CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Title: Wind Energy Project in Tamilnadu, India by Shanthi Gears Ltd.
Version: 02
Date: 10/05/2010

A.2. Description of the small-scale project activity:

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Description:
The project activity comprises of installation and operation of 4 Wind Turbine Generators (WTGs) by M/s. Shanthi Gears Ltd., Coimbatore having a wind power generation capacity of 5.25 MW. The WTGs are located in Tirunelveli district of Tamilnadu. The generated electricity is utilized for captive consumption.

Purpose of the project activity:
The project activity is utilising renewable wind energy by displacing fossil fuels to generate electricity. The project activity is installing 4 Wind Turbine Generators which are Suzlon make. The total installed capacity by the project activity is 5.25 MW. The electricity generated is utilized for captive consumption.

The purpose of the project activity is to develop, construct, operate and maintain the 5.25 MW wind based generation facility in the state of Tamilnadu. The project activity also utilises renewable wind energy by displacing equivalent amount of electricity that would have been generated from the grid connected by fossil fuel. The project activity thus reduces anthropogenic GHG emissions to the atmosphere which is approximately 11,933 t CO_2e.

In the pre-project scenario the electricity was being drawn from the grid that is connected with fossil fuel predominantly and thus emitting GHGs to the atmosphere.

In the project scenario the project activity is installing 4 WTGs to generate electricity that which will be utilized for captive consumption. The details of the components of this project activity are as follows:

Location	Total capacity of wind mills	No. of Wind turbines	Capacity of each turbine	Date of Commissioning
Uthumalai-village, Melmaruthappapuram-village, V.K.Pudur-Taluk, Thiruvambalapuram-village, Radhapuram-Taluk (Tirunelveli-Dist, TAMILNADU)	5.25 MW	4	3*1.25 MW and 1*1.5 MW	20/03/2006, 27/09/2006, 3/08/2006 and 22/09/2007

The baseline scenario is similar to the pre-project scenario where electricity supplied would have been procured from grid connected by fossil fuels to the project proponent who uses the wind power for captive consumption. In addition, electricity would have also been generated from the future capacity addition.

The technology employed does not require any fuel input for generating electricity, it only requires wind energy which gets converted to kinetic energy and further to electrical energy.
The project activity by utilising renewable wind energy for electricity generation reduces anthropogenic GHG emissions to the atmosphere and thereby leading to sustainable development.

Contribution of the project activity to sustainable development

Ministry of Environment and Forests, Govt. of India has stipulated[1] the social well being, economic well being, environmental well being and technological well being as the four indicators for sustainable development in the host country approval eligibility criteria for Clean Development Mechanism (CDM) projects.

Social well being
The project activity is coming up in a remote hilly area. Due to wind farms in general, there is overall infrastructure development in the area like – all season roads, employment opportunity and increased business due to movement of skilled labour in the area. The land used by wind mills were also sold at better rates, which otherwise had no other use.

Economic well being
The project activity results in generation of additional employment opportunities both directly and indirectly during commissioning and operation of wind mills. It is also creating business opportunities during installation for civil contractors and electrical technicians, traders in the operations. The prices of the infertile lands were raised due to this project activity thus benefiting the land owners.

Environmental well being
The project activity is producing electricity through wind energy which would other wise have been produced from fossil fuel, thereby reducing GHG emissions to the atmosphere. It is safe and provides clean energy.

Technological well being
The project activity utilized state of the art wind turbines available at that time and can encourage other industries to use renewable electricity for meeting the captive requirement.

A.3. Project participants:

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Name of 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)
India (Host Country)	Shanthi Gears Ltd. Coimbatore (A Private entity)	No

The project proponent will be the sole owner of the issued CERs.

[1] http://www.cdmindia.in/approval_process.php

CDM – Executive Board

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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India

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

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State-Tamilnadu

A.4.1.3. City/Town/Community etc:

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Dist.-Tirunelveli

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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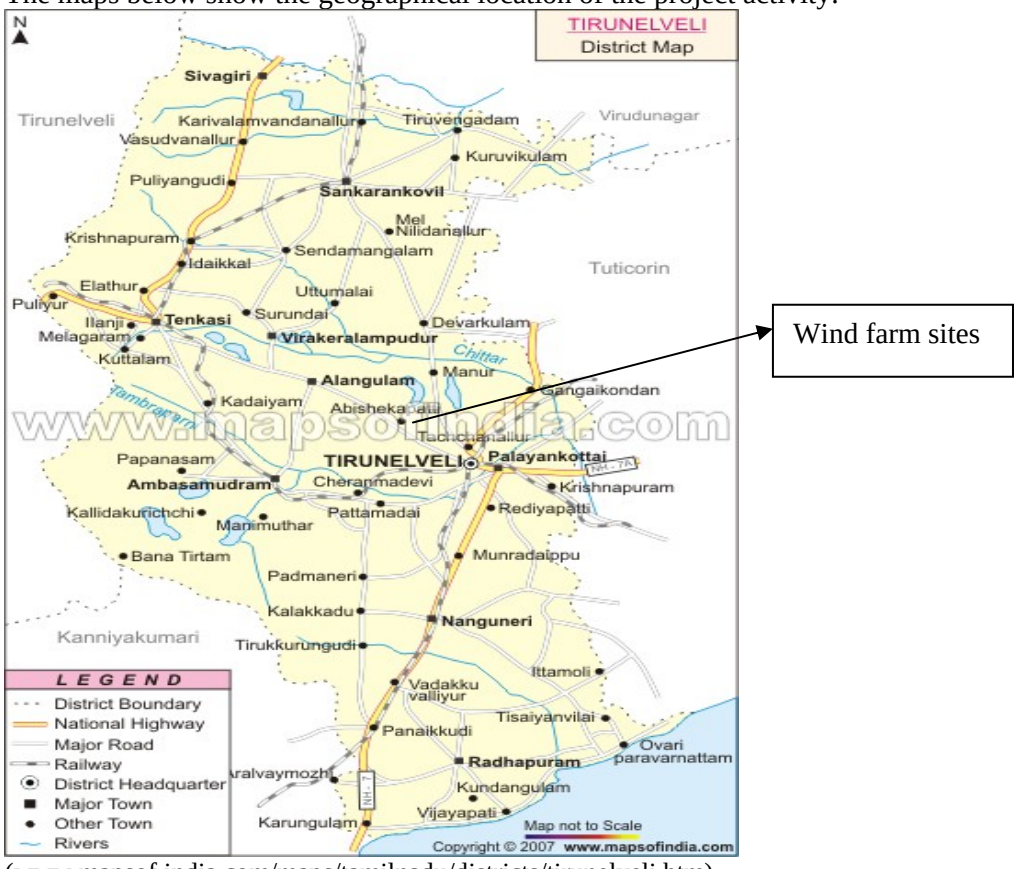
The maps below show the geographical location of the project activity.



(www.mapsof india.com/maps/tamilnadu/districts/tirunelveli.htm)

Table 1: Geographical details of installed WTGs

Location	Longitude/ Latitude	SC. No.	Make/Model
Village: Uthumalai, Taluk: Veerakeralampudur, District: Tirunelveli, State: Tamilnadu, India	N 9 01 11.3 E 77 33 30.5	1963	Suzlon S-66
Village: Melamaruthappapuram, Taluk: Veerakeralampudur, District: Tirunelveli, State: Tamilnadu, India	N 8 14 14.0 E 77 45 41.0	2020	Suzlon S-66
Village: Thiruvambalapuram, Taluk: Radhapuram, District: Tirunelveli, State: Tamilnadu, India	N 8 59 35.6 E 77 31 56.1	2417	Suzlon S-82
Village: Uthumalai, Taluk: Veerakeralampudur, District: Tirunelveli, State: Tamilnadu, India	N8 59 28.0 E77 32 41.8	1624	Suzlon S-66

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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The proposed CDM project activity generates power using wind energy, which is a renewable source of energy. The proposed CDM project activity qualifies for the simplified modalities and procedures for the small scale CDM project activities as the electricity generation capacity of the proposed CDM project is 5.25 MW, which is less than the maximum qualifying capacity of 15 MW. The grid connected project activity utilizes the wind potential for power generation and the generated electricity is utilized for captive purpose.

According to small scale CDM modalities the project activity falls under:

Type: I –Renewable energy projects

Category: AMS I F Ver 1- Renewable electricity generation for captive use and mini-grid

Technology:

Technology employed for the project activity:

The purpose of the project activity is to generate electricity from renewable wind energy which is utilized for captive consumption. The total installed capacity is 5.25 MW generated from 4 WTGs installed by the project proponent in Tirunelveli district of Tamilnadu. The technology implied here is the kinetic energy of natural wind is getting converted to mechanical energy which later is converted to electrical energy. Since wind energy generation is a clean technology, no anthropogenic emissions including GHGs are emitted to the atmosphere.

In the pre-project scenario, the electricity was being drawn from the grid that is connected predominantly to fossil fuel based power plants and that generated electricity was being used for captive consumption.

Technical Specifications:

All the wind mills consist of 3 blades. They are of SUZLON make. The life cycle of each wind mills is 20 years according to the industrial norms.

Technical details of all SUZLON WEGs are as follows:

Sr. no.	Item	Description
	HT.Sc.No.	2020, 1963, 2417, 1624
1	Make	SUZLON
2	Model no.	S66, S-82 (SC- 2417)
3	Rating in kW	1250 KW 1500 KW (SC- 2417)

4	Hub height	74 m, 78.5 m (SC- 2417)
5	Rotor diameter	66m, 82m (SC- 2417)
6	No. of rotor blade	3
7	Orientation	Upwind/horizontal axis
8	Rotational speed	13.8/20.7 rpm
9	Rotor Swept area	3421 m^2 5281 m^2 (SC- 2417)
10	Cut-in wind speed	3m/s, 4m/s (SC- 2417)
11	Rated wind speed	14m/s, 12.5 m/s (SC- 2417)
12	Cut-out wind speed	22m/s, 20m/s (SC- 2417)
13	Regulation	Pitch regulated
14	Generator Type	Asynchronous 4/6 pole, Asynchronous 4 pole (SC. 2417)
15	Rotation speed	1006/1506 rpm, 1511 rpm (SC- 2417)
16	Rated output	250/1250 kW, 1500 kW (SC- 2417)
17	Frequency	50 Hz

Specifications of the wind mill are mentioned below:

S.No.	Specifications	Values	Unit
1.	Total installed capacity	4 (3 WTGs)	MW
2.	Plant load factor	27.46	%
3.	Life time	20	years

Since the electricity generated is through renewable wind energy no GHGs are emitted to the atmosphere. Therefore the technology implemented is a clean technology. The power generated mainly depends on wind speed and the grid availability factor. The type and services provided are through renewable wind energy with total installed capacity of 5.25 MW.

The baseline is similar to the pre-project scenario where electricity is used from the grid supplied by fossil fuels and future capacity addition in the grid.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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The project proponents have chosen the fixed crediting period of 10 years. The estimated emission reductions for chosen crediting period are as follows:

Years	Annual estimation of emission reductions in tonnes of CO2e
2011	11,933
2012	11,933

2013	11,933
2014	11,933
2015	11,933
2016	11,933
2017	11,933
2018	11,933
2019	11,933
2020	11,933
Total estimated reductions (tonnes of CO_2e)	11,933
Total number of crediting years	**10**
Annual average of estimated reductions over the crediting period (tCO_2e)	1,19,330

Shanthi Gears Ltd. will be the sole owner of the issued CERs.

A.4.4. Public funding of the small-scale project activity:

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There is no public funding for the project activity from the Parties included in Annex I. No ODA has been used for the project. The entire project cost is met by the project proponent and in part by the debt finance from banks.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for small-scale CDM project activities, a small scale project is considered a debundled component of a large project activity if there is a registered small-scale activity.

- With the same project participants
- In the same project category and technology, and
- registered within the previous 2 years
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity

The project participants of the proposed CDM project have not registered or applied for registration of any CDM project in the past 2 years whose boundary is within one km of the project boundary of the proposed project and in the same project category and technology. The proposed CDM project activity is not a debundled component of a large scale project activity. Thus, the project activity can use the simplified modalities and procedures or small scale project activities.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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Electricity generation:

Methodology : AMS-I.F
Title : Grid connected renewable electricity generation
Sectoral Scope : 01
Version : 1
EB : EB 54

Refers to the Tool:
Tool to calculate the emissions factor for an electricity system.
Version: 2, EB-50, Annex 14

Reference: Appendix B of the simplified modalities and procedures for small scale CDM project activities in the **"**Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories"
For more information of both the methodologies please refer to link:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved html

B.2 Justification of the choice of the project category:

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The choice of the project category is justified below:

Applicability condition of AMS IF, V. 1	**Proposed project activity**	**Justification**
1. This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e., in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below: (a) A national or a regional grid (grid hereafter); (b) Fossil fuel fired captive power plant; (c) A carbon intensive mini-grid.	The project activity comprises renewable wind energy generation units for captive use which displaces the fossil fuel fired generating unit in Southern Grid of India which is predominantly Fossil fired electricity generation.	Hence this applicability condition is met.
2. For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e., the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.	The project activity is connected to the national grid	Hence this condition is not applicable
3. Project activities or project activity components supplying electricity to a grid shall apply AMS-I.D. Project activities for standalone off-the-grid power systems supplying electricity	Project activity is not supplying the generated units to Grid or to households.	Hence this applicability condition is met.

to households/users included in the boundary are eligible under AMS-I.A.		
4.Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	This is not applicable to the project activity as the project activity is not a hydro power plant.	Not Applicable
5. For biomass power plants, no other biomass other than renewable biomass are to be used in the project plant.	This is not applicable to the project activity as the project activity is not a Biomass based power plant.	Not Applicable
6. This methodology is applicable for project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition, (c) involve a retrofit[4] of (an) existing plant(s); or (d) involve a replacement[5] of (an) existing plant(s).	Project activity install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant)	Hence this applicability condition is met.
7. In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[6] from the existing units.	Project activity is not a capacity addition to the existing renewable power generation units.	Not Applicable
8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Project activity is not a retrofit or replacement of existing project activity	Hence this applicability condition is met
9. If the unit added has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15MW for a small scale	The project activity is a Greenfield project and has not added units. It is an entirely renewable energy	Not Applicable

CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	based project and is not co-fired type. In any case, the size is on 6.75 MW and below the limit prescribed in the methodology.	
10. Combined heat and power (co-generation) systems are not eligible under this category.	The project activity is generating only electricity and is not a Co-generation plant.	Hence this condition is not applicable.
11. In case electricity produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the electricity will have to be entered into specifying that only the facility generating the electricity can claim emission reductions from the electricity displaced.	The project activity does not involve or delivers the generated units to another facility or facilities within the project boundary.	Hence this condition is not applicable.

Thus, the project activity can use the methodology AMS.IF.

B.3. Description of the project boundary:

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According to the approved small-scale methodology AMS IF, the project boundary encompasses the physical, geographical site of the renewable generation source.

The project activity is utilising renewable wind energy which is a cleaner technology, so no GHGs are emitted to the atmosphere.

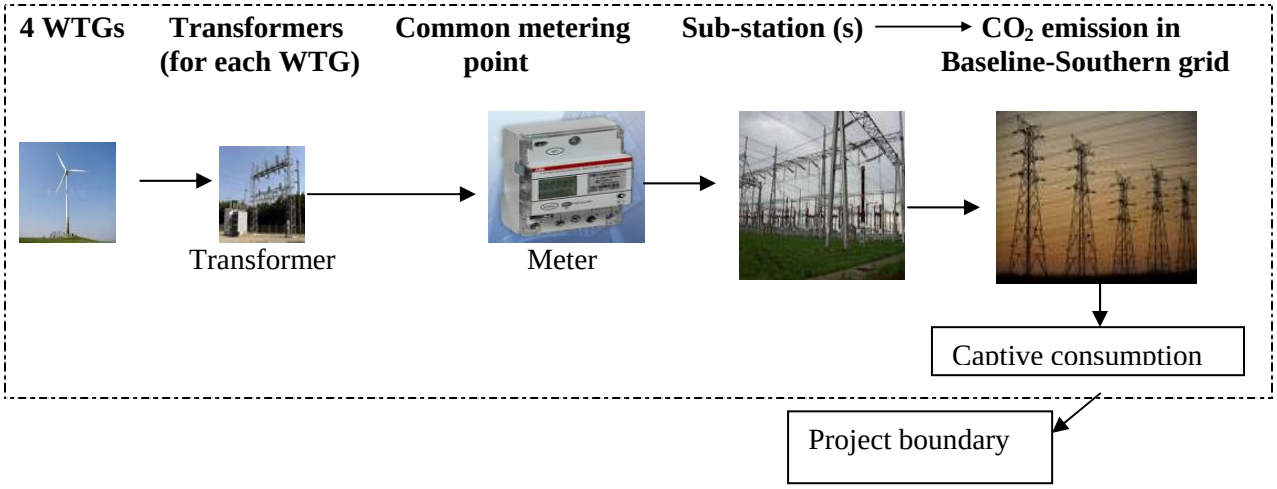
As per the baseline is considered, it is estimated that only CO_2 is emitted to the atmosphere. The other two gases CH_4 and N_2O were conservative, hence excluded and considered insignificant.

The project boundary encompasses the physical, geographical site of the 5.25 MW project activities at the project location as specified in Section A.4.1.4 above.

	Source	**Gas**	**Included/ Excluded**	**Justification/Explanation**
Baseline	Fossil fuel fired power plants connected to the grid	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded. This is conservative. Hence insignificant.
		N_2O	Excluded	Excluded. This is conservative. Hence insignificant.
Project Activity	Electricity generation through wind energy	CO_2	Excluded	The project activity is renewable energy project which will not create any emissions by itself. This is excluded for simplification.
		CH_4	Excluded	The project activity is renewable energy project which will not create any emissions by itself. This is excluded for simplification.
		N_2O	Excluded	The project activity is renewable energy project which will not create any emissions by itself. This is excluded for simplification.

In the absence of the project activity, electricity would have been drawn from fossil fuel fired power plants connected to the grid which emit CO_2 to the atmosphere. CH_4 and N_2O are excluded. In case of project activity, electricity delivered through wheeling both to grid and for captive consumption through wind energy is a cleaner technology. Therefore, no CO_2 emissions to the project activity.

Flow diagram of the project boundary (flow from left to right):



B.4. Description of baseline and its development:

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The project category applicable to the proposed CDM project is AMS IF. Accordingly, the applicable baseline is (Para 14) the emission factor of a grid shall be calculated as per the procedures provided in AMS ID.

The emission coefficient can be calculated in a transparent and conservative manner as:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures to calculate the operating margin can be chosen, but the restrictions to use the simple OM and the Average OM calculations must be considered.

(OR)

b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used. Calculations must be based on data from an official source (where available) and made publicly available.

According to step a) the combined margin emission coefficient (in kg CO_2e/kWh) of the current generation mix in the southern grid has been considered for determining the emission in the baseline, as applicable to wind power projects according to ACM0002. The combined margin calculations were based on the operating margin and build margin data available from the Central Electricity Authority (CEA)[2], Government of India.

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

Parameters involved defining the baseline Scenario

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Parameter	Data Source
$EF_{grid,OM,y}$ = Operating Margin Emission Factor (tCO_2/MWh)	Central Electricity Authority : CO2 Baseline Database,version 5.0,November 2009[3]
$EF_{grid,BM,y}$=Build margin Emission factor(tCO_2/MWh)	Central Electricity Authority : CO2 Baseline Database,version 5.0,November 2009[4]
$EF_{grid,CM,y}$= Combined margin CO2 emission factor for the project electricity system in year y(tCO_2/MWh)	Calculated as the weighted average of the operating margin and build margin

The baseline emission factor has been considered from the "**CO_2 Baseline Database for the Indian Power Sector**", Version 05 published by CEA in November 2009. The emission factor, calculated based on the data published by CEA for the latest year 2009 (based on combined margin approach), is as mentioned for the respective grids.

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 small-scale CDM project activity:

As per the paragraph 28 of the simplified modalities and procedures for the small scale CDM project activities, a simplified baseline and monitoring methodology listed in appendix B may be used for a small scale CDM project activity if the project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more of the barriers listed in attachment A to appendix B. These barriers are:

- Investment barrier
- Technological barrier
- Barrier due to prevailing practice
- Other barriers

The barriers that is considered for the project activity is 'Investment barrier'

Step I:

Identification of alternative scenarios to the project activity:

1. *Project activity undertaken without CDM revenues.*
2. *With the current practice where the supply is from grid.*

To the project proponent since the first option is technically feasible, which he could have opt for, can consider as the feasible alternative.

The project proponent instead of implementing new plants with hydro or any other fossil fuel like coal would have opted getting the supply from grid generated. Therefore the first and the fourth alternative can be considered as the most possible alternatives to the project activity.

[3] http://www.cea.nic.in/planning/c and e/user_guide_ver5

[4] http://www.cea.nic.in/planning/c and e/user_guide_ver5

The above 2 alternatives are consistence with current laws and regulations.

Therefore the step 1 of the additionality has been crossed.

Step II:

Investment analysis:

The power generation from wind mills is associated with high cost – both capital intensive and unit cost of electricity generation. The cost of generation of energy through wind mill is higher when compared to other forms of energy like coal, natural gas etc. especially because of its low plant load factor. So the individual sub-project owners have taken the decision to commission windmills considering the CDM revenues to make the project financially viable.

The financial indicator chosen for investment barrier is IRR. The internal rate of return (IRR) on investment as financial indicator is one of the known financial indicator used by banks, financial institutions and project developer for making investment decision. The financial indicator chosen is the internal rate of return of the project (IRR). This is compared with the cost of financing which has been taken from the Weighted Average Cost of Capital (WACC). As per the Guidance on the Assessment of Investment Analysis, V. 03, Para 11, WACC is appropriate benchmark for project IRR. WACC is not calculated based on company's internal returns (to follow Para 13 of same Guidance), but taken from public available data on market returns (for three years) and performance of six energy companies. Following formula is used for WACC calculation.

$$WACC\ (Post\ tax) = [(1-g) * CE] + [g * CD\ (1-T)]$$

where,
g is the level of gearing or leverage in the project activity, i.e. the proportion of debt in the total capital structure (i.e. debt + equity).
CD is the cost of debt finance (pre-tax)
CE is the cost of equity finance (post-tax)
T is the tax rate

Cost of equity in this is calculated from following formula

$$CE = Rf + \beta*(Rm - Rf)$$

where:
Rf = Risk-free rate of return
Rm = Market rate of return
β = Equity beta
Rm – Rf = Market risk premium

The WACC works out to be 16.10%, 16.14% and 17.45% based on the investment decision years and is used as benchmark for the project IRR in this project activity[5].

[5] A detailed calculation sheet is provided to DOE

The estimated project cost has been referred from the figure which was given by the supplier as a realistic approach. The project costs associated with the project activity are the initial investments that are incurred by the project proponent for the supply, commissioning and erection of the wind mills. This includes the cost that was paid to the manufacturer of the turbine (cost of the machine and charges for erection and commissioning) and also to respective Electricity Boards (infrastructure and development charges).

The following table illustrates the (representative case) parameters used for the investment analysis. Some of these parameters are common for all Investment year. Some of the parameters are specific to Investment year.

Result of IRR analysis

Investment decision year	Project IRR (%)	
	Without CDM	With CDM
2005 – 1.25 MW	11.61%	13.36%
2006 – 1.25 MW x 2	13.52%	15.82%
	12.98%	15.19%
2007 – 1.5 MW	8.95%	10.62%

The results of the financial analysis show that the project IRR without CDM for all the sub-projects is lower than benchmark WACC considered.

As per guideline provided by EB in meeting no. 41 annex 45 the criteria for choosing the sensitivity analysis parameter is:

Sensitivity analysis
16. Guidance: Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets.. Where a DOE considers that a variable which constitute less than 20% have a material impact on the analysis they shall raise a corrective action request to include this variable in the sensitivity analysis.

The project activity involves the sale of electricity to the grid; hence it is the sole source of revenue for this project. This revenue is based on two parameters namely, the tariff & the power generation. The tariff is fixed without any escalation. Also, ± 10% variation in either of these parameters would be affecting IRR to the similar extent.

Similarly the parameters which can affect 20% of the total cost for this case is only the investment cost. Since the investment costs were considered on the purchase/ work orders, as per actual, there were no possibilities of this cost getting reduced. Hence the sensitivity analysis would have to be performed only for an increase in capital cost which would result in decreasing project IRR further and make CDM revenue all the more important to make project happen. Hence this analysis has not been presented.

For the project activity of 3 * 1.25 MW+ 1*1.5 = 5.25 MW wind power undertaken by Shanthi Gears Ltd.		
Capacity of the wind farm	5.25 MW	
No. of machines	4 machines	
Capacity of machines	1.25 MW x 3 1.5 MW x 1	
Plant load factor	27.46%	Tamilnadu electricity regulatory commission, Wind project tariff related issues
Project cost	INR 195.00 Million	
Debt Equity	70% 30%	
Interest rate Tenure Moratorium	9% 10 yrs 12 months	
Tariff	2.70 Rs./ kWh (2006) 3.50 Rs./ kWh (2007)	TNEB HT tariff[6]
O & M charges (1 year & 2 year) O & M charges (3rd year @1.25% of project cost with 5% annual escalation per year.	Nil 1.04 Million	
Income Tax Depreciation Rate On wind energy generators On other assets **Book depreciation rate (straight line method basis)** On wind	 80% 10% 4.5%	Tamilnadu electricity regulatory commission
Income Tax Income Tax rate Minimum Alternate Tax Surcharge Cess	 30% 10% 10% 2%, 2% & 3%	 Rates prevalent at the time of investment decision. 2005, 2006 & 2007 commissioned
IRR		

Table 1: Result of sensitivity analysis

No. Of WTG	Project IRR (%) without CDM		Benchmark
	PLF = +10%	PLF = -10%	
1	13.09	10.06	**16.10%**
2	15.32	11.67	**16.14%**
3	14.73	11.17	**16.14%**
4	10.41	7.40	**17.45**

[6] http://www.tneb.in/template_3.php?tempno=3&cid=0&subcid=54

The sensitivity analysis shows that in all case the project activity is less attractive and does not cross the benchmark. By analyzing the comparative analysis, it can be concluded that the project is additional at all load factors analyzed in the sensitivity analysis.

Prior Consideration of CDM and continuous follow up:

The following detailed chronological sequence of events describes the stages in the CDM process underwent by Shanthi Gears Ltd.

The chronology of events for the project activity:

S. No.	Key Events	Dates	Proof
1.	Management decision to consider CDM revenues for the installation of wind mills by way of Board resolution	11/07/2005	Minutes of the Board Meeting
2.	Placed Purchase Order on Suzlon for 1.25 MW wind mill	21/12/2005 (CDM start date)	Purchase Order
3.	Commissioning of 1.25 MW WTG	20/03/2006	Commissioning certificate
4.	Appointment of First CDM Consultant	19/05/2006	Agreement
5.	Order placed for Wind turbines	18/07/2006 11/08/2006 14/08/2007	Purchase Order
6.	Expiry of contract with First Consultant	20/05/2008	Agreement
7.	Offers received from CDM consultants	22/09/2008	Proposal from Consultants
8.	Appointment of Second CDM consultant	24/11/2008	Agreement with Second Consultant
9.	Appointment of DOE for Validation	Dec 2008	Agreement with DOE
10.	Issued Public notice for Stake holders meeting	01/10/2009	Newspaper advertisement
11.	Termination of agreement with the second consultant	01/01/2010	Termination letter
12.	Appointment of Third Consultant	04/01/2010	Agreement with Third Consultant
13.	Submission of PDD for completeness check	11/05/2010	Mail dated 11/05/2010
14.	PDD for Global stakeholder consultation	May 2010	

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Thus, it can be concluded that the project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The project category is renewable electricity generation displacing electricity from a grid system, which is fed by both fossil fuel fired generating plants (using fossil fuels such as coal, natural gas, diesel, naphtha etc.) and non-fossil fuel based generating plants (such as hydro, nuclear, biomass and wind).

$BE_y = EG_{BL,y} * EF_{CO2,y}$

Where,

BE_y = Baseline Emissions in year y; t CO2
$EG_{BL,y}$ = Qunatity of net electricity displaced as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,y}$ = Emission Factor (t CO2e/MWh), Emission factor of a grid shall be calculated as per the procedures provided in AMS I.D

The Emission Factor can be calculated in a transparent and conservative manner as follows:

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

Or

(b) *The weighted average emissions (in kg CO2equ/kWh) of the current generation mix.*

The project proponent has chosen the option (a) i.e. combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) for the purpose of calculation of baseline. Actual CO2 emission factor are used for the purpose. Value has been used from the latest version of Baseline Carbon Dioxide Emissions from Power Sector provided by the Central Electricity Authority, Version 5, Govt. of India.

The baseline emission (BEy in tCO2) is the product of the baseline emission factor (EFy in tCO2/MWh) times the electricity supplied by the project activity to the grid (EGy in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities ($EG_{baseline}$ in MWh), as follows:

$EG_{add,y} = EG_{pj,y} - EG_{existin,y}$

Where,
$EG_{add,y}$ = Net increase in electrical energy generation at existing plant in year y; kWh/y
$EG_{pj,y}$ = The total net actual electrical energy produced in year y by all units, existing and new project units; kWh/y
$EG_{existing}$ = The estimated net electrical energy that would have been produced by existing units (installed before the project activity) in year y in the absence of the project activity, kWh/y

Since the project does not involve any modification or retrofit of the existing generation facility hence $EG_{add,y} = 0$

$EF_{grid\ CM\ y}$ is determined as follows:

The weighted average of the Operating Margin emission factor ($EF_{gridOM,,y}$) and the Build Margin emission factor ($EF_{grid\ BM,y}$)

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

Where,
$EF_{grid\ CM,y}$ = Combined Margin CO2emission factor in year y (tCO2/MWh)
$EF_{grid\ OM,y}$ = Operating Margin CO2emission factor in year y (tCO2/MWh)
$EF_{grid\ BM,y}$ = Build Margin CO2emission factor in year y (tCO2/MWh)

W OM = Weighting of operating margin emissions factor (%)
W BM = Weighting of build margin emissions factor (%)

For wind and solar projects, the default weights are as follows: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature).

$EF_{CO2} = EF_{grid\ OM,\ y} * 0.75 + EF_{grid\ BM,\ y} * 0.25$

.

Where,

$EF_{grid\ OM,\ y}$ = Operating Margin CO2emission factor in year y (tCO2/MWh)
$EF_{grid\ BM,\ y}$ = Build Margin CO2emission factor in year y (tCO2/MWh)
W OM = Weighting of operating margin emissions factor (%)
W BM = Weighting of build margin emissions factor (%)

Calculation of combined margin emission factor of the grid

Step 1: Calculation of Operating Margin Emission Factor

For calculation of operating margin four options are available:

a) Simple operating margin
b) Simple adjusted operating margin
c) Dispatch data analysis operating margin
d) Average operating margin

The operating margin emission factor has been calculated using simple operating margin option by using the 3 year data vintage[7]:

The $EF_{OM,Y}$ is estimated to be:

Grid	Year	$EF_{OM,Y}$ (tCO_2/MWh)
Southern	2006-2007	1.00
	2007-2008	0.99
	2008-2009	0.97

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be 0.99 tCO_2/MWh for Southern.

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,Y}$
The $EF_{BM,y}$ is estimated as 0.82 tCO_2/MWh (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation) for Southern.

Step 3: Calculation of Baseline Emission Factor EFy
The baseline emission factor EFy is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

[7] Refer Annex 3 for the detailed calculation of emission factor.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$$

Where the weights *wOM* and *wBM*, are 75% and 25% respectively, and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

Baseline Emission factor: **0.94 tCO_2/MWh** for Southern grid.

Weighted Average Emission Co-efficient:

The weighted emission rate for the current generation mix as per the CEA CO_2 Baseline database is **0.83 tCO_2/MWh** for **Southern grid**.

The project proponent has opted for approach 'a' i.e. combined margin emission factor with ex-ante approach where emission factor is fixed for the whole crediting period. The ex ante approach is considered conservative since the grid system in future is expected to become more carbon intensive as the projects planned to establish in the region is mostly thermal energy based.

$PE_y = 0$ ----------**(G)**

$L_y = 0$ ----------**(H)**

(Leakage is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, as per the simplified procedures for SSC project activities, no leakage calculation is required.)

From Equation (A), (B), (G) and (H),

$ER_y = BE_y$ ----------**(I)**

Actual emission reductions will be calculated *ex-post* based on the actual monitored data on energy supplied to respective regional grids during each year of the crediting period and fixed CEA baseline grid emission factor 0.94 tCO_2/MWh for Southern Grid.

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

.

Data / Parameter:	EF_{OM}
Data unit:	t CO_2e/MWh
Description:	Operating margin emission factor
Source of data used:	"CO_2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in version -05 November-2009
Value applied:	0.99
Justification of the choice of data or description of	The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	t CO_2e/MWh
Description:	Build margin grid emission factor for Southern Regional Grid
Source of data used:	"CO_2 Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India. The "CO_2 Baseline Database for Indian Power Sector" is available at www.cea.nic.in version -05 November-2009
Value applied:	0.82
Justification of the choice of data or description of measurement methods and procedures actually applied :	The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.
Any comment:	

.

Data / Parameter:	**$EF_{grid\ CM,\ y}$, Southern Regional Grid**
Data unit:	tCO_2/MWh
Description:	Combined Margin CO_2 emission factor for southern regional grid
Source of data used:	"**CO_2 Baseline Database for the Indian Power Sector**", Version 05 published by Central Electricity Authority, Ministry of Power, Government of India in November 2009
Value applied:	0.94
Justification of the choice of data or description of measurement methods and procedures actually applied :	To obtain homogeneity in the approach in the country to establish authentic and consistent quantification of the CO_2 emission baseline in the Indian power sector, CEA values have been used. This database by CEA is an official publication of GOI for purpose of CDM Baselines and is based on most recent data available.
Any comment:	• Calculated as per combined margin approach (detailed in B.4) based on 75% of OM and 25% of BM values. • Value is calculated based on ex-ante approach and the same will be used for the crediting period

B.6.3 Ex-ante calculation of emission reductions:

>>

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

$$= 0.75 * EF_{OM,y} + 0.25 * EF_{BM,y}$$

$$= 0.75 * 0.98 + 0.25 * 0.82$$

$$= 0.94$$

$EF_y = EF_{CM, grid, y}$
$EF_y = 0.94$

Electricity generation from the project activity is
= 5.25 *24 *365* 27.46% = 12,628.9 MWh

The total net electricity generation estimated is 12,628.9 MWh.

EG_y = 12,628.9 MWh

Thus,

BE_y= 12,628.9 x 0.94

= 11,933 tCO_2e

Emissions Reductions = Baseline Emissions (BE) – Project Emissions (PE) – Leakage (LE)

Project Emissions $PE_y = 0$

$LE_y = 0$

ER_y = 11,933 – 0 -0
= 11,933 tCO_2e

Hence,

$ER_y = BE_y$

Thus,

ER_y = 11,933 **tCO_2e**

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

>>

Year	Estimation of project activity emissions (t CO_2e)	Estimation of baseline emissions (t CO_2e)	Estimation of leakage emissions (t CO_2e)	Estimation of overall emissions reductions (t CO_2e)
2011	0	11,933	0	11,933
2012	0	11,933	0	11,933
2013	0	11,933	0	11,933
2014	0	11,933	0	11,933
2015	0	11,933	0	11,933
2016	0	11,933	0	11,933
2017	0	11,933	0	11,933
2018	0	11,933	0	11,933
2019	0	11,933	0	11,933

2020	0	11,933	0	11,933
Total (tonnes CO_2e)	**0**	119,330	**0**	119,330

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity supplied to the grid by the WTGs in project activity
Source of data to be used:	Electricity supplied to the grid as per the joint meter readings
Value of data	12628.9
Description of measurement methods and procedures to be applied:	Net electricity supplied to the grid is will be measure through the meter readings of the energy meters installed by electricity board, which have facility to record export and import of energy. The monitoring of 'net electricity supplied to the grid' would be as per the details provided in Power Purchase Agreement signed between the TNEB and PP.
QA/QC procedures to be applied:	Every month these meter readings will be jointly recorded by electricity board representative and plant personnel. The quantity of net electricity supplied will be cross-verified from the invoice raised on respective EBs by the project proponent. Meters will be calibrated as per PPA schedule
Any comment:	The data will be archived for crediting period + 2 years

B.7.2 Description of the monitoring plan:

>>

The Project has a two metering system, first is LCS (Local Control System) meter installed by the WTG supplier which is pre-calibrated and sealed by the supplier that meets the Indian and regional electricity authority's standards. Another meter is installed and owned by the Power Purchaser i.e. Tamilnadu Electricity Board (TNEB).

The electricity generated is monitored at each wind mill using LCS on daily basis by the site operator or supervisor. The daily meter reading will be taken and maintained at the wind farms in respective wind farm's electricity meter log books. There is also a joint electricity meter installed by the state electricity board for the windmills. The reading of the joint meter reading is recorded on monthly basis by the official from state electricity board in presence of site operator/ supervisor.

The receipt of the sales to grid is then cross-checked with the data recorded by each individual meter to avoid any differences. The individual meter is calibrated and sealed by the supplying company and is not interfered by project proponent with out the presence of manufacturing company or its accredited representatives. Whereas, the other meter is owned by the state electricity board and will be calibrated as per their schedule. The invoices are raised based on the TNEB meter readings, so this can also be considered as the third party certified electricity generation. In any case, the meter form the power purchaser is the main/ primary meter and the one on LCS is the secondary or check meter.

Secondary Monitoring and Contingency Plan:

The secondary monitoring, which will provide a backup (fail-safe measure), in case of failure of the primary monitoring due to unforeseen reasons, data recording would be done at the individual WTGs with the help of the Local Control System (LCS) meter attached with each WTGs. The total electricity generation will also be cross checked with the invoices raised for the particular month.

In case of any error observed in the meter readings of the individual WTGs and TNSEB meter, site engineers will set correct value in presence of the supervisor and a written report will be sent to the project proponent. In cases, where the joint meter reading is taken on monthly basis and the data of the few days within a particular month is required, the individual meter readings of the WTG will be used. Also, when there is difference of values for the same reading in two meters, the lower meter reading will be used as a conservative approach.

Designation	Responsibilities
Project Head (Incharge person from Project proponent)	Registration Data storage and electronic archiving
Project Executor and Controller (WTG owner or appointed person on behalf)	• Recording • Verification • Storage of Data
Site main Controller	• Operation, Monitoring and Verification of Data • Data Recording • Storage of data
Operation and Maintenance Contractor	• Operation and Maintenance • Storage of data • Data Recording

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

>>

Date of completion of the application of the baseline and monitoring methodology is: 10/05/2010

Name of responsible person(s)/entity (ies) for application of the above:

Organization:	Kanaka Management Services Pvt. Ltd
Street/P.O.Box:	4th Phase, Yelahanka New Town
Building:	No.271, SFS 407
City:	Bangalore
State/Region:	Karnataka
Postfix/ZIP:	560 064
Country:	INDIA
Telephone:	91-80-65464140
FAX:	
E-Mail:	info@kms-group.com
URL:	www.kms-group.com
Represented by:	-
Title:	Consultant
Salutation:	

Last Name:	P
Middle Name:	-
First Name:	-Nandagopal
Department:	-
Mobile:	-
Direct FAX:	-
Direct tel:	-91-9008167850
Personal E-Mail:	-nandagopal@kms-group.com, nandagopal.kmspl@gmail.com

Kanaka Management Services is not a project participant.

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:

>>
21/12/2005
This is the date of purchase order of first WTG in this project activity.

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

>>
20 years 0 months

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

Fixed crediting period (10 years 0 months) is chosen

C.2.1. Renewable crediting period

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

>>
NA

C.2.1.2. Length of the first crediting period:

>>
NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/01/2011 or the date of registration of the project activity which ever is later.

C.2.2.2. Length:

>>
10 years 0 months

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

As per the Ministry of Environment and Forests (Government of India) notification the project activity does not fall under the purview of the Environmental impact Assessment thus the project activity is exempted from the environmental clearances[8].

It should be noted here that EIA is not a regulatory requirement in India for wind energy projects. The project proponent has discussed impacts on the environment resulted and that could result from the project activity. Although an EIA is not required, the project proponent has foreseen certain impacts due to the project activity.

Environmental impacts:

- Renewable energy generation and GHGs emission reduction.
- *Impact due to noise*: Acceptable noise levels for nearby living inhabitants, vulnerable nature areas, etc., by means of a global sound profile.
- *Impact on air and water*: wind energy plant are known to contribute zero atmospheric pollution as no fuel combustion is involved during any stage of operation and there is no effluent discharge during operation of wind turbine generator.
- *Socio economic impacts*: The locals have been benefited economically through land sales. The project activity helps the upliftment of skilled and unskilled manpower in the region. The project will be providing employment opportunity to not only during the construction phase, but also during its operational life time. The project activity improves employment rate and livelihood of local populace in the vicinity of the project. Moreover, the project generates eco-friendly, GHG free power, which contributes to sustainable development of the region.

Conclusion: The net impact on the environment pollution category would be positive as all necessary abatement measures would be adopted. The project activity does not have any major adverse impacts on environment during its construction or operational phase. The human interest parameter would show positive impacts due to increased job opportunities at the facility as well as other ancillary unit coming up in the same region.

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:

>>

The Environmental impact assessment discussion concludes that the project will not present any significant impact on the natural environment and will contribute to the socioeconomic development of the region and the reductions of the GHG emissions.

SECTION E. Stakeholders' comments

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[8] http://enfor.nic.in/divisions/iass/notif/eia.htm

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

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The WEG installation and development of wind farm does not require any EIA (Environmental Impact Assessment). Additionally the installations carried out under the proposed project activity are away from human habitation, and the land used for installations of WEG is of no use (barren land).

The villages in the near vicinity were contacted before the implementation of the proposed project activity, and were appraised about the execution of wind farm project. The local stakeholders raised no issues, thus no action was required.

The land used for installations has been kept without any fencing and thus no right-of- way/ current usage (what so ever) has been disturbed. The villagers are free to move around and make use of the land (if it can come to any use).

As per the CDM requirement the stake holders meeting was conducted on 12/10/2009 by Shanthi Gears Ltd. Public notice was given in local newspaper.

E.2. Summary of the comments received:

>>

A survey was conducted in the area of the Sankaneri and Devarkulam of Tirunelveli District of Tamilnadu.

Primary data was collected through questionnaires and focus group discussions. Responses were tabulated on a Likert scale and then coded and classified to arrive at the final analysis. The stakeholders were predominantly male and adult. It was observed that almost 95% were strongly in favour of the Project. The rest 5% were concerned about certain rumors they had heard about wind mills which is addressed below. Questions were made simple and easy to understand. A number of pictures and graphics were also taken as part of the interview to make the respondents understand better. The orientation and questionnaire addressed the following:

Name: Location:
Occupation: Education:

Sr.No.	Question	Response
1	Is your environment affected by wind mill/s?	
2	Has the employment increased due to wind mills?	
3	Has your livelihood affected by the wind mills?	
4	Is there any noise pollution at the residential places due to the wind mills?	
5	Is there any vibration problem due to the wind mills?	
6	Is there any water problem due to the wind mills?	
7	Does the wind mill affect migration of birds?	

8	Does the wind mill affect grazing of cattle?	
9	Is your TV reception affected by wind mills?	
10	What are the benefits from the mind mills?	
11	Any other comments and suggestions?	

Signature: Date:

The survey had a 90% response rate. The reason for this high response rate was the fact that the local Panchayat was involved in mobilizing people for this survey. The respondents felt confident that the local municipal body was involved.

1. Most respondents were farmers with no education at all.
2. 95% of the respondents felt that the Project did not have any negative impacts on their livelihood.
3. Almost 88% felt that the Project actually benefited them through employment
4. 100% of respondents agreed with the development of the Project
5. The main issue that concerned them was a perception that wind mills moved away rain clouds (almost 82.7%) and women in the group were concerned that the windmills were creating a lot of heat which depleted the groundwater sources. This concern was understandable since it is invariably women who travel long distances to fetch water. Further around 10% of the respondent group were concerned about blades falling.
6. No additional comments were received.

Conclusion

It can be concluded that there was no opposition to the setting up of the Project. In summary:

1. The issues discussed were well understood and the local stakeholders did not have any issues with the Project being in the area. They well understood the fact that it would not interfere with their village and community.

2. However some perceptions were interesting to note. The villagers felt that the presence of the wind turbines moved away rain clouds and that was the reason the monsoons were not bringing in any rain to the area and causing crop failure. Further, they had heard that wind mills increased the heat in the neighboring areas. Both these false perceptions were explained in detail by us, especially the fact the clouds are much higher than the height of the wind mill and it is highly unlikely that it would cause the problem. Further the case was made stronger by cross checking this information with the Indian Institute of Tropical Meteorology and the Center for Wind Energy Technology. The women in the group who traversed long distances to fetch water for daily activities were concerned that the wind mills created a lot of heat and were depleting groundwater sources. All these perceptions were explained and the respondent group was convinced.

3. Falling blades although not witnessed, but heard of was another concern. We explained that this is very unlikely and since the windmills are located far from the community and houses it would not affect them directly. However, their concerns were noted.

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

>>

No negative comment were received, overall finding was that the participants expected the local villagers would benefit from the project activity. The general queries raised during the stakeholder consultation meetings were resolved.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Shanthi Gears Limited
Street/P.O.Box:	Shanthi Gears Road, Singanallur
Building:	304 A
City:	Coimbatore
State/Region:	Tamilnadu
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Country:	India
Telephone:	91-422-2273722
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E-Mail:	info@shanthigears.com
URL:	www.shanthigears.com
Represented by:	
Title:	Manager Finance
Salutation:	Mr.
Last Name:	Srinivas
Middle Name:	
First Name:	S
Department:	Finance
Mobile:	91-9843013313
Direct FAX:	
Direct tel:	
Personal E-Mail:	srinivas@shanthigears.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Public funding to the project activity from Annex-I countries. The entire project cost is met by the project proponent and in part by the debt finance from the banks.

Annex 3

BASELINE INFORMATION

The baseline is explained under section B.6

Annex 4

MONITORING INFORMATION

The monitoring information is explain under section B.7