



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006**

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**SECTION A. General description of project activity.****A.1. Title of the project activity:****Tuppadahalli Wind Energy Project**

Version : 01
Date : 01/02/2011

A.2. Description of the project activity:**Purpose of the Project Activity:**

The main purpose of this project activity is to generate clean form of electricity from renewable wind resources. This project activity is the installation of Wind Turbine Generators (WTG's) in Shimoga and Chitradurga Districts of Karnataka, India promoted by the project proponent, an Indian company that is a 100% subsidiary of the Spanish Acciona group of companies, ie. Acciona Energía Internacional, S.A. and Acciona, S.A.

The total installed capacity of this project activity is 56.1 MW from 34 WTGs, capacity of each WTG is 1.65 MW. The equipment supplier for this project activity is Vestas Wind Technology India Private limited. The Wind Turbine Generators (WTGs) are Vestas V82 Class IIa turbines.

The entire power generated will be exported to the state grid maintained by the Karnataka Power Transmission Corporation Limited (KPTCL). The electricity generated will be supplied to an Electricity Supply Company (ESCOM) in the state grid under a long-term Power Purchase Agreement (PPA). MESCOM is a licensed electricity distribution company, owned and controlled by the State Government of Karnataka, and an integral part of the Southern Regional Grid.

In the absence of the project activity the equivalent amount of electricity would have been generated from the grid connected/new power plants in the southern regional grid which are/will be predominately based on fossil fuels. The fossil fuel based power generation has been the mainstay of electricity generation in the Indian Power Sector¹. As per the applicable methodology the baseline scenario for the proposed project activity is the grid based electricity system, which is also the pre project scenario. Thus, the project activity leads to reduce the GHG emissions as it displaces power from fossil fuel based electricity generation in the southern regional grid.

The carbon credit revenue stream under the Clean Development Mechanism has been one of the key factors taken into account by the project proponent from the start. The project proponent proposes to develop this project under the Clean Development Mechanisms (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC), as the project leads to a significant reduction in greenhouse gas emissions and contributes to the sustainable development of the region, Karnataka, and of India

Contribution to Sustainable development:

¹ http://cea.nic.in/god/opm/Monthly_Generation_Report/18col_T_10_03/opm_02.pdf



Ministry of Environment and Forests, Govt. of India has stipulated the social well being, economic well being, environmental well being and technological well being as the four indicators for sustainable development in the interim approval guidelines host country approval eligibility criteria for Clean Development Mechanism (CDM) projects².

Social well being:

The proposed project activity would lead to direct and indirect benefits to the region, through the generation of local employment in areas in and around the project activity, and the improved conditions for developing economic activities, which may result from the empowerment of vulnerable sections of society dwelling near the project area due to the creation of employment opportunities.

The proposed project activity supplies electricity to the grid and this may ultimately benefit the local communities with improved power supply, and in this case this power supply is renewable, hence assisting in the quest for energy security of the current and future generations.

Economic well being:

The project displaces electricity from the Karnataka grid, thereby reducing the region's dependence on fossil fuel resources while narrowing the existing electricity supply gap in the State of Karnataka. This has a positive impact on the economic well being of the state and the country.

The implementation of the project activity brings in significant investment into a developing region, an investment that in the absence of this project activity would not have taken place. This brings with it an increase in business opportunities for contractors, suppliers, etc. at different phases in the implementation of the project activity, from construction through to operation.

The project activity may help in creating direct/ indirect employment opportunities to the local people both temporary and permanent during the construction of the project as well as in operation.

Environmental well being:

Wind energy is one of the cleanest, most sustainable ways of generating electricity, which produces no emissions such as SO_x, NO_x, or particulates. Because the project will displace electricity from the state grid, largely from fossil fuel resources, it will result in a reduction of the pollutants such as SO_x, NO_x, etc. associated with those plants, and in a significant reduction in greenhouse gas emissions, which contribute to global warming.

Because wind energy is a renewable resource, the project will also contribute to resource conservation, of coal, diesel, and other non-renewable energy resources.

Technological well being:

Wind energy projects have no associated GHG emissions, and so represent a clean technology which can be used now, and in the future, to generate clean electricity. The development of projects such as the proposed project activity is important now, in that it acts as a stimulus and an accelerant to the wind and

² http://envfor.nic.in/divisions/ccd/cdm_iac.html



renewable energy sector in India. This will also assist in further encouraging R&D efforts by technology providers, which will lead to the development of better and more efficient equipment.

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

A.3. Project participants:

Name of the party involved ((host) indicates a host party)	Private and/or Public entity (ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host)	Private entity: Tuppadahalli Energy India Pvt. Ltd.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Country: India

A.4.1.2. Region/State/Province etc.:

State: Karnataka

A.4.1.3. City/Town/Community etc.:

Villages of Gangaondanahalli, Gondihosahalli, Attighatta, Tuppadahalli, Malahulu, Pennasamudra, Bettakadur and Devarahosahalli.

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project site is located near Village of Tuppadahalli in the Hollalkere and Chennagiri Taluk in the district of Shimoga and Chitradurga in the Indian state of Karnataka. Tuppadahalli is approximately 55 km from Chitradurga town, and approximately 260 km from Bangalore, the capital city of Karnataka. The site of Tuppadahalli is located at a latitude and longitude of around 13° 50' 00" – 14° 00' 00" N and 76°00' 00" – 76°05'00" E.

The location of the project site in the state map of Karnataka, India, is shown below³:

³ www.mapsofindia.com

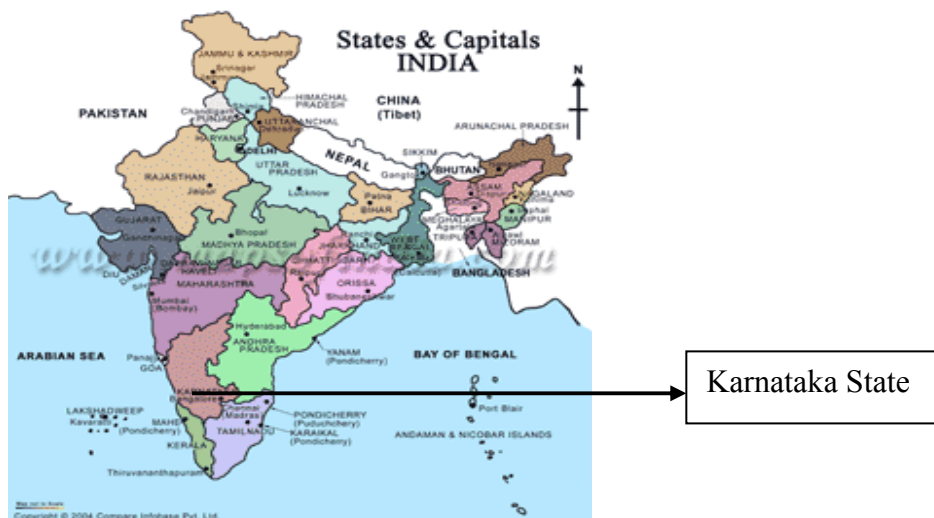


Fig 1: Location of Karnataka State in India Map

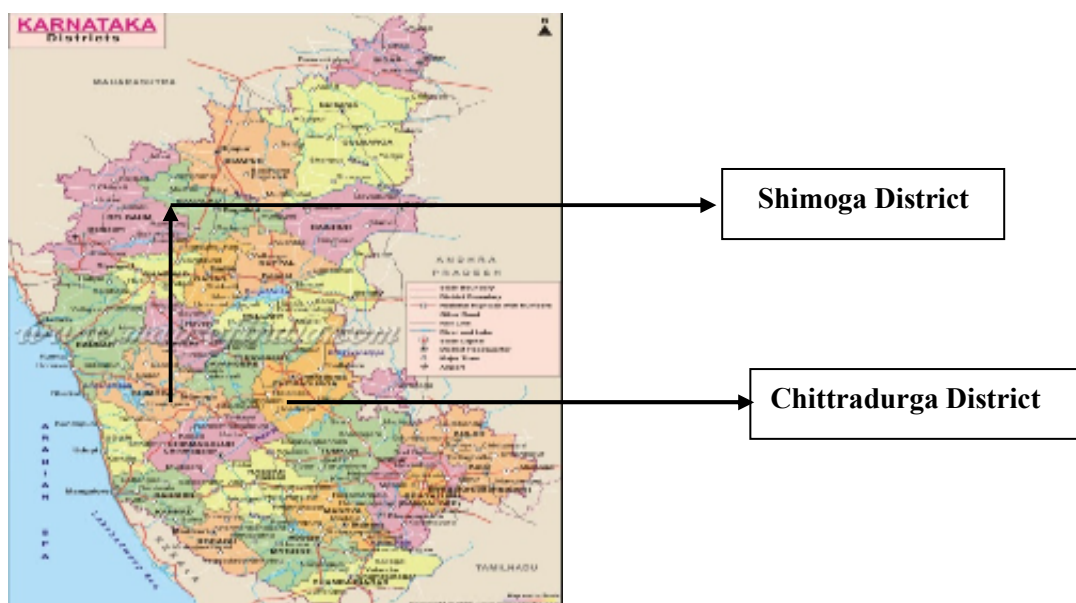


Fig 2: Location of Districts in Karnataka State Map

A.4.2. Category(ies) of project activity:

The project activity is considered under UNFCCC – CDM category “Zero emissions – grid connected electricity generation from renewable sources” with capacity greater than 15 MW. 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 be principally categorized as –

Category: 1; Energy industries (renewable/non-renewable sources)



Approved consolidated baseline methodology ACM0002⁴ “Consolidated baseline methodology for grid connected electricity generation from renewable sources”; Version 12.1

A.4.3. Technology to be employed by the project activity:

The project activity involves installation of 34 Nos. Of Vestas V82 Class IIa WTGs with the total installed capacity of 56.1 MW. The life time of the WTGs is around twenty years as per the industry standards.

Technology:

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. The technology is a clean technology since there are no GHG emissions associated with the electricity generation. There is no noticeable adverse impact on the environment caused by the wind farm during construction, operation or disposal/scraping after its technical useful life of 20 (twenty) years. The waste oils during the operation stage are disposed off in an environmentally benign manner and the scraping of the project assets doesn't degrade the environment as assets are dismantled and sold. The project activity consists of Vestas Wind Technology India private Limited make WTGs of 1650 kW respectively. The technical specifications of the turbine are given below.

Specifications of the individual WTGs are as follows:

Description	Specifications
Rated capacity	1.65 MW
Tower/rotor height	78 Meter
Rotor Diameter	82 Meter
Cut-in wind speed	3.5 m/s
Rated wind speed	7.5 m/s
Cut-out wind speed	20 m/s (10 minute average)
Rotor swept area	5,281 sq. meters
Rotational speed	14.4 rpm
Rotor material and blades material	Carbon fibre/epoxy/wood/glass
Regulation	Active Stall
Generator	1-speed, water cooled
Rated output	1,650 kW
Rotational speed at rated power	1,012 rpm
Operating voltage	3 x 690 V
Frequency	50 Hz
Insulation class	F/B
Cooling system	Oil cooler/Radiator: Cooling capacity 37.5 kW Water cooler/Radiator: Cooling capacity 46.2 kW
Gear Box	1. Step planet, 2. Step helical
Manufacturer	Vestas

⁴<http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L>



Gear ratio	1:70,2
Nominal load <i>Gearbox Mechanical power</i>	1,800 kW
Yaw Drive System	Planetary gear motor
Yaw bearing	Ball bearing, internal gearing
Aerodynamic brake	Hydraulic disk brake
Mechanical brake	Hydraulic disk brake
Control unit	SCADA

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO ₂ e (tCO ₂ e)
2011 – 12	128,809
2012 – 13	128,809
2013 – 14	128,809
2014 – 15	128,809
2015 – 16	128,809
2016 – 17	128,809
2017 – 18	128,809
Total estimated reduction (tCO ₂ e)	901,663
Total number of crediting years	7 years ⁵
Annual average over the crediting period of estimated reduction (tCO ₂ e)	128,809

A.4.5. Public funding of the project activity:

No public funding from parties included in Annex I is available for the project activity.

SECTION B. Application of a baseline and monitoring methodology
B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

The methodology applied for this project activity is

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

Reference⁶: Approved consolidated baseline methodology ACM0002, Version 12.1, EB58.

⁵ Twice renewable for a total of 21 years



ACM0002 draws upon the following tools which have been used in the PDD:

- Tool to calculate the emission factor for an electricity system⁷ (Version 02, EB50)
- Tool for the demonstration and assessment of additionality⁸ (Version 5.2, EB39)

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The Project activity is wind based renewable energy source, zero emission power project connected to the Karnataka state grid, which forms part of the Southern regional electricity grid. The Project will displace fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in Southern regional electricity grid.

ACM0002 – Applicability Conditions	Project Applicability
<i>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, wave power plant/unit or tidal power plant/unit</i>	The project activity is an installation of new wind power project; hence the project activity meets the applicability criterion.
<i>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 11 to calculate the parameter $EG_{PJ,y}$): 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 expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.</i>	The project activity is a newly grid connected wind power project. Hence this criterion is not applicable.
<i>In case of hydro power plants, one of the following conditions must apply:</i> • <i>The project activity is implemented in an existing reservoir, with no change in the volume of reservoir, or</i> • <i>The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power</i>	The project activity is a new wind power plant; hence these conditions are not applicable.

⁶ <http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L>

⁷ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf>

⁸ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf>



density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	
The methodology is not applicable to the following: - Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; - Biomass fired power plants; - Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	Project activity does not involve: - Switching from fossil fuels to renewable energy sources at the site of the project activity. - Biomass fired plants. - Construction of new reservoir or increase in an existing reservoir.
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	This project activity is a newly grid connected wind power project.

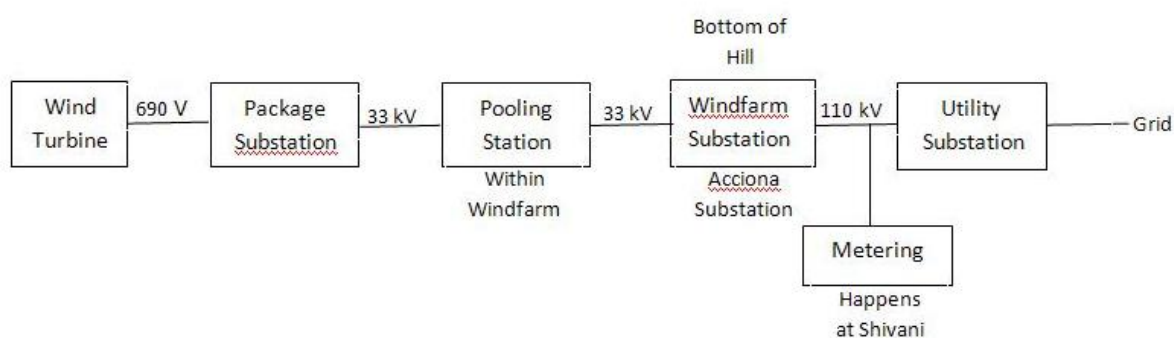
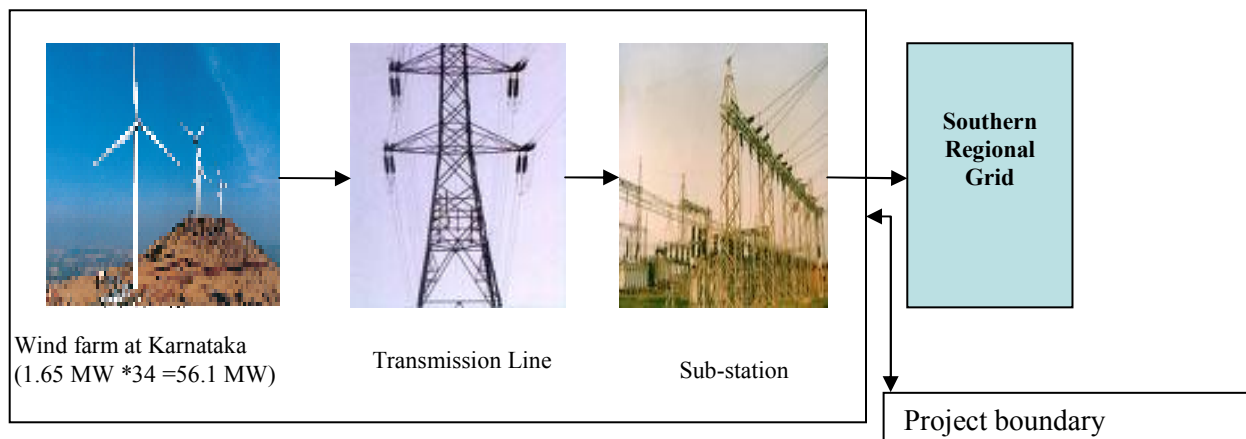
. Since the project generates and exports renewable electricity to the grid system, hence the choice of project Type and category is justified.

B.3. Description of the sources and gases included in the project boundary:

As per the **Approved consolidated baseline and monitoring methodology ACM0002**, the project boundary is “*The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.*”

According to the “Tool to calculate the emission factor for an electricity system”, grid/project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

A schematic of the project boundary is given below:



As per the approved methodology, ACM0002, Version 12.1, following gases and emission sources has been included in the project boundary.

	Source	Gas	Included	Justification/Explanation
Baseline Emission	Grid connected electricity generation	CO ₂	Yes	In the baseline scenario, electricity would have been sourced from the Southern Regional Grid which in-turn would be connected to fossil fuel fired power plants which emits CO ₂ .
		CH ₄	No	Excluded for Simplification. This is conservative.
		N ₂ O	No	Excluded for Simplification. This is conservative.
Project Emission	Electricity generation from the project activity	CO ₂	No	As per ACM 0002 project emissions are not considered for wind power project.
		CH ₄	No	As per ACM 0002 project emissions are not considered for wind power project.



		N ₂ O	No	As per ACM 0002 project emissions are not considered for wind power project.
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B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

Identification of Baseline Scenario:

As this project installs a new grid connected renewable power plant, the baseline according to the methodology ACM0002, version 12.1

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”

The most plausible baseline scenario identified for the project activity is continuation of current practice i.e. operation of grid connected power sources. As per the approved consolidated methodology ACM0002 version 12.1, since the project activity does not modify or retrofit an existing facility, the applicable baseline shall be the electricity delivered to the grid by the project 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 as described in the “Tool to calculate the emission factor for an electricity system”.

Accordingly the baseline emissions are given as:

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

Where

BE_y = Baseline Emissions in year (tCO₂/yr)

$EG_{pj, y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid, CM,y}$ = Combined margin⁹ CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO₂/MWh)

The key parameters used to determine the baseline emissions are furnished below:

Key Parameter	Value	Data Source	Website
EF _{CO₂, y}	Baseline emission factor for the Southern Regional Grid	CEA published baseline emission factor for Southern Regional Grid (CM), Ex-ante fixed for	CEA ¹⁰ “CDM Carbon Dioxide Baseline Database, Version

¹⁰ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



		the first crediting period of 7 years.	5 November 2009)”
EG _y	Net power export to the grid per annum	Monthly Statement	-----

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The project is a clean energy project and the energy produced is fed into power deficit Southern Regional Grid. Additional energy supplied from the project activity will help in meeting the energy demand of the region and later increasing the reliability of the southern grid. This in the business-as usual scenario would have been met with the help of conventional fossil fuel based power plants.

As per the selected methodology ACM0002, the project developer is required to establish that the GHG emission reductions due to the project activity are additional to those that would have occurred in the absence of the current project activity as per the “Tool for the demonstration and assessment of additionality” by employing following steps:

Step 1: Identification of alternatives to the project activity

Step 2: Investment analysis (OR)

Step 3: Barrier analysis

Step 4: Common Practice analysis

Project proponent establishes additionality on the ground of Step 1, 2 & 4.

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

In sub-step 1a and 1b, it is required to identify realistic and credible alternative(s) that were available to the project proponent or similar project developers that provide output or services comparable with the project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

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

The following paragraphs illustrate the alternatives:

As this project installs a new grid connected renewable power plant, the alternatives according to the methodology ACM0002, version 12.1, EB 58 is *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”*

The most plausible baseline scenario identified for the project activity is continuation of current practice i.e. operation of grid connected power sources.



Outcome of step 1a: Continuation of present scenario of grid-supplied power would be a conservative approach to baseline establishment.

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

- Electricity generation from wind farm is not a legal requirement or a mandatory choice. There are states and sectoral policies which are primarily framed to encourage wind based power project to attract more private investment as there are many anticipated risks under the project and requires good amount of equity to be involved.
- The Indian Electricity Act of 2003 does not restrict or empower any authority to restrict the fuel choice for power generation. In addition, it may be noted that the draft National Electricity Policy (revised in August 2004) asserts 'coal would necessarily continue to remain the major fuel'.
- The applicable environmental regulations do not restrict the use of wind energy for power generation.

According to the EB 16th meeting Report, Annex 3, page 1 'Clarifications on the treatment of National and/or Sectoral policies and regulations (paragraph 45 (e) of the CDM Modalities and Procedures) in determining a baseline scenario', which is "Type E-“national and/or Sectoral policies or regulations that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) may not be taken into account in developing a baseline scenario (i.e. the baseline scenario should refer to a hypothetical situation without the national and/or Sectoral policies or regulations being in place)", this analysis is performed based on this hypothetical situation without regarding the introduction of the Generation Based Incentive (GBI) in 2009¹¹. According to the above decision, purchase price of electricity, which excludes the Generation Based Incentive, was applied to the investment analysis.

Outcome of Step 1b: The alternative scenario, as per Step 1a, to project activity is in compliance with mandatory legislation and regulations taking into account the enforcement in the region and EB decisions on policies of region or sector.

Step2: Investment Analysis

Determine whether the proposed project activity is economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps:

Sub-step 2a: Determine appropriate analysis method

Since the project activity shall generate financial income from sale of power to the grid, we shall rule out Option I (simple cost analysis) and apply either Option II (Investment comparison analysis) or Option III (Benchmark analysis).

Sub-step 2b: Option III - Apply Benchmark analysis

¹¹ Generation Based Incentive (GBI) Announced by the Ministry of New and Renewable Energy(MNRE), GoI, on December 17, 2009. GBI consists on a premium to wind generation of Rs.0.50/kWh limited to Rs.6.2 Million/MW to be spread in not less than 4 years and for a maximum of 10 years for projects to be commissioned on or before 31-Mar-12.



The purpose of the investment analysis is to determine whether the proposed project activity is financially attractive or not without the revenue from sale of certified emission reductions (CERs). This is done by comparing the financial returns from the project to that of a suitable benchmark and if the returns of the project activity are less than the benchmark, it can be said that the project is not a financially viable option.

Selection of financial indicator:

IRR is widely accepted financial metric used by many corporations and financial institutions for investment decision – making and is a long established benchmark for investment decisions in the power sector and also the project is funded with both equity and debt, the pre-tax Project IRR is the appropriate financial indicator for carrying out the investment analysis.

Hence the pre-tax Project IRR is chosen as the appropriate financial indicator for carrying out the investment analysis of the project activity.

According to the paragraph 16 of the Guidance on the Assessment of the Investment Analysis, version 03, Annex 58, EB 51¹², *“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”*

In line with the guidance, Benchmark Approach is considered as appropriate benchmark for this project activity.

According to the paragraph 12 of the Guidance on the Assessment of the Investment Analysis, Version 3, Annex 58, EB 51, *“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 cost of capital are the appropriate benchmarks for a project IRR”*.

In line with the guidance, the Weighted Average Cost of Capital has been chosen as the appropriate benchmark for this project activity.

WACC has been calculated as weighted average cost of equity and cost of debt using the following formula¹³.

$$WACC = (E/I) * Re + D/I * Rb * (1 - Tc)$$

Where

Re is the cost of equity

Rb is the cost of debt

I is the Total Investment

E is the Equity component of investment

D is the Debt component of investment

Tc is the marginal tax rate

¹² http://cdm.unfccc.int/EB/051/eb51_repan58.pdf

¹³ <http://www.investopedia.com/terms/w/wacc.asp>



Project Participant proposes to use pre-tax Project IRR for project evaluation and hence a pre-tax WACC is calculated for comparison.

Cost of Equity:

The cost of equity has been determined based upon the Capital Asset Pricing Model (CAPM). The CAPM economic model is used worldwide to determine the required / expected return on equity based on the potential risk of an investment.

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

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

$$R_i = R_f + (\beta) (R_m - R_f)$$

Where,

R_i = Required Rate of Return on Equity

R_f = Rate of a risk free investment

R_m = Expected market return

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

$(R_m - R_f)$ = Market Risk Premium

Risk Free Return:

Risk free rate is understood as the rate of return on the assets that is theoretically free of any risks, therefore the rate of interest on long term government bonds are considered as risk free rates. Accordingly the risk free rate has been taken available from Reserve Bank of India¹⁴ at the time of decision to invest in the project.

Market Risk Premium:

The market risk premium is the difference between the expected market rate of return and risk free rate.

Expected Market Return:

The market rate of return is calculated by Compound Annual Growth Rate (CAGR). This formula as follows¹⁵:

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

¹⁴ http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/0RBIAN240810_F.pdf Page no 138

¹⁵ http://www.12manage.com/methods_cagr.html



Towards calculating the historical returns on a market portfolio, the project participant has used stock market indices from BSE 500¹⁶. BSE is chosen with a view to eliminating the unsystematic risk associated with the projects totally. The index represents about 93% of the total market capitalizations, and hence represents the total market. A period starting from April 1999 to March 2010 has been considered to remove the impact of short term volatility. The detailed calculation of CAGR for the market is given in the spread sheet. The value of market return for the above period is estimated at 19.56%

Beta:

Beta is the measure of the expected volatility of a particular stock relative to a well-diversified market portfolio. Beta indicates the sensitivity of the stock to market risk factors. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. PP has considered beta values of listed companies which function in the electricity generation area in India covering both the conventional power generation and non conventional generation. Following formula has been used:

$$\text{Asset beta} = \text{Equity beta} / [1 + (1 - \text{Tax}) \times (\text{debt} / \text{equity})]$$

Where, Equity beta¹⁷ is the ratio between covariance of Sensex stock and variance of Sensex.

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

1. Reliance Infra
2. CESC
3. GIPCL
4. NLC
5. NTPC
6. Tata Power
7. BF Utilities
8. JP Ventures Limited

In estimating the cost of equity, average beta value of above stocks has been considered.

Cost of Debt:

In accordance with the guidance of step 2b of the Additionality Tool, PP had chosen the bank interest rate applicable to the project activity.

The pre-tax weighted average cost of capital for this project activity is 14.08% calculated from the above mentioned formulae¹⁸ and this is considered as the benchmark for the pre-tax project IRR.

Sub- Step 2c: Calculation and comparison of financial indicators

Detailed assumptions used in the financial analysis at the time of investment approval are presented below:

¹⁶ <http://www.bseindia.com/histdata/hindices.asp>

¹⁷ <http://www.bseindia.com/about/abindices/betavalues.asp>

¹⁸ Detailed calculation of WACC is given in the spread sheet and submitted to the DOE during validation.



PARAMETER	VALUE	UNIT	SOURCE
Capacity of each WTG	1.65	MW	Agreement with Vestas
Number of machines	34	#	Purchase order
Project capacity	56.1	MW	Calculated
Plant Load Factor	27.75	%	Technical Report for Investment Review Dated 05 th July 2010
Tariff for years 1-20	3.70	Rs/kWh	Karnataka Electricity Regulatory commission (KERC), December 2009 order. Tariff is only fixed for the first ten years of the 20-year PPA.
Generation Based Incentive (GBI)	0.50	Rs/kWh	Excluded from calculation. GBI available equals Rs.0.50/kWh limited to Rs.6.2 Million/MW to be spread in not less than 4 years and for a maximum of 10 years for projects to be commissioned on or before 31-Mar-12.
Income TAX			
Corporate Tax rate	33.22	%	Income Tax Act ¹⁹
Minimum Alternate Tax	19.93	%	Income Tax Act ²⁰
Financial Data			
Total Project Cost	3,287	INR million	Based on final price offers negotiated with Vestas and other suppliers.
Debt Amount	60	%	Assumed at the time of decision making
Equity Amount	40	%	Assumed at the time of decision making
Term Loan Assumed	1+12	years	Assumed at the time of decision making
Interest Rate Assumed	11.75	%	Assumed at the time of decision making
Moratorium Assumed	1	year	Assumed at the time of decision making

The only source of revenue for this project activity is the sale of electricity using the fixed price of Rs. 3.70/kWh to State electricity grid with no escalation. The operating costs include costs to be incurred on operation and maintenance, insurance, and land lease costs. These costs and revenues have been detailed in the spreadsheet. IRR has been computed over the project life time of 20 years.

One of the main incentives offered by the Government of India to investors in wind power projects is 80% accelerated depreciation on the written down value which this project does not avail. Tuppadahalli Energy India Private Limited has considered tax benefits under section 80IA of IT Act. The project developer does not avail tax shelter from 80% accelerated depreciation benefit available for wind power projects in India.

The proposed project activity investment is being made through a domestic corporate entity, Tuppadahalli Energy India Pvt. Ltd. This corporate entity currently generates no profits to utilize the tax break offered to wind farm investors in India in the form of “accelerated depreciation”.

¹⁹ <http://www.taxguru.in/budget-2010/tax-rate-applicable-for-a-y-2011-12-on-income-dividend-wealth-mat-stt-capital-gain-and-presumptive-income.html>

²⁰ <http://www.taxguru.in/budget-2010/tax-rate-applicable-for-a-y-2011-12-on-income-dividend-wealth-mat-stt-capital-gain-and-presumptive-income.html>



It acts as a barrier, as competitors can benefit from this tax subsidy creating demand for wind energy assets, and thereby there is a demand supply mismatch resulting in higher price for the equipment and services available for wind power project development (land, approvals, planning, and studies), wind turbine supply or engineering, procurement and construction of the whole project. Although Tuppadahalli Energy India Pvt. Ltd. is unable to utilize the depreciation, it has to bear the additional cost leading to higher project and maintenance cost based on the demand-supply gap in the market.

This barrier to competition is directly attributable to the restrictions on use of depreciation tax subsidies for tax shelter on profits from existing operations. As per the Indian Income Tax Act, 1961, the parent company and its subsidiary are considered two different entities and the possibility of transfer of the income tax or depreciation benefits between these two entities is not possible. In other words, the depreciation benefit available to Tuppadahalli Energy India Pvt. Ltd. can't be utilized by Acciona Energia, the parent company, which in any case is a company outside India.

Now, a new incentive is available for those companies unable to avail themselves of the accelerated depreciation, in the form of the Generation Based Incentive, GBI. This incentive, however, does not represent as interesting an incentive as the accelerated depreciation.

Based on the above assumptions, the pre-tax Project IRR for this project activity is 9.31% which is below than the Benchmark of 14.08 %. These financial calculations include all the relevant revenues and the cost associated with the project.

Conclusion:

As can be seen from above mentioned information, project IRR is less than the benchmark IRR and hence it can be said that the project is not financially attractive.

Sub-Step 2d: Sensitivity analysis

The purpose of sensitivity analysis is to conclude that financial un-attractiveness is robust to reasonable variations in the critical assumptions.

The sensitivity analysis has been done in accordance with EB 51, Annex 58 'Guidance on the Assessment of Investment Analysis' paragraph 17 and 18²¹. The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions.

For this project activity Plant Load Factor, Project Cost and Tariff Rate are selected as sensitive parameters to check financial attractiveness. The investment analysis provides a valid argument in favor of additionality only if it consistently supports the conclusion that the project activity is likely to be financially unattractive. The effect of the variation in these four parameters on the pre-tax Project IRR is summarized below;

Plant Load Factor:

There is inherent variability in Wind power generation from year to year, caused by the cyclic non-systematic variations in the wind patterns. As a result, it is important to carry out the effect of varying PLF (with +/-10% change in generation) on the pre-tax Project IRR. Although +/- 10% variation in

²¹ http://cdm.unfccc.int/EB/051/eb51_repan58.pdf



generation is unlikely, said sensitivity is considered conservative based on extensive historical analysis done by the project proponent itself, coupled with its global experience in project prospecting, analysis, execution and operation, which spans over two decades in different parts of the world.

Estimated power generation calculated and real generation is expected to deviate less than 10% normally if we take into account five year periods, as is expected in these estimates. However, we can see more significant differences between energy estimated and energy produced in individual years, particularly during the first years of a wind farm's life. Once the farm has been in operation for longer, this difference typically becomes smaller. Also not all sites behave the same way: some of them have higher deviations more frequently. Even with in-depth knowledge and experience of wind farms and wind resource, as Acciona has, deviations greater than 10% (in either direction) could occur in some years. In the examples we have reviewed, wind farms with more than 15 years operation, had deviations higher than 10% in specific years, even if not overall.

The wind power project's dependence on plant load factor (PLF) poses a significant risk to the financial viability of the project activity. The sensitivity analysis of the pre-tax Project IRR with the variation of PLF demonstrates the risk associated with the project. The following table shows the impact of variations in the pre-tax project IRR with a change of $\pm 10\%$ in the PLF:

% change in PLF	-10%	+10%
Project IRR	7.22	11.27

Project Cost:

Project cost also has a significant and considerable effect on the pre-tax Project IRR. The project cost assumption for the financial analysis is based on the final negotiated price offer from Vestas. Because costs have been realistically considered as part of a fixed cost contract with Vestas, which constitutes 80% of total project costs, a variation in project cost is considered highly unlikely. Following is the impact on return of the change in project cost.

% change in Project cost	-10%	+10%
Project IRR	10.95	7.92

Tariff Rate:

The tariff rate of this project activity is Rs. 3.70²² without escalation for ten years. Sensitivity Analysis for tariff rate is considered from eleventh year onwards. The tariff rate also poses a significant risk to the financial viability of the project activity. The sensitivity analysis of the pre-tax Project IRR with the variation of Tariff rate demonstrates the risk associated with the project. The following table shows the impact of variations in the pre-tax Project IRR with a change of $\pm 10\%$ in the tariff rate:

²² Power Purchase Agreement (PPA) to be executed with MESCOM as per Government of Karnataka capacity transfer approval dated 21 December 2010. PPA terms including tariff is determined by Karnataka Electricity Regulatory Commission dated 11 December 2009.



% change in Tariff Rate	-10%	+10%
Project IRR	8.69	9.87

This sensitivity analysis result shows that the variation in Project Cost, Plant load Factor and Tariff Rate does not improve the pre-tax Project IRR to the 14.08% benchmark value even under favourable circumstances. The above table clearly shows that the project activity requires CDM revenues to overcome the Investment Barriers.

Step 4: Common practice analysis

As per the tool²³, this test is a **credibility check** to complement the investment analysis (Step 2) or barrier analysis (Step 3).

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

Project activities are considered similar, as per the “Tool for the demonstration and assessment of additionality (Version 05.2)”, if they are in the same region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Following this guideline, the project proponents have analysed all large-scale wind energy projects of similar scale in the state of Karnataka.

Wind Potential and Installations in India:

As on 31/01/2010, the total installed capacity of power generation in India through all power generation (coal, gas, oil, nuclear, hydro and others) sources is 162,366.8 MW²⁴ whereas the installed capacity of wind power in India is 11,806.69 MW²⁵. Thus only 7.3 % of the total installed capacity in India is through wind generation sources. Hence it can be seen that the proportion of total installed capacity of wind power in the country is very low.

Wind Potential and Installations in Karnataka:

Given that the gross potential for wind power in India is 45,195 MW, the exploitation of the technology is very low. In the state of Karnataka, the gross potential for wind power generation is very high at 6,620 MW just below Andhra Pradesh and Gujarat²⁶; however the installed capacity in the state is much lesser than states such as Tamil Nadu, Maharashtra and Gujarat. As on 31/03/2010, the total installed capacity of power from all generation sources in Karnataka is 10,533.54MW²⁷. Out of this only 1,472.75 MW²⁸ comprises of installations utilizing wind energy to generate power.

Moreover, the plant load factor of wind projects is much lower than that achieved in conventional sources of power generation and hence the share of power from wind power sources would be lesser when compared to the total power generation.

²³ Tool for the demonstration and assessment of additionality, EB 39, Version 5.2

²⁴ http://cea.nic.in/power_sec_reports/executive_summary/2010_06/1-2.pdf

²⁵ <http://www.windpowerindia.com/statstate.html>

²⁶ <http://www.windpowerindia.com/statest.html>

²⁷ http://cea.nic.in/power_sec_reports/Executive_Summary/2010_05/27-33.pdf

²⁸ <http://www.windpowerindia.com/statstate.html>

Wind Energy Generation:

During the year 2008 - 09, the power generated from the entire power generation source in India is 723,800MU²⁹³⁰ and the power generated from the renewable power source in India is 28,952MU³¹ which is about 4% of the total energy generated and the contribution of wind energy to the above renewable energy generation mix in India is only 13334MU³² which is about 1.84 % of the total energy generated during 2008 - 09 in India. The power generated through wind in Karnataka is only 1723MU³³ which is 0.23 % of the total energy generated in India. Hence it can be seen that the power generated from the wind power makes a very small contribution to the total power generated in the country and is not deemed a common practice.

The project activity under consideration is a large scale project activity with proposed capacity of 56.1 MW. For the purpose of analysis, similar project activity has been defined as any project activity with size above 25MW and set up by a single project proponent post year 2000 in the state of Karnataka. Following table provides list of project type excluded from analysis and justification has been provided alongside for exclusion of each project type.

S.N	Project type excluded from analysis	Justification
1	<25 MW Capacity	The scale of investment is not comparable to the project activity under consideration which is a large scale. As per the additionality tool, the projects are considered similar if they are of a similar scale. For conservative analysis though, Tuppadahalli Energy India Pvt. Ltd. has considered all projects which are more than 25MW capacity.
2	Outside region of project activity i.e. Karnataka	Different regions have different regulatory framework and different wind potential (these two are most critical factors for financial performance of the project activity besides the project cost), hence projects which have come up outside the state are excluded.
3	Projects with windmill of rated capacity =<1000 kW	The project proponent proposes to implement WTGs of capacity 1650 kW. WTGs of lower capacity are different from 1650 kW machines in terms of generation, technical aspects and costing. Conservatively Tuppadahalli Energy India Pvt. Ltd. has considered capacity above 1000 kW in the state of Karnataka for common practice analysis.

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

²⁹ From the Power Ministry of India, Annual Report 2009 – 10, Chapter 3, Page No 7..

³⁰ http://www.powermin.nic.in/JSP_SERVLETS/internal.jsp

³¹ <http://cleantechnica.com/2010/07/25/indias-renewable-energy-generation-capacity-could-reach-48-gw-by-2015/#more-13309>

³² http://windpowerindia.com/index.php?option=com_content&view=category&layout=blog&id=10&Itemid=2

³³ http://windpowerindia.com/index.php?option=com_content&view=category&layout=blog&id=10&Itemid=2



Sub-step 4a shows that there are only 07 projects^{34,35} that can be described as similar activities to the proposed project activity after applying the above exclusion criteria. However, these project activities are found to be in the CDM pipeline. The list of these project activities along with their CDM status has been provided as under-

KARNATAKA LARGE SCALE WIND PROJECTS CDM STATUS

Sl. No	Project Promoter	Capacity (MW)
1	Accion Wind Energy Pvt Ltd	29.7 ³⁶
2	Ramgad Minerals & Mining Pvt. Ltd	41.9 ³⁷
3	MSPL Limited	121.95 ³⁸
4	BP Energy India Pvt Ltd	99.4 ³⁹
5	Nuziveedu Seeds Ltd	54.85 ⁴⁰
6	Vijayanand Roadlines Ltd	42.5 ⁴¹

From the above analysis, it can be concluded that no existing similar project activity in the state of Karnataka can be observed without consideration of CDM. This is due to the unattractive returns associated with such project activities, have been carried out only after taking CDM revenues into consideration. Registration of the project activity as a CDM project would lead to revenue to overcome the financial barriers.

On the basis of the conclusions of the analysis in Sub-step 4a, it is seen that similar activities i.e. non CDM wind projects are not observed. Hence as per the tool of additionality v 5.2 the step 4b is not required.

Early Consideration of CDM:

As per the EB 49, Annex 22 Guidelines on the Demonstration and Assessment of Prior Consideration of the CDM⁴², *“the project activities with a starting date on or after August 2008 the project participant must inform a Host party DNA and the UNFCCC Secretariat in writing of the*

³⁴ Directory, Indian Windpower 2009, 9th Edition

³⁵ <http://www.windpowerindia.com/statpriv.asp>

³⁶ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1216117082.43/view>

³⁷ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1142448670.58>

³⁸ <http://cdm.unfccc.int/UserManagement/FileStorage/6TU55OXGCAEHNZQV27694ATC31SOM3>
<http://cdm.unfccc.int/UserManagement/FileStorage/Q310ELI5TNBZF896SR72UGOAMPXWKJ>

³⁹ http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf

³⁹ <http://cdm.unfccc.int/Projects/Validation/DB/8KN4OY1U6F2U113KZAN09DHM3FO0HK/view.html>

⁴⁰ <http://cdm.unfccc.int/Projects/Validation/DB/Y5L6EF2VB8A8SDAOF8BNP1B85FEOQM/view.html>

⁴⁰ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1173772302.89/view>

<http://cdm.unfccc.int/Projects/Validation/DB/69J8TNRR5CNV4D9LWCAG623YGZQO3F/view.html>

⁴¹ <http://cdm.unfccc.int/Projects/DB/SGS-UKL1225104443.35/view>

⁴² http://cdm.unfccc.int/EB/049/eb49_repan22.pdf



commencement of the project activity and of their intension to seek CDM Status. Such Notification must be made within six months of the project activity starting date”

Before implementing this project activity, the project proponent had registered wind power project under CDM⁴³. Thus the project proponent is aware about the CDM benefits prior to the project activity. The Project participant has also sent the intimation letter to the Host Party DNA and the UNFCCC Secretariat about the project activity on 23/08/2010 which is before the starting date of this project activity, which is the date of placing work orders for wind turbines on 13/09/2010. This is a greenfield project under development and the CDM was considered from the beginning. The CDM process, including validation, started early. The wind turbine erection is expected to begin earliest in February 2011 with the synchronization likely to happen earliest in April 2011.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The generated power from this project activity is supplied to the southern regional grid. This project activity is a grid connected renewable energy project, emission reduction quantity depends on the units of energy exported to the grid (in MWh) and the baseline emission factor of the southern regional grid. The methodology covers the monitoring of units exported to southern regional grid. The emission reductions will result from the units of power export to the grid.

Formula used to calculate the net emission reduction for the project activity is

$$ER_y = BE_y - PE_y - LE_y$$

Where,

ER _y	-	Emission Reduction in year y (tCO ₂ e/year)
BE _y	-	Baseline emission in year y (tCO ₂ e/year)
PE _y	-	Project emissions in year y (tCO ₂ e/year)
LE _y	-	Leakage emissions in year y (tCO ₂ e/year)

Project Emission:

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

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

Leakage Emission:

This project activity is a grid connected wind power generation. As there is no energy generating equipment is transferred from another activity to this proposed project activity. Hence there is no leakage from the project activity.

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

There is no GHG emission within the project boundary. So the above equation is simplified to

$$ER_y = BE_y$$

Baseline Emission (BE_y)

⁴³ <http://cdm.unfccc.int/UserManagement/FileStorage/6AKJ3ZR2LHVIMO36XVJNAU4OVC13ML>



Baseline Emission are calculated by multiplying the net quantity of electricity supplied by this project activity (EG_Y) with the CO₂ baseline emission factor for the electricity displaced due to the project ($EF_{CO_2,elec}$) as follows:

$$BE_y = EGBL_y * EF_{CO_2, grid, y}$$

Baseline emission factor (EF_{CO_2})

A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' based on that baseline emission factor has been calculated Ex-ante based.

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

Step 1. Identify the relevant electricity systems.

The tool⁴⁴ defines the electric power system as the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. Keeping this into consideration, the Central Electricity Authority (CEA)⁴⁵, Government of India has divided the Indian Power Sector into two regional grids (see table below).

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 project activity is located in the state of Karnataka which comes under Southern Regional grid and the electricity generated by this project displaces the electricity from the southern regional grid. Due to the displacement of electricity, the project activity would have impact on the southern regional grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. Since the project supplies electricity to the Southern grid, emissions generated due to the electricity generated by the southern regional grid as per CM calculations will serve as the baseline for this project.

Step 2 Choose whether to include off-grid power plants in the project electricity systems (Optional)

⁴⁴ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf>

⁴⁵ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf



Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: *Only grid power plants are included in the calculation.*

Option II: *Both grid power plants and off-grid power plants are included in the calculation.*

Option I corresponds to the procedure contained in earlier versions of this tool. Option II allows the inclusion of off-grid power generation in the grid emission factor. Option II aims to reflect that in some countries off-grid power generation is significant and can partially be displaced by CDM project activities, e.g. if off-grid power plants are operated due to an unreliable and unstable electricity grid. Option II requires collecting data on off-grid power generation as per Annex 2 and can only be used if the conditions outlined therein are met. Option II may be chosen only for the operating margin emission.

The Project Participant chooses the grid power plants (Option I) to calculate the operating margin and build margin Emission Factor.

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

The calculation of the operating margin emission factor ($EF_{OM,y}$) 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 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.

Years	2004 – 05	2005-06	2006-07	2007-08	2008-09
Southern Regional Grid ⁴⁶	21.6 %	27.0%	28.3%	27.1%	22.8 %

The above table 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 Southern regional grid is only 25.36% which is much lesser than 50% of the total generation. Thus, Simple OM method can be used for calculating the emission factor.

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

- *Ex ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period,

Or

⁴⁶ www.cea.nic.in/planning/c%20and%20e/Government%20of%20india%20website.htm



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

The project proponent choose an ex ante option for calculation of the OM with a three year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emission 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 based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid, Omsimple,y}$	=	Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i, m,y}$	=	Amount of fossil fuel type i consumed by power plant/unit m in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)
$Eg_{m,y}$	=	Net electricity generated and delivered to the grid by power plant/ unit m in year y (MWh)
m	=	All power plants/units serving the grid in year except low cost must run power plants/units
i	=	All fossil fuel types combusted in power plant/unit m in year y
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation.

Operating Margin ⁴⁷	2006-07	2007-08	2008-09	Weighted Average
Operating Margin (tCO ₂ /MWh)	0.9991	0.9906	0.9704	0.9867

Step 5 Identify the group of power units to be included in the build margin

Project participants can choose between one of the following two options:

⁴⁷ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

**Option 1**

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

Option 2

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

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

Step 6 Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid, BM, y} = \frac{\sum_m EG_{m, y} * EF_{EL, m, y}}{\sum_m EG_{m, y}}$$

Where:

$EF_{grid, BM, y}$	=	Build margin CO ₂ emission factor in year y (tCO ₂ /MWh).
$EG_{m, y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh).
$EF_{EL, m, y}$	=	CO ₂ emission factor of power unit m in year y (tCO ₂ /MWh)
m	=	Power units included in the build margin.
Y	=	Most recent historical year for which power generation data is available.

Build Margin ⁴⁸	2008 – 09
Build Margin (tCO ₂ /MWh)	0.8179

Step 7 Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

⁴⁸ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



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

Where:

$$\begin{aligned} EF_{\text{grid,BM},y} &= \text{Build margin CO}_2 \text{ emission factor in year } y \text{ (tCO}_2\text{/MWh)} \\ EF_{\text{grid,OM},y} &= \text{Operating margin CO}_2 \text{ emission factor in year } y \text{ (tCO}_2\text{/MWh)} \\ w_{\text{OM}} &= \text{Weighting of operating margin emissions factor (\%)} \\ w_{\text{BM}} &= \text{Weighting of build margin emissions factor (\%)} \end{aligned}$$

$$\begin{aligned} EF_{\text{OM}} &= 0.9867 \text{ tCO}_2\text{/MWh} \\ w_{\text{OM}}^{49} &= 0.75 \\ EF_{\text{BM}} &= 0.8179 \text{ tCO}_2\text{/MWh} \\ w_{\text{BM}} &= 0.25 \end{aligned}$$

$$\begin{aligned} EF_{\text{CO}_2 \text{ elec},y} &= 0.75 * 0.9867 + 0.25 * 0.8179 \\ &= 0.9445 \text{ tCO}_2\text{/MWh} \end{aligned}$$

Parameter	Weighted Average
Operating Margin Emission Factor (tCO ₂ / MWh)	0.9867
Build Margin (tCO ₂ / MWh)	0.8179
Combined Margin (tCO ₂ / MWh)	0.9445

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	EF _{OM}
Data unit:	tCO ₂ eq/MWh
Description:	Operating Margin emission factor of the Southern Regional Grid
Source of data used:	Central Electricity Authority (CEA) CO ₂ Baseline Database values have been used for calculation ⁵⁰ .
Value applied:	0.9867
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated from Central Electricity Authority (CEA) CO ₂ Baseline Database, Version: 5, Dated Nov 2009
Any comment:	The above value is fixed and it is same for the entire crediting period

Data / Parameter:	EF _{BM}
Data unit:	tCO ₂ eq/MWh

⁴⁹ For the project activities like wind & solar: w_{OM} = 0.75 and w_{BM} = 0.25 is used as a default values.

⁵⁰ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



Description:	Build Margin emission factor of the Southern Regional Grid
Source of data used:	Central Electricity Authority (CEA) CO ₂ Baseline Database values have been used for calculation ⁵¹ .
Value applied:	0.8179
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated from Central Electricity Authority (CEA) CO ₂ Baseline Database, Version: 5, Dated Nov 2009
Any comment:	The above value is fixed and it is same for the entire crediting period

Data / Parameter:	EF _{CM}
Data unit:	tCO ₂ eq/MWh
Description:	Combined Margin emission factor of the Southern Regional Grid
Source of data used:	Central Electricity Authority (CEA) CO ₂ Baseline Database values have been used for calculation.
Value applied:	0.9445
Justification of the choice of data or description of measurement methods and procedures actually applied :	Central Electricity Authority (CEA) CO ₂ Baseline Database values have been used for calculation.
Any comment:	The above value is fixed ex- ante and it is same for the entire crediting period.

B.6.3. Ex-ante calculation of emission reductions:

Formula used to calculate the net emission reduction for the project activity is

$$ER_y = BE_y - PE_y - LE_y$$

As explained in section B.6.1 PE_y and LE_y are zero. There is no GHG emission within the project boundary. So the above equation is simplified to

$$ER_y = BE_y$$

Baseline Emission (BE_y)

Baseline Emission are calculated by multiplying the net quantity of electricity supplied by this project activity (EG_y) with the CO₂ baseline emission factor for the electricity displaced due to the project ($EF_{CO_2\text{ elec}}$) as follows:

$$BE_y = EG_{BL,y} * EF_{CO_2}$$

Where:

$$EF_{CO_2\text{ elec}, y} = 0.9445 \text{ tCO}_2/\text{MWh}$$

$$EG_{BL,y} = 136,379 \text{ MWh/year}$$

⁵¹ <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



Putting EG and EF in above formula

$$ER_y = 128,809 \text{ tCO}_2/\text{year}$$

The total Emission Reduction (ER) from this project activity is 128,809 tCO₂/year

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (t CO ₂ e)	Estimation of baseline emissions (t CO ₂ e)	Estimation of leakage (t CO ₂ e)	Estimation of overall emission reductions (tCO ₂ e)
2011-12	0	128,809	0	128,809
2012-13	0	128,809	0	128,809
2013-14	0	128,809	0	128,809
2014-15	0	128,809	0	128,809
2015-16	0	128,809	0	128,809
2016-17	0	128,809	0	128,809
2017-18	0	128,809	0	128,809
Total (tonnes of CO₂ e)	0	901,663	0	901,663

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	EG _y
Data unit:	MWh
Description:	Net quantity of electricity exported to the grid by the project activity during the year y
Source of data to be used:	Joint meter reading available at project site and invoice to MESCOM.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	136,379
Description of measurement methods and procedures to be applied:	This is based on the joint meter reading carried out by site personnel and MESCOM and/or KPTCL representatives. Monitoring Frequency: Continuously Recording Frequency: Monthly
QA/QC procedures to be applied:	Energy meters are calibrated at least once a year.
Any comment:	The Monitored Data to be kept for a minimum of two years after the end of the crediting period or the last issuance whichever is later.

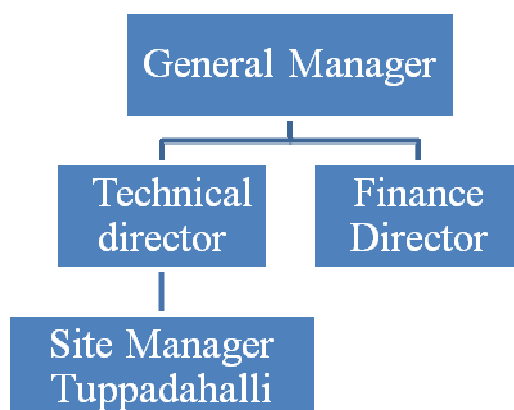
**B.7.2. Description of the monitoring plan:**

According to approved monitoring methodology ACM0002 Version 12.1, Sectoral Scope 1, “Consolidated Monitoring Methodology for Zero Emissions grid connected electricity generation sources” is proposed to be used to monitor the emission reductions.

The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication are as per the CDM Manual. The CDM Manual provides details of metering systems, equipments, procedures for data measurement, recording and data flow prepared for the project activity. It also contains the methodology for calibration of meters, data storage and archiving of data.

Important information on monitoring is provided below:

Organisational structure: Following management structure is proposed to be implemented at site for the monitoring of project activity. There might be changes in this structure in terms of roles however the responsibilities undertaken by the roles would always be maintained.



Role	Responsibility
General Manager	Overall responsible for the management of project activity
Technical Director	Ensure correctness of data and compliance of monitoring methodology
Finance Director	Generation of invoices and CER calculation
Site Manager	Ensuring proper data recording and calibration of relevant meters as per the defined frequency.

Generating point: This would be exact place where energy is generated at the various individual windmills

Border point: It is the connection point of the electrical line between the wind-farm and the grid (MESCOM).



Point of measurement: The exact place where meters are connected to measure energy fed in to the grid.

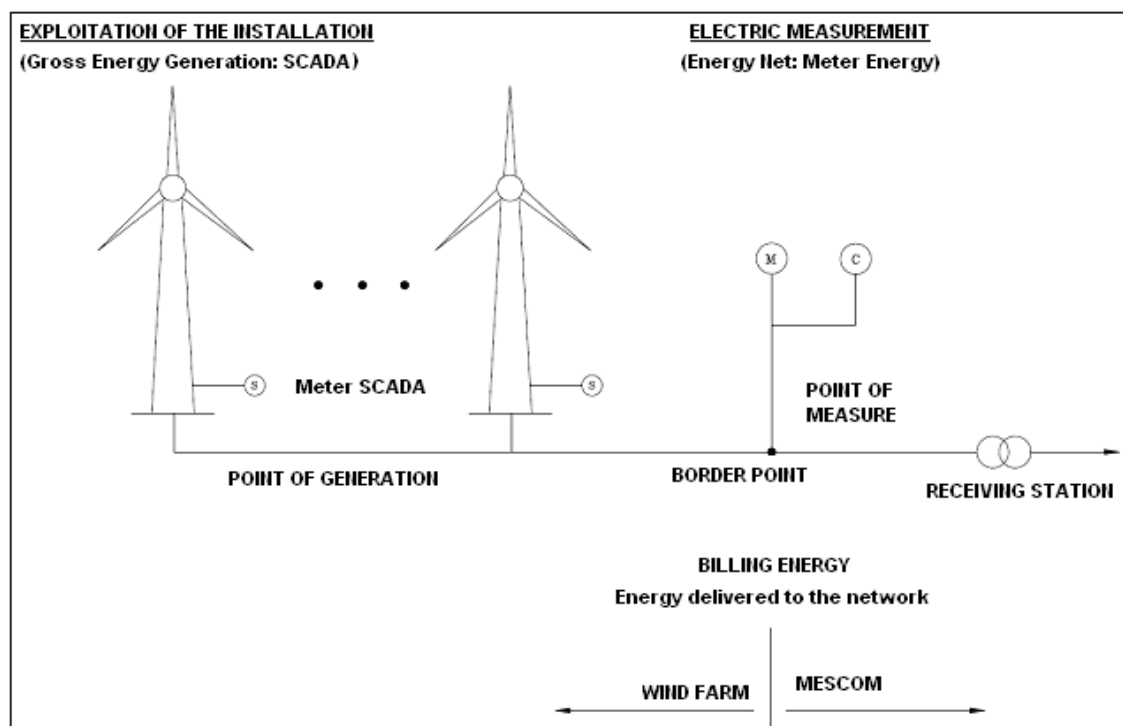
Each of the double circuit lines has a measuring point with two measurement meters:

Main meter: This would primarily be used for accounting and billing of electricity.

Check meter: This shall be connected to the same core of the Current Transformer (CT) and Voltage Transformer (VT) to which main meter is connected and be used for accounting and billing of electricity in case of failure of main meter.

All the meters would be of 0.2 accuracy class.

The reading shall be taken simultaneously and jointly periodically as per the procedure stipulated by the utility MESCOM for payment for electricity received. Information stored is the measurement at the receiving stations directly obtained from meters, that is, the energy exported to and the energy imported from the grid. Data integrity between main and check meters reading will be performed. If there is any discrepancy, a report explaining the problem detected and the corrective actions to be taken will be created and documented.



Data storage:

Evidences generated will be kept available during the running of the project and for a minimum of two years after the end of the crediting period or the last issuance, whichever is later.

Main and check meters reading:

The reading shall be taken simultaneously and jointly periodically. Information stored is the measurement from the receiving station directly obtained from meters, that is, the energy export and the energy import to the grid.



B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

Date of completing the final draft of the baseline: 18/10/2010

Name of the entity determining the baseline:

Rajnish Krishanlal Sapra

Tuppadahalli Energy India Private Limited⁵²

C1 – 001, Tower C, The Millennia,

No 1 & 2, Murphy Road, Ulsoor,

Bangalore – 560 008, Karnataka

The entity determining the baseline is also the Project Proponent of this Project Activity and the details are provided in Annexure 1 of this Project Design Document.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

13/09/2010⁵³

C.1.2. Expected operational lifetime of the project activity:

20 (Twenty) years⁵⁴ 0 (Zero) months.

C.2. Choice of the crediting period and related information:

Project Activity will use renewable crediting period.

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

01/04/2011 or Registration Date of the project with the UNFCCC as a CDM project, whichever is later.

C.2.1.2. Length of the first crediting period:

7 (Seven) years (twice renewable⁵⁵) 0 (Zero) months.

⁵² Tuppadahalli Energy India Pvt. Ltd. is also a Project Participant listed in Annex 1

⁵³ From the date of Purchase Order issued for WTG.

⁵⁴ From the Technology Supplier

⁵⁵ Project will claim emission reductions only for 20 years which is the life time of project activity.

**C.2.2. Fixed crediting period:****C.2.2.1. Starting date:**

NA

C.2.2.2. Length:

NA

SECTION D. Environmental impacts**D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

In India, Ministry of Environment and Forest is the host party. As per the prevailing host party laws, (the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated September 14, 2006), 38⁵⁶ activities are required to undertake environmental impact assessment studies. The project activity does not require EIA to be conducted as per EIA notification. Furthermore the Environmental Impact Assessment study is not required for wind power project as there is no negative environmental impact due to the project activity and wind energy is one of the cleanest sources of energy.

Additionally, although not required to, and as part of its commitment towards respect for the environment, the project proponent has conducted an EIA study following the internal criteria set out by Acciona Energía.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

There is no significant environmental impact due to this project activity hence EIA is not required for this project activity.

SECTION E. Stakeholders' comments**E.1. Brief description how comments by local stakeholders have been invited and compiled:**

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Tuppadahalli Energy India Private Limited has proposed to install 56.1MW wind energy project in the state of Karnataka. A local stakeholder consultation meeting had been conducted in order to identify the concerns of the people regarding the implementation of the project activity.

The stakeholders identified for the project were: the usual occupants of the villages around and the local communities, governmental agencies, employees and consultants/advisors, who they assumed would have

⁵⁶ <http://envfor.nic.in/legis/eia/so1533.pdf>



an interest in the CDM project activity. Their views were welcomed, to understand their opinion on the proposed CDM project activity. A Notice to hold the stakeholder consultation meeting was displayed in local news paper in “Udayawani” and in “Deccan Herald” dated 09.10.2010 in local language and English language respectively. The meeting was scheduled on 20.10.2010 at 11:00am to 2:30 pm at the project location itself.

The meeting started with the welcome address by Mr. Prashanth Vittal, Director, Tuppadahalli Energy India Private Limited. He explained the purpose of the meeting and requested the members to give candid feedback / suggestions. Mr. Prashanth Vittal explained regarding the project and purpose of setting up a wind project activity.

Mr. Prashanth Vittal again briefed about the current electricity generation scenario in India and Karnataka in particular. He informed about the benefits of setting up of wind farms which included no pollution, no adverse environmental impacts, etc.

Mr. Nagaraj Bhat, Tasildar, welcomed wind power projects and highlighted about the various benefits of setting wind power projects.

Mr. ShamiUlla, Dy. Tasildar and Mr. Shhivanna, Village Accountant, welcomed wind power projects and highlighted the benefits like creation of employment, improvement of basic infrastructure and improvement of electricity supply.

Mr. Shridhara & Mr. Srikanth of Vestas (Technology Supplier), explained the functioning of wind power plant and clarified the members that wind power projects are clean and help in the sustainable development of the region and the country as such. He insisted that more such projects be set up so that the nearby villages also get benefited.

The members concluded that they will encourage more such projects so that more local people get employment and business opportunities can be created.

The meeting was concluded with vote of thanks from Mr. Prashanth Vittal of Tuppadahalli Energy India Private Limited.

E.2. Summary of the comments received:

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After a brief discussion regarding the consequences and impacts of this project activity the comment pertaining to project activity were received and answered in the meeting. The stakeholders were happy to know the development this project activity would bring to their region. They also appreciated the project activity as it was pollution free and might help in resolving the situation of frequent power cuts. The stakeholders concerns during the meeting were also towards employment, advantages of project activities and development for the local region. Questions regarding the power cuts, employment etc were raised by the stakeholders, which were replied to positively by the project proponent. Thus, overall there was agreement that the proposed project is a beneficial project.

E.3. Report on how due account was taken of any comments received:

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The stakeholders were given clarification on the issues raised as above to their satisfaction. The comments from the stakeholders were addressed by Mr. Prashant of Tuppadahalli Energy India Private Limited., Mr. Nagaraj Bhat, Tasildar and Mr. Shridhara of Vestas.

Overall there was unanimous agreement that the project activity was a good initiative undertaken by the Project proponents which contributes to sustainable development.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Tuppadahalli Energy India Pvt. Ltd.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in this project activity



Annex 3

BASELINE INFORMATION

Refer section B.6.1 for details of baseline information.



Annex 4

MONITORING INFORMATION

Monitoring plan is already discussed in section B.7.