°54'29.73"	E77°27'00.05"
8	TSK 447	Seepalakottai	Theni	WEG T 131	29-Jul-2010	N9°52'36.71"	E77°27'22.31"
9	TPK 108	Poomalaikundu	Theni	WEG T 128	29-Jul-2010	N9°54'07.38"	E77°25'34.54"
10	TPK 529	Poomalaikundu	Theni	WEG T 125	29-Jul-2010	N9°54'30.80"	E77°27'31.72"
11	TJP 78	Jangalpatti	Theni	WEG T 123	29-Jul-2010	N9°54'08.24"	E77°28'35.82"
12	TJP 198	Jangalpatti	Theni	WEG T 136	29-Jul-2010	N9°53'23.69"	E77°29'16.57"
13	TJP 324	Jangalpatti	Theni	WEG T 134	29-Jul-2010	N9°52'56.42"	E77°28'51.89"
14	TSK 470	Seepalakottai	Theni	WEG T 132	29-Jul-2010	N9°52'32.26"	E77°28'10.93"
15	TPK 228	Poomalaikundu	Theni	WEG T 130	29-Jul-2010	N9°52'59.62"	E77°26'27.69"