**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	3 MW Captive Wind Project by Bhagwati Spherocast Pvt. Ltd. in Gujarat
Version number of the PDD	4
Completion date of the PDD	03/02/2014
Project participant(s)	Bhagwati Spherocast Pvt. Ltd.
Host Party(ies)	India
Sectoral scope(s) and selected methodology(ies)	Sectoral Scope 01: Energy industries (renewable / non-renewable sources) Methodology: AMS I.D: Grid connected renewable electricity generation (Version 17)
Estimated amount of annual average GHG emission reductions	5,972 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Project activity involves the implementation of 3 MW captive wind project by Bhagwati Spherocast Pvt. Ltd. in Gujarat. The proposed project activity involves generation of electricity from phase wise installations of two Wind Turbine Generators (WTGs) owned by Bhagwati Spherocast Pvt. Ltd., Gujarat. The WTG S-82 were supplied & installed by Suzlon Energy Limited with rating of 1500 kW each. The WTGs have been installed at Maliya-Miyana, Rajkot and Adodar, Porbandar sites respectively in the state of Gujarat, India. Both the WTGs have been commissioned and commissioning dates are as follows:

	Site	WTG capacity	Commissioning date
Phase – 1	Maliya-Miyana	1.5 MW	01/10/2009
Phase – 2	Adodar	1.5 MW	17/02/2011

Purpose of this green field project activity is to use generated electricity for captive purpose i.e. supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
Prior to the project activity, Project proponent at Ahmedabad unit was using the electricity produced by NEWNE grid (generated by fossil fuels based power plant) which is replaced by renewable energy generated through wind mills in the project case. Thus the implementation of the project activity will reduce the GHG emissions which would have been generated through fossil fuel based electricity from grid. The project will generate 6,268 MWh of electricity per year and thus will bring an emission reduction of 5,972 tCO2e annually and 41,804 over a period of 7 years (first crediting period). The baseline scenario for the project activity is identical to the scenario existing prior to the implementation of the project activity.

Project Participant's background:

Bhagwati Spherocast Pvt Ltd. located 8 kms away from Ahmadabad City, at GIDC Estate, Odhav is a medium scale private limited company, setup in 1977. This unit has an annual capacity of 17,400 tons and is producing high duty grey iron and ductile iron castings as per the International Standards for various OEM industries. The ISO 9001: 2008 company has a R&D laboratory approved by the Dept. of Science & Technology, Govt. of India. The foundry unit is manufacturing high quality castings for a wide spectrum of industries.

Project activity contribution to sustainable developments:

National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) in the Ministry of Environment and Forests (MoEF), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India.

Thus proposed project activity will achieve the following Sustainable Development criteria of the country/ region apart from earning foreign exchange for the country.

Economic well being:
The CDM project activity generates permanent and temporary employment opportunity within the vicinity of the project. The electricity supply in the nearby area improves which directly and indirectly improves the economy and life style of the area.

Social well being:
The project activity provided / provides job opportunity to local people during erection, commissioning and maintenance of the wind machines. Frequency of visiting villages and nearby areas by skilled, technical and industrialist increase due to installation /site visit/operation and maintenance work related to WTGs. This directly and indirectly positively effects the economy of villages and nearby area. Employment generation raises standard of living and social upliftment.

Environmental well being:
The wind power is one of the cleanest renewable energy powers and does not involve any fossil fuel. There is no GHG emission during its operation. Further, the impact on land, water, air and soil is negligible. Thus the project activity contributes to environmental well-being without causing any negative impact on the surrounding environment.

Technological well being:
The project activity is step forward in harnessing the untapped wind potential and further diffusion of the wind technology in the region. The project activity leads to the promotion of WTGs and demonstrates the success of wind turbines in the region which further motivate more investors to invest in wind power projects. Hence, the project activity leads to technological well-being.

A.2. Location of project activity

A.2.1. Host Party(ies)

India

Region/State/Province

State: Gujarat

A.2.2. City/Town/Community etc.

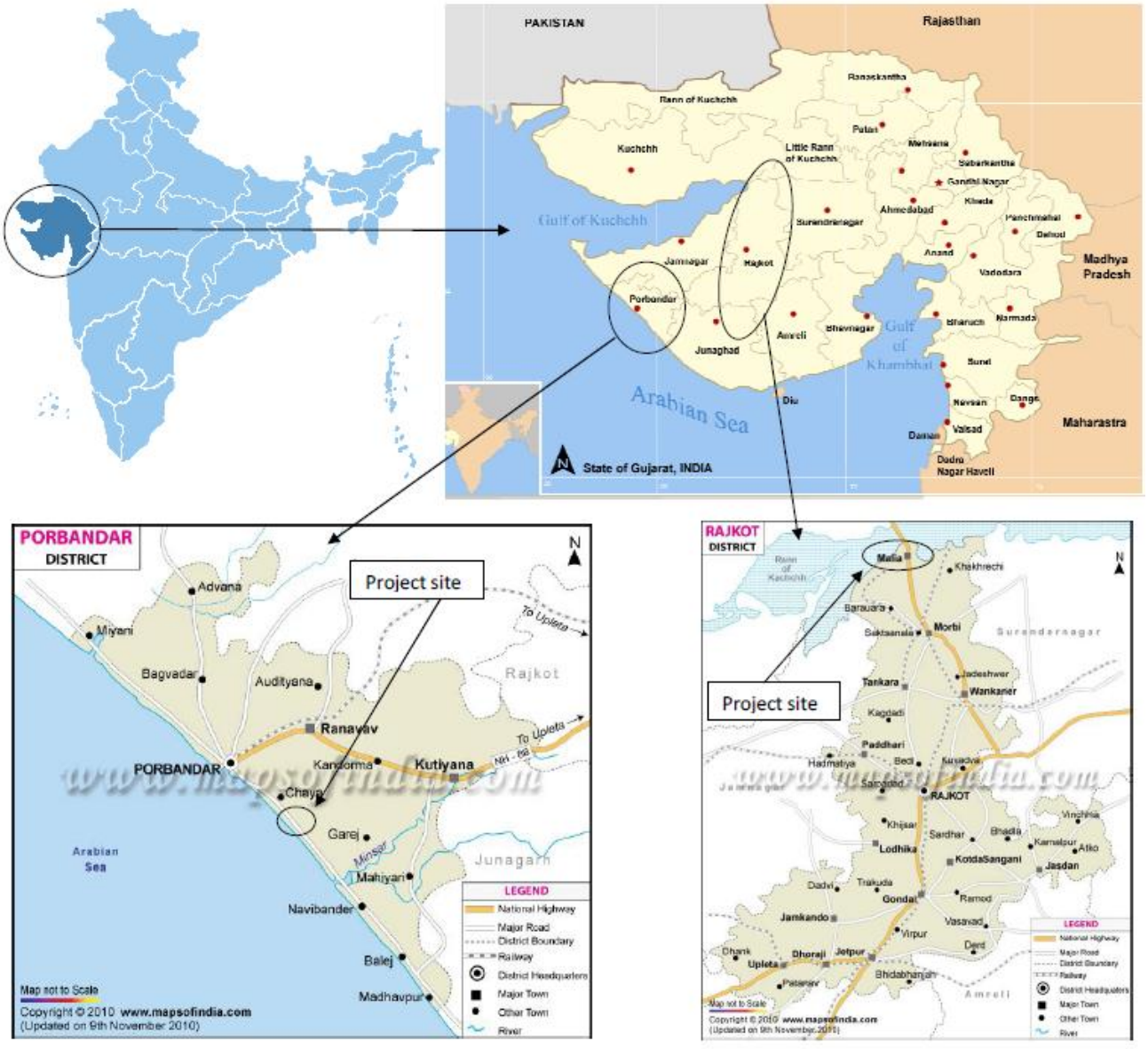
Phase 1: Village: Vershamedi, District: Rajkot

Phase 2: Village: Adodar, District: Porbandar

A.2.3. Physical/ Geographical location

WTG ID No	WTG capacity (Location No.)	Village	District	Latitude	Longitude
SEL/1500/09-10/1566	1.5 MW (VM-02)	Maliya Miyana,	Rajkot	N 22^0 58' 07.8"	E 70^0 34' 06.5"

WTG ID No	WTG capacity (Location No.)	Village	District	Latitude	Longitude
		Vershamedi			
SEL/1500/10-11/1913	1.5 MW (ADO-30)	Adodar	Porbandar	N 21^0 34' 51.6"	E 69° 39' 50.3"



A.3. Technologies and/or measures

Project Type: I – Renewable Energy Project

Project Category: I.D. – Grid Connected Renewable Electricity Generation (Version 17, EB 61)

The Project activity involves installation and operation of two numbers of 1500 kW S-82 wind turbine generators of Suzlon Energy Limited and then wheeling the generated electricity via NEWNE grid to industrial unit at Ahmadabad region. The project is a renewable energy project with maximum output capacity of 3 MW and is well below the specified limits of 15 MW of maximum output capacity as per Appendix B of the simplified modalities and procedures for small-scale project activities & the purpose of the project activity is to use generated electricity for captive purpose i.e. supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. Hence it qualifies for the mentioned type and category.

The technology being employed, converts wind energy to electrical energy. In wind power generation, energy of wind is converted into mechanical energy and subsequently into electrical energy. The technology is an environment friendly technology since there are no GHG emissions associated with the electricity generation. There is no transfer of technology involved in the project activity. The life of the plant is considered as 25 years. The technology is environmentally safe and sound.

Technical Details:

The project activity consists of 2 WTGs of 1500 kW. Technical details of the WTGs have been as listed below which has been sources from "WTG manufacturer specifications document"

The technical Specifications of the WTGs

Operational Data

Rated power	:	1500 kW
Turbine type	:	Horizontal axis wind turbine
Cut in wind speed	:	4 m/s
Cut off wind speed	:	20 m/s
Restart point, after high wind stop	:	17 m/sec
Survival wind speed	:	52.5 m/s
Wind class	:	IIIa
Estimated design life	:	20 years

Rotor

Diameter	:	82 m
No. of rotor blades	:	3 upwind / horizontal axis
Rotor blade type	:	AE 40
Blade length	:	40 m
Rotor cone angle	:	4.3^0
Rotor axis tilt angle	:	5^0 with respect to horizontal
Rational speed	:	15.6 to 18.4 RPM

Rotor speed	:	16.3 m/Sec (at rated power)
Tip speed	:	70 m/Sec (at rated power)
Swept area	:	5281 m^2
Power regulation	:	Independent electromechanical pitch system for each blade & Suzlon-Flexi-Slip System
Rotor air brake	:	Pitch / full blade

Generator

Make	:	Suzlon generator
Type	:	Single speed induction generator with slip rings, variable rotor resistance via Suzlon-Flexi-Slip system
Rated power	:	1500 kW
Rated voltage	:	690 V AC (phase to phase)
Frequency	:	50 Hz
No. of poles	:	4
Synchronous speed	:	1500 RPM
Full load power factor	:	0.92 (uncompensated)

Wind turbine main panel / CPU panel

Capacitor bank voltage	:	3 phase – 690 volts AC
Frequency	:	50 Hz
Cut in system	:	Soft starters using tyristors
Type	:	Switching through multiple capacitor banks

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Bhagwati Spherocast Pvt. Ltd. (Private Entity)	No

A.5. Public funding of project activity

There is no Public Funding involved in this project.

A.6. Debundling for project activity

As per the provisions prescribed in "Clean development mechanism project standard" and further referring to "Guidelines on assessment of debundling for SSC project activities" according to which EB 54, Annex 13, Para 2, "*A small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:*

- *With the same project participants;*
- *In the same project category and technology/measure; and*
- *Registered within the previous 2 years; and*
- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point*"

The project participant hereby confirms that they have not registered any small scale CDM activity or applied to register another small scale CDM project activity within 1 km of the project boundary, in the same project category and technology/measure in previous 2 years. Thus, the proposed project activity is not a de-bundled component of a large project activity.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

As listed in Appendix "B" of the Simplified Modalities and Procedures for Small-Scale CDM project activities, the following type and category is applicable to the proposed CDM project activity.

Type I	:	Renewable Energy Projects
Category I.D	:	Grid connected renewable electricity generation
Sectoral Scope 01	:	Energy industries (renewable / non-renewable sources)
Reference	:	Version 17 (EB 61) (in effect from 17/06/2011)
Tool referred	:	Tool to calculate the emission factor for an electricity system
Reference	:	Version 04.0

B.2. Project activity eligibility

The project activity involves generation of grid connected electricity from renewable wind energy. Since the project activity capacity is 3 MW which is less than the maximum qualifying capacity of 15 MW for a small scale CDM project activity under Type-I of the small scale methodology AMS-I.D "Grid Connected Renewable Electricity Generation" (Version 17, EB 61). The installed capacity will not increase throughout the crediting period of 7 years and the project activity will remain within the limit of small scale in each year of the crediting period. Therefore, small scale methodology AMS I-D is applied.

The Specific features of the project and applicability of the said methodology are discussed below:

Applicability of AMS I.D
Para – 1:   *This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:*[1]   *a) Supplying electricity to a national or a regional grid; or*   *b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.*
Project Status: The project activity comprises of installation of two WTGs for power generation. The power generated will be wheeled to the manufacturing facility of the project proponent at Ahmadabad through the NEWNE grid. Hence this project is satisfying option (b).
Para – 2:   *Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A*[2]*) applies is included in below table i.e.*

Table 2 Applicability of AMS-I.D, AMS-I.F and AMS-I.A based on project types

S. No	Project type	AMS I.A	AMS I.D	AMS I.F
1	Project supplies electricity to a national/regional grid	-	√	-
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)	-	-	√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)	-	√	-
4	Project supplies electricity to a mini grid17 system where in the baseline all generators use exclusively fuel oil and/or diesel fuel	-	-	√
5	Project supplies electricity to household users (included in the project boundary)	√	-	-

[1] Refer to EB 23; annex 18 or the definition of renewable biomass.

[2] AMS-I.D "Grid connected renewable electricity generation", AMS-I.F "Renewable electricity generation for captive use and mini-grid" and AMS-I.A "Electricity generation by the user"

Applicability of AMS I.D				
	located in off grid areas			

Project Status:

The project activity comprises of installation of two WTGs for power generation. The power generated will be wheeled to the manufacturing facility of the project proponent at Ahmadabad through the regional grid. The source of electricity at Ahmadabad unit was NEWNE grid and wheeled electricity displaces grid electricity. The 3rd option of Table 2 of AMS-I.D Version 17, EB 61 is applicable (please refer footnote). Hence the project activity satisfies this applicability criterion.

Para – 3:

This methodology is applicable to 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;[3]

(c) Involve a retrofit[4] *of (an) existing plant(s); or*

(d) Involve a replacement[5] *of (an) existing plant(s).*

Project Status:

The project activity comprises of installation of 2 (two) WTGs at sites where Project Proponent does not own any other renewable energy plant prior to the implementation of the project activity. Hence, the project activity qualifies as a Greenfield project activity. Hence the project activity satisfies option (a) of applicability criterion.

Para – 4:

Hydro power plants with reservoirs that satisfy certain 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;*

[3] *A capacity addition is an increase in the installed power generation capacity of an existing power plant through: (i) The installation of a new power plant besides the existing power plant/units; or (ii) The installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.*

[4] *Retrofit (or rehabilitation or refurbishment). It involves an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.*

[5] *Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced.*

Applicability of AMS I.D
• *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.*
Project Status: As the given project activity is a Wind Power project and is not a Hydro Power Project therefore this eligibility criterion is not applicable to the Project activity.
Para – 5: *If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel,[6] the capacity of the entire unit shall not exceed the limit of 15 MW.*
Project Status: The total power generation capacity of the two WTGs is 3.0 MW. There is no involvement of a non-renewable power generation unit. Hence this criterion is also satisfied. As the project activity is a Greenfield small scale Wind Power Project with installed capacity of 3 MW and doesn't involve the installation of any non-renewable component. Therefore this criteria is not applicable to this project activity.
Para – 6: *Combined heat and power (co-generation) systems are not eligible under this category.*
Project Status: The project activity does not involve installation of combined heat and power (co-generation) systems. Therefore the given criterion is not applicable to the project activity.
Para – 7: *In the case of project activities that involve the 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[7] from the existing units.*
Project Status: The Given project activity involve the installation of small scale wind power project at a place where there was no power generation facility existing before the installation of given project activity by the project proponent. Hence it doesn't involve the addition of new unit to any of existing renewable power generation facility. Therefore the given criteria is not applicable to the project activity.
Para – 8: *In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the*

[6] *A co-fired system uses both fossil and renewable fuels, for example the simultaneous combustion of both biomass residues and fossil fuels in a single boiler. Fossil fuel may be used during a period of time when the biomass is not available and due justifications are provided.*

[7] *Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".*

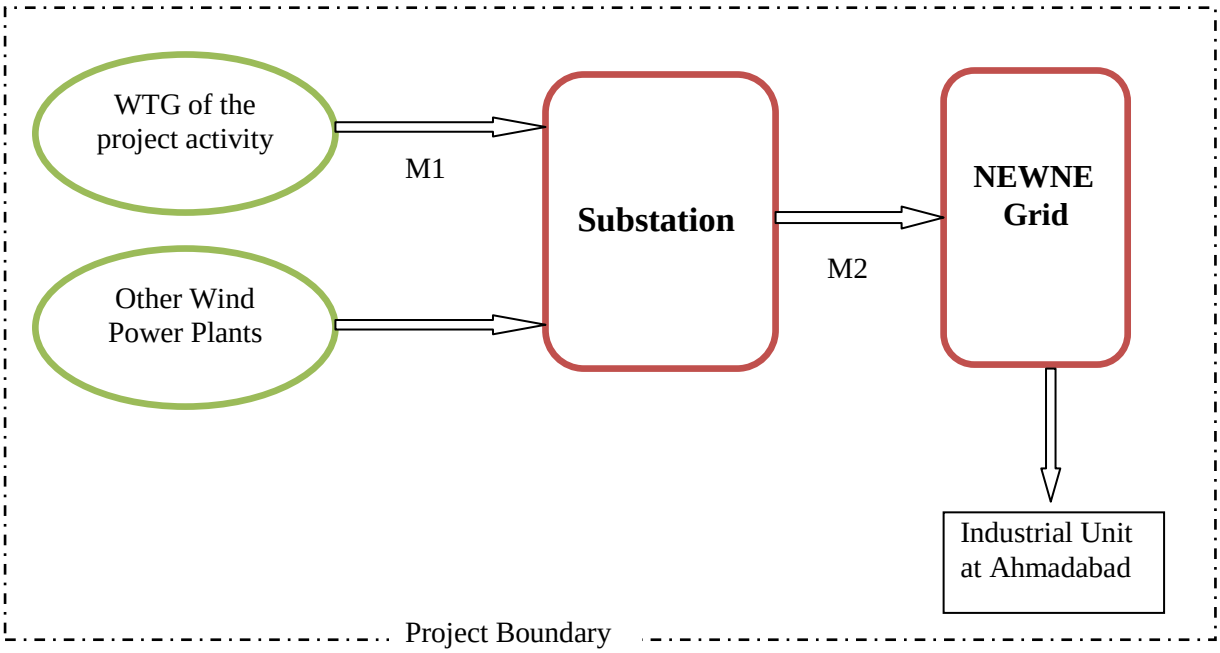
Applicability of AMS I.D
retrofitted or replacement unit shall not exceed the limit of 15 MW.
Project Status: The Given project activity is the installation of Greenfield wind power project and doesn't involves any retrofit/replacement work and the output capacity will always be within the threshold limit of small scale project as the total installed capacity of project activity is 3 MW. Therefore the given criteria is not applicable to the project activity.

B.3. Project boundary

In accordance with the above mentioned methodology (AMS I.D, Version 17), *"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."*

The project boundary includes the wind turbine generators, sub-stations, grid, all power plants connected to grid and industrial unit of the PP where electricity is wheeled. The proposed project activity will evacuate power via NEWNE Grid. Therefore the entire NEWNE Grid all connected power plants have been considered in the project boundary for the proposed CDM project activity.

The Project boundary has been shown is as follows:



Project boundary also depicts the metering locations M1 and M2.

Emission Sources and GHG included in the project boundary

Source		GHGs	Included	Justification/Explanation
Baseline project scenario	Fossil Fuel dominated NEWNE Grid	CO_2	Yes	Considered as a Major Source of emission
		CH_4	No	Excluded for the sake of simplicity, this is conservative too.
		N_2O	No	Excluded for the sake of simplicity, this is conservative too.
Project scenario	Wind energy power plant	CO_2	No	As project is Renewable power plant, it Is not applicable
		CH_4	No	As project is Renewable power plant
		N_2O	No	As project is Renewable power plant

B.4. Establishment and description of baseline scenario

The proposed project activity will evacuate power to the NEWNE & completely comply with the para 10 of AMS-I.D Ver17. The Power generated by wind will be wheeled to the manufacturing facility of project proponent at Ahmadabad. The source of electricity of the Ahmadabad unit was NEWNE grid thus wheeled electricity displaces grid electricity. Thus as per As per para 10 of the methodology AMS-I.D Version 17, the baseline is as follows

"The baseline scenario is that the 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 into the grid."

As per para 23 of AMS-I.D Version 17 equation no. 10

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (1)$$

Where:

ER_y : Emission reductions in year y (t CO2/y)
BE_y : Baseline Emissions in year y (t CO2/y)
PE_y : Project emissions in year y (t CO2/y)
LE_y : Leakage emissions in year y (t CO2/y)

As per para 20 & 21 of AMS-I.D Version 17

For most renewable energy project activities, $PE_y = 0$

As per para 22 of AMS-I.D Version 17

If the energy generating equipment is transferred from another activity, leakage is to be considered. Now as no energy generating equipment has been transferred from any other activity therefore leakage is not applicable for the project activity, thus leakage emissions are considered to be zero.

$LE_y = 0$

Thus, $ER_y = BE_y$

Thus, Emission reductions in year *y* (t CO_2/y) = Baseline Emissions in year *y* (t CO_2/y)
As per para 11 of the methodology AMS-I.D Version 17 equation no. 1

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y} \quad \textbf{(2)}$$

Where:

BE_y	Baseline Emissions in year *y* (t CO_2)
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year y (t CO_2/MWh)

As per para 12 of the methodology AMS-I.D Version 17,

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

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 (Version 04.0).'.

OR

The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Where:

EF_{BM} : Build margin CO_2 emission factor in year y (tCO_2/MWh)
EF_{OM} : Operating margin CO_2 emission factor in year y (tCO_2/MWh)
W_{OM} : Weighting of operating margin emissions factor (%)
W_{BM} : Weighting of build margin emissions factor (%)

In case of wind power generation project W_{OM} = 0.75 and W_{BM} = 0.25

Simple Operating Margin for NEWNE Grid (including imports)

	2008-09	2009-10	2010-11	Weighted Average
NEWNE (tCO_2/MWh)	1.0066	0.9777	0.9707	0.9842

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 7.0

Build Margin for NEWNE Grid (not adjusted for imports)

	2010-11
NEWNE (tCO_2/MWh)	0.8588

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 7.0

Emission Factor NEWNE Grid (Combined Margin)

The combined margin emissions factor is calculated for NEWNE Grid as follows:

$EF_{CO_2,grid,y} = EF_{OM} * W_{OM} + EF_{BM} * W_{BM}$

$= 0.9842 * 0.75 + 0.8588 * 0.25\ tCO_2/MWh$

$= \mathbf{0.9528\ tCO_2/MWh}$

Particulars	Details	Source
Operating Margin (tCO_2/MWh)	0.9842	CEA Database ver 7
Built Margin (tCO_2/MWh)	0.8588	CEA Database ver 7
Combined Margin (tCO_2/MWh)	0.9528	

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 7.0

B.5. Demonstration of additionality

As per Clean development mechanism Project Standard para 44, baseline scenario should be established taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector.

Para 7(a) of same states that, only those national and/or sectoral policies or regulations under paragraph 6(a) i.e. type E+ policy that increase GHG emissions, that have been implemented before adoption of the Kyoto Protocol by the COP (decision 1/CP.3, 11 December 1997), shall be taken into account when developing a baseline scenario. For more emitting power sector, there was no policy with comparative advantage existed before 11 December 1997. Hence it is not applicable for baseline determination.

Para 7(b) of the same state that those National and/or sectoral policies or regulations under paragraph 6 (b), i.e. type E- policy that decrease GHG emissions, that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) need not be taken into account in developing a baseline scenario. As per Electricity Act 2003, Section 86(1), SERC shall "Promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person". The Ministry of Power has published the implementation plan[8] of various sections (of Electricity Act 2003) including the provision of incentivising renewable energy projects through State Electricity Regulatory Commissions. Hence, it

[8] http://www.powermin.nic.in/acts_notification/electricity_act2003/status.htm

can be concluded that the provincial and sectoral policies are E-, policies that decrease GHG emissions. Also, these policies have been implemented since the adoption by the COP of the CDM M & P (decision 17/CP.7, 11 November 2001).

Therefore, the baseline scenario is the electricity generation by grid connected fossil fuel dominated power plants confirming to para 44 of the CDM Project Standard. Additionally, the project proponent is under no compulsion to opt for any particular technology or even a renewable mode of power generation. There is no governmental body or state electricity board policy which requires a particular kind of fuel to be chosen. Hence the selection of baseline scenario confirms to Annex 3 of EB 22. Moreover the project under consideration is a wind power project and the methodology itself specifies the baseline of the project activity which has been elaborated in section B.4 of the PDD.

Demonstration of additionality for the CDM project activity:

As per the Guidelines on the demonstration of additionality of small-scale project activities (ver. 09 EB 68 Annex 27)[9] of the simplified modalities and procedures for small scale CDM project activities, to establish the project additionality, it has to be shown that the project activity would not have occurred anyway due to at least one of the following barriers:

- **Investment barrier**: a financially more viable alternative to the project activity would have led to higher emissions;
- **Technological barrier**: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
- **Barrier due to prevailing practice**: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- **Other barriers**: Without the project activity, for another specific reason identified by the project proponents, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The PP has selected Investment barrier to demonstrate in a conservative and transparent manner that the proposed CDM project activity is financially unattractive. In line with the guidelines stipulated under Annex 34 of EB 35 ("Non-binding best practice examples to demonstrate additionality for SSC project activities"), a benchmark analysis is used in the project case under investment barrier.

Appropriateness of using benchmark analysis for additionality demonstration and its conformity to guidance 19 of Annex 5, EB 62[10] -

Considering the fact that the alternative to the project is the supply of electricity from the grid (mentioned in para 11 of methodology) & the choice of the developer is to invest or not to invest , benchmark analysis has been considered appropriate for demonstration of additionality, which is in conformity with guidance 19 Annex 5 EB 62.

[9] http://cdm.unfccc.int/Reference/Guidclarif/meth/methSSC_guid05.pdf
[10] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

Selection of Benchmark & Financial Indicator:

The post tax Equity IRR was found to be the most appropriate financial indicator for feasibility analysis of these project activities. The project proponents had carried out an estimation of the costs involved in the project activity and the revenues that it would be expected to generate over its operational lifetime. Based on this, the equity IRR for the project activities were found to be lesser than benchmark. However, the project proponents took the decision to implement the project after taking CDM revenue into consideration which improved the equity IRR.

As per para 12 of EB 62 Annex 05, "In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Required/expected returns on equity are appropriate benchmarks for Equity IRR."

In accordance with above Guideline, "Return on Equity" has been considered as an appropriate benchmark for the type of IRR i.e. Equity IRR.

Input values to calculate the benchmark are based on publicly available data sources which can be clearly validated by the DOE, thus it complies with guidance 13 of EB 62, Annex 5.

Default Value Benchmark:

As suggested in Appendix A in EB62 Annex 5 and latest Clarification from UNFCCC in EB 73 (Applicability of the "Guidelines on the assessment of investment analysis" version 01.0), default value benchmark is presented below:

Appendix A in EB62 Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.75%**

The Required return on equity (benchmark) was computed in the following manner:

Nominal Benchmark = {(1+Real Benchmark)*(1+Inflation rate)}-1
Where:

- Default value for Real Benchmark = 11.75% (as per Appendix of Annex 5, EB 62)
- Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India) for India. Further, in case where RBI Inflation forecast was not available Average Inflation rate forecast has been sourced from IMF web site.

Inflation forecast are provided by RBI for 5 years and 10 years. Inflation forecast for WTG 1 and WTG 2 have been considered for 10 years as it is conservative as compared to inflation forecast for 5 years.

Benchmark estimation for WTG installed in phase-1 :

Appendix A in EB62 Annex5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.75%**

Inflation Rate Forecast sourced from RBI website:

Inflation Rate Forecast for 10 Years = 4.50%[11]

Thus, Benchmark = {(1+11.75%)*(1+4.50%)}-1
= 16.78%

Benchmark estimation for WTG installed in phase-2 :
Appendix A in EB62 Annex5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.75%**

Inflation Rate Forecast sourced from RBI website:
Inflation Rate Forecast for 10 Years = 5.00%[12]

Thus, Benchmark = {(1+11.75%)*(1+5.00%)}-1
= 17.34%

Input parameters used for this project activity:

WTG installed in Phase-1:

Details of the project			Source	Weblink
Capacity of Machines	MW	1.50	Offer from Suzlon dated 15 April 2009	
Number of Machines	Nos	1	Offer from Suzlon dated 15 April 2009	
Total Capacity	MW	1.50	Calculated	
Capacity Utilization Factor (CUF/PLF)	%	23.85	Letter from Loan issuing bank as per EB 48 Annex 11	
Wheeling Charge	%	10	Wind Power policy 2009 (For more than 1 WTG installed by same PP)	http://geda.gujarat.gov.in/policy_files/Windpower%20Policy%202009_GEDA.pdf
Saving in Electricity per unit	INR/kWh	4.07	Electricity unit rate of the Ahmadabad unit where power is wheeled (at the time of decision making) from March 2009 bill	
Escalation in Tariff	%	0.60%	CAGR calculated on the basis of electricity bill of last 5 years i.e. (April 2004 to March 2009)	
Means of Finance				
Total Project Cost	INR Mn	99.18	Offer from Suzlon dated 15 April 2009	
Debt equity ratio	%	70:30	GERC order No.2 of 2006 Dt. 11-8-2006	http://www.gercin.org/renewablepdf/en_1303213122.pdf
Terms of Loan				
Interest Rate	%	11.50	Most conservative value (minimum value) selected between BPLRs of 5 nationalised banks	

[11] http://www.rbi.org.in/scripts/PublicationsView.aspx?id=11306
[12] http://www.rbi.org.in/scripts/PublicationsView.aspx?id=12291

Details of the project			Source	Weblink
Loan Tenure	Quarter	40	GERC order No.2 of 2006 Dt. 11-8-2006	http://www.gercin.org/renewablepdf/en_1303213122.pdf
Moratorium Period	Quarter	0	GERC order No.2 of 2006 Dt. 11-8-2006	http://www.gercin.org/renewablepdf/en_1303213122.pdf
Repayment Period	Quarter	40	GERC order No.2 of 2006 Dt. 11-8-2006	http://www.gercin.org/renewablepdf/en_1303213122.pdf
Depreciation				
Rate of Income Tax Depreciation (Written Down Value basis)				
On Wind Energy Generators	%	80.00	As per IT Act	http://law.incometaxindia.gov.in/DIT/File_opener.aspx?page=ITRU&schT=rul&csId=4a23cee1-1818-45d6-ab19-f155e08ed789&rNo=&sch=depreciation&title=Taxmann%20-%20Direct%20Tax%20Laws
Rate of Book Depreciation (Straight Line Method Basis)				
On all assets	%	4.75	The Companies Act,1956 Schedule XIV	http://asa-india.com/Depreciation%20Rates%20Companies%20Act.pdf
Book Depreciation up to (% of asset value)	%	90	GERC order No.2 of 2006 Dt. 11-8-2006	http://www.gercin.org/renewablepdf/en_1303213122.pdf
Salvage Value @ % of project cost	%	10	GERC order No.2 of 2006 Dt. 11-8-2006	http://www.gercin.org/renewablepdf/en_1303213122.pdf
Taxation for the Financial Year 2009-10				
Income tax rate	%	33.99	As per Income Tax Rule	http://law.incometaxindia.gov.in/Directtaxlaws/act2005/gr.htm
MAT	%	17.00	As per Income Tax Rule	http://indiabudget.nic.in/ub2009-10/bs/speecha.htm
Service Tax	%	10.30	Directorate of Service Tax, Department of Revenue, Ministry of Finance	http://www.servicetax.gov.in/st-proc-home.htm
Price of CER (euro/CER)	Euro	12.2	https://www.eex.com/en/market-data/emission-allowances/derivatives-market/certified-emission-reductions-futures#!/2009/04/27	
Exchange price(Rs./Euro)	INR/Euro	65.86	http://www.x-rates.com/historical/?from=EUR&amount=1.00&date=2009-04-27	

WTG installed in Phase-2:

Details of the project			Source	Weblink
Capacity of Machines	MW	1.50	Offer from Suzlon dated 26/07/2010	

Details of the project			Source	Weblink
Number of Machines	Nos	1	Offer from Suzlon dated 26/07/2010	
Total Capacity	MW	1.50	Calculated	
Capacity Utilization Factor (CUF/PLF)	%	23.85	Letter from Loan issuing bank as per EB 48 Annex 11	
Wheeling Charge	%	10	GERC order No.1 of 2010 Dt. 30-01-2010 (For more than 1 WTG installed by same PP)	http://www.gercin.org/renewablepdf/en_1303211765.pdf
Saving in Electricity per unit	INR/kWh	4.23	Electricity unit rate of the Ahmadabad unit where power is wheeled (at the time of decision making)	
Escalation in Tariff	%	0.71%	CAGR calculated on the basis of electricity bill of last 5 years i.e. (2005-2010)	
Means of Finance				
Total Project Cost	INR Mn	98.42	Offer from Suzlon dated 26/07/2010	
Debt equity ratio	%	70:30	GERC order No.1 of 2010 Dt. 30-01-2010	http://www.gercin.org/renewablepdf/en_1303211765.pdf
Terms of Loan				
Interest Rate	%	11.00	Most conservative value selected between BPLRs of 5 nationalised banks	
Loan Tenure	Quarter	40	GERC order No.1 of 2010 Dt. 30-01-2010	http://www.gercin.org/renewablepdf/en_1303211765.pdf
Moratorium Period	Quarter	0	GERC order No.1 of 2010 Dt. 30-01-2010	http://www.gercin.org/renewablepdf/en_1303211765.pdf
Repayment Period	Quarter	40	GERC order No.1 of 2010 Dt. 30-01-2010	http://www.gercin.org/renewablepdf/en_1303211765.pdf
Depreciation				
Rate of Income Tax Depreciation (Written Down Value basis)				
On Wind Energy Generators	%	80.00	As per IT Act	http://law.incometaxindia.gov.in/DIT/File_opener.aspx?page=ITRU&schT=rul&csId=4a23cee1-1818-45d6-ab19-f155e08ed789&rNo=&sch=depreciation&title=Taxmann%20-%20Direct%20Tax%20Laws
Rate of Book Depreciation (Straight Line Method Basis)				
On all assets	%	4.75	The Companies Act,1956 Schedule XIV	http://asa-india.com/Depreciation%20Rates%20Companies%20Act.pdf
Book Depreciation up to (% of asset value)	%	90	CERC order dated 26/04/2010	http://cercind.gov.in/2010/ORDER/February2010/53-2010_Suo-Motu_RE_Tariff_Order_FY2010-11.pdf

Details of the project			Source	Weblink
Salvage Value @ % of project cost	%	10	CERC order dated 26/04/2010	http://cercind.gov.in/2010/ORDER/February2010/53-2010_Suo-Motu_RE_Tariff_Order_FY2010-11.pdf
Taxation for the Financial Year 2009-10				
Income tax rate	%	33.22	As Per Income tax rule	http://www.incometaxindiapr.gov.in/incometaxindiacr/contents/forms2010/pamphets/COMPANIES_2012_13.htm
MAT	%	19.93	As Per Income tax rule	http://www.incometaxindiapr.gov.in/incometaxindiacr/contents/forms2010/pamphets/COMPANIES_2012_13.htm
Service Tax	%	10.30	Directorate of Service Tax, Department of Revenue, Ministry of Finance	http://www.servicetax.gov.in/st-profiles/brand-promtn.htm
Price of CER (euro/CER)	Euro	11.40	https://www.eex.com/en/market-data/emission-allowances/derivatives-market/certified-emission-reductions-futures#!/2010/07/28	
Exchange price(Rs./Euro)	INR/Euro	60.70	http://www.x-rates.com/historical/?from=EUR&amount=1.00&date=2010-07-28	

Considering the above input values, Equity IRRs for both the WTGs are given below:

Phase no	Equity IRR without CDM	Benchmark
Phase -1	7.07%	16.78 %
Phase -2	10.25%	17.34%

This substantiates that the investment is not financially attractive (equity IRR for the project activity is less than the Benchmark) for all WTGs. Thus it can be easily concluded that project activity is additional and is not business as usual scenario.

Sensitivity Analysis

As per Guidance 20 of Annex 5 of EB 62 Annex 5, 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 and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets. Guidance also states, "All parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude". The Annex also states, as a general point of departure, variations in the sensitivity analysis should at least cover a range of +10% and –10%, unless this is not deemed appropriate in the context of the specific project circumstances.

In accordance to above guidelines PP has considered following parameters to check for the robustness through sensitivity analysis.

1. PLF
2. O&M Cost
3. Project Cost
4. Electricity Tariff

The results of sensitivity analysis are as follows:

Equity IRR	**WTG in Phase-1**			
Variation %	**-10%**	**0%**	**10%**	**Variation required to Breach Benchmark**
Project Cost	11.36%	7.07%	4.82 %	-21.19%
Electricity Tariff	3.94%	7.07%	11.36%	22.50%
PLF	3.94%	7.07%	11.67 %	22.28%
O & M Cost	7.79%	7.07%	6.41%	-142.4%

Equity IRR	**WTG in Phase-2**			
Variation %	**-10%**	**Normal**	**10%**	**Variation required to Breach Benchmark**
PLF	5.73%	10.25%	14.42%	16.55%
O&M	10.91%	10.25%	9.58%	-115%
Project Cost	14.12%	10.25%	6.60%	-16.5%
Electricity Tariff	5.73%	10.25%	14.42%	16.55%

a) Project Cost:

The actual project cost for WTG-1 as per the purchase orders is INR 84.21 million. Considering the actual project cost, equity IRR of the project is worked out 13.55% which is less than the benchmark. As the actual project cost has already been incurred, the cost cannot go any further down.

The actual project cost for WTG-2 as per the purchase orders is INR 83.7 million. Considering the actual project cost, equity IRR of the project is worked out 16.59% which is less than the benchmark. As the actual project cost has already been incurred, the cost cannot go any further down.

b) O&M Cost:

The actual O&M cost for WTG 1 as per O&M agreement (O&M agreement (Service only) and maintenance (with parts and/ consumables) agreement) is INR 1.50 Million Considering this value, equity IRR of the project is 8.14% which is less than the benchmark. Equity IRR crosses the benchmark at 142.4% reductions in O&M cost which is not possible.

The actual O&M cost for WTG 2 as per O&M agreement (O&M agreement (Service only) and maintenance (with parts and/ consumables) agreement) is INR 1.50 Million. Considering this value, equity IRR of the project is 11.18% which is less than the benchmark. Equity IRR crosses the benchmark at 115% reduction in O&M cost which is not possible.

c) PLF:

PLF as per GERC tariff order dated 11/08/2006 is 23% which is less than the PLF considered at the time of decision making. Furthermore, the equity IRR will cross the benchmark if the PLF will increase by 22.28% which is not realistic.

PLF as per GERC tariff order dated 30/01/2010 is 23% which is less than the PLF considered at the time of decision making. Furthermore, the equity IRR will cross the benchmark if the PLF will increase by 16.55% which is not realistic

PLF for Gujarat for 2009, 2010 and 2011 is mentioned as 18.02%, 20.78% and 15.63% as per India Wind Energy Outlook, 2012" published by Global Wind Energy Council, World Institute of Sustainable energy and Indian Wind Turbine Manufacturing Association which is lower than PLF considered at the time of decision making for WTG 1 and WTG 2.

d) **Electricity Tariff:**

The tariff for WTG 1 and WTG 2 is taken from electricity bills and escalation is considered using historical 5 years electricity bills for WTG 1 and WTG 2. The same energy charges are mentioned in respective GERC tariff order for HT tariff for Torrent Power Limited. As tariff is considered from actual electricity bills a increase in tariff of 20.50% for WTG 1 is not realistic and increase of tariff of 16.55% for WTG 2 is not realistic.
Actual debt equity ratio for WTG 1 is 59:41 and equity IRR at actual debt equity ratio is 7.49% which is less than the benchmark. Actual debt equity ratio for WTG 2 is 77.7:22.3 and equity IRR at actual debt equity ratio is 9.48% which is less than the benchmark. The actual interest rate for WTG 1 as per loan sanction letter is 10.5% and equity IRR at this interest rate is 7.93% which is less than the benchmark.

As evident from the results given above, the project remains additional even under the most favourable conditions.

As per the Clean Development Mechanism Project Standard Version 05 Para 27, for project activities with start date after 02 August 2008, PP must inform the Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. PP has intimated UNFCCC board and NCDMA of India. Chronology of the events has been tabulated as following:

Chronology of Events	WTG-1	WTG-2
Offer Letter date	15/04/2009	26/07/2010
Board Resolution Date	28/04/2009	29/07/2010
Date of Purchase Order	16/07/2009	12/08/2010
Date of Commissioning	01/10/2009	17/02/2011
1st Consultant appointment	23/10/2009	-

Chronology of Events	WTG-1	WTG-2
Host Country Approval	11/10/2012	11/10/2012
Termination of 1st Consultant	26/12/2011	-
Prior Intimation to UNFCCC & MoEF	29/09/2009	02/11/2010
2nd Consultant appointment	11/02/2012	
Stakeholder consultation	07/10/2010	
Appointment of DOE	17/12/2012	
PDD Webhosted as per the UNFCCC website[13]	03/01/2013 to 01/02/2013	

The project was intimated in 2 phases and start date for phase I (WTG 1) was 16/07/2009 and prior consideration was sent within 180 days on 29/09/2009 and start date for phase 2 (WTG 2) was 12/08/2010 and prior consideration notification was sent within 180 days on 02/11/201 within 180 days. The table above shows that notification to seek CDM status has been sent to UNFCCC and Host Party DNA within the 180 days of start date (i.e. purchase order date). Hence, as per Para 7 of the Clean development mechanism project cycle procedure Version 05, it is confirmed that CDM was seriously considered in the project activity.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

The approved baseline and monitoring methodology, AMS I.D (version 17) provides two options to choose from for calculation of emission factor of the regional grid. The **Emission Factor** of the regional grid shall be calculated as per the procedures provided in paragraph – 12 of the methodology AMS I.D (version 17): *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 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.

The approved baseline methodology suggests that either of the above stated two options can be selected for determination of an emission factor for the Western grid. For the project case, the option (b) is selected.

Please refer to Appendix 4 for detailed calculation of the emission factor.

[13] http://cdm.unfccc.int/Projects/Validation/DB/EA42U2JPXGBJQD7MK98Q6RKNWM6QBZ/view.html

Operating Margin Emission Factor of NEWNE Grid :

	2008-09	2009-10	2010-11	Weighted Average
NEWNE (tCO2/MWh)	1.0066	0.9777	0.9707	0.9842

Build Margin Emission Factor of NEWNE Grid:

	2010-11
NEWNE (tCO2/MWh)	0.8588

Emission Factor NEWNE Grid (Combined Margin):

Particulars	Details	Source
Operating Margin (tCO_2/MWh)	0.9842	CEA
Built Margin (tCO_2/MWh)	0.8588	CEA
Combined Margin (tCO_2/MWh)	0.9528	

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 7.0

As per para 11 of the methodology AMS-I.D Version 17, equation no. 1

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y} \quad \textbf{(1)}$$

Where:

BE_y Baseline Emissions in year *y* (t CO_2)

$EG_{BL,y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ CO_2 emission factor of the grid in year y (t CO_2/MWh)

As per para 23 of AMS-I.D Version 17 equation no. 10

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (\textbf{1})$$

Where:

ER_y Emission reductions in year *y* (t CO_2/y)

BE_y Baseline Emissions in year *y* (t CO_2/y)

PE_y Project emissions in year *y* (t CO_2/y)

LE_y Leakage emissions in year *y* (t CO_2/y)

Project Emissions

As the project activity is an electricity generation activity by the way of converting wing energy to electrical energy which doesn't involve any GHG emission also as per para 20 & 21 of AMS-I.D Version 17 "For most renewable energy project activities, $PE_y = 0$"

Therefore for the project activity $PE_y = 0$

Emissions due to Leakage
According to para 22 of AMS-I.D version 17 "If the energy generating equipment is transferred from another activity, leakage is to be considered."

As the project activity doesn't involve transfer of any energy generating equipment from another activity thus leakage emissions for the project activity are considered to be zero.

$LE_y = 0$

Thus, $ER_y = BE_y$

Emission reductions in year *y* (t CO_2/y) = Baseline Emissions in year *y* (t CO_2/y)
In case of the project activity, Grid emission factor has been fixed ex-ante.

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**$EF_{OM,y}$**
Unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 7.0, published by the Central Electricity Authority, Ministry of Power, Government of India. The "Baseline Carbon Dioxide Emission Database Version 7.0 for Indian Power Sector" is available at http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver7.pdf
Value(s) applied	0.9842
Choice of data or Measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 04.0" The data has been sourced from "CO_2 Baseline Database for Indian Power Sector" version 7.0, published by the Central Electricity Authority, Ministry of Power, Government of India as a 3-year generation weighted average using data for the years 2008-2009, 2009-2010 & 2010-2011.
Purpose of data	Calculation of baseline emissions
Additional comment	The database is an official publication of Govrnment of India for the purpose of CDM baseline. It is based on most recent data available to the Central Electricity Authority and hence considered authentic. This parameter is fixed ex-ante for the first crediting period.

Data / Parameter	$EF_{BM, y}$
Unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year y
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 7.0, published by the Central Electricity Authority, Ministry of Power, Government of India. The "Baseline Carbon Dioxide Emission Database Version 7.0 for Indian Power Sector" is available at http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver7.pdf
Value(s) applied	0.8588
Choice of data or Measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 04.0" The data has been sourced from "CO2 Baseline Database for Indian Power Sector" Version 7.0. Value has been considered for most recent available year from the above referred database.
Purpose of data	Calculation of baseline emissions
Additional comment	The database is an official publication of Govrnment of India for the purpose of CDM baseline. It is based on most recent data available to the Central Electricity Authority and hence considered authentic. This parameter is fixed ex-ante for the first crediting period.

Data / Parameter	$EF_{CO2, y}$
Unit	tCO_2/MWh
Description	Grid Emission Factor (or combined margin for wind project)
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 7.0, published by the Central Electricity Authority, Ministry of Power, Government of India. The "Baseline Carbon Dioxide Emission Database Version 7.0 for Indian Power Sector" is available at http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver7.pdf
Value(s) applied	0.9528
Choice of data or Measurement methods and procedures	Calculated as following EFCO2,grid,y=0,75*EFOM,y+0.25*EFBM,y The value applied is calculated using *"Tool to calculate the Emission Factor for an electricity system"* (version 04.0).
Purpose of data	Calculation of baseline emissions
Additional comment	The database is an official publication of Government of India for the purpose of CDM baseline. It is based on most recent data available to the Central Electricity Authority and hence considered authentic. As the calculation of baseline emission has been done ex ante its value will remain fixed for the entire crediting period.

B.6.3. Ex-ante calculation of emission reductions

Emission reductions are calculated as follows:

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$

Where,

ER_y	Emission reductions in year y (tCO_2e)
BE_y	Baseline emissions in year y (tCO_2e)
PE_y	Project emissions in year y (tCO_2e)
LE_y	Leakage emissions in year y (tCO_2e)

$EF_{CO_2,grid,y}$ = Baseline emission factor
= 0.9528 tCO_2/MWh

BE_y = 3 x 23.85% x 8760 x 0.9528
= 5,972 tCO_2 e

Here, $PE_y = 0$ as well as $LE_y = 0$

Hence, $\mathbf{ER_y = BE_y =}$ 5,972 tCO_2 e

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
2014-15	5,972	0	0	5,972
2015-16	5,972	0	0	5,972
2016-17	5,972	0	0	5,972
2017-18	5,972	0	0	5,972
2018-19	5,972	0	0	5,972
2019-20	5,972	0	0	5,972
2020-21	5,972	0	0	5,972
Total	41,804	**0**	**0**	41,804
Total number of crediting years	**7**			
Annual average over the crediting period	5,972	**0**	**0**	5,972

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	EG_y
Unit	MWh
Description	Net electricity supplied to the NEWNE grid by Project activity.
Source of data	Certificate for share of electricity authorized by GETCO
Value(s) applied	6,268
Measurement methods and procedures	The net electricity exported to the grid by project activity WTG will be ascertained by government agency GETCO (Gujarat Energy Transmission Corporation Limited) on the basis of ABT meter reading at substation(includes generation from project and non project WTGs) and meter readings at various transformer yard meters (near WTGs). On the basis of these meters readings, apportioning is carried out in order to estimate the net electricity generated by the project activity. Apportioning is discussed in detail in section B.7.3 The net electricity generated by the project activity is taken directly from the share certificate issued by state utility (currently SLDC) on monthly basis. Continuous monitoring, hourly measurement and monthly recording is carried out.
Monitoring frequency	Continuous monitoring, hourly measurement and monthly recording
QA/QC procedures	The ABT meter at the substation is of 0.2S accuracy class and is maintained by GETCO (Gujarat Energy Transmission Corporation Limited). Calibration of the substation meter is done by GETCO at least once in 3 years. Calibration of the yard meters will be carried out at least once in 3 years; these yard meters are of accuracy class 0.2s. The substation also has trivector meters (one main meter and one check meter) of 0.2s accuracy class beside ABT meter. If some defect occurs to ABT meters, these trivector meters can be used to obtain the reading. All meters (ABT, main and check) meters are calibrated at least once in a three year by GETCO or its representatives.
Purpose of data	Calculation of baseline emission
Additional comment	Data will be archived for a period of 2 years after crediting period or last issuance whichever is later'

Data / Parameter	$EG_{GETCO, Export}$
Unit	MWh
Description	Electricity exported to the grid by the Project Activity and the other PPs connected to the same sub-station
Source of data	Jointly taken by the Suzlon and State Utility in the form of JMR (Joint Meter Reading) on monthly basis.
Value (s) applied	This data will not be directly used for the calculation of emission reduction. State Utility will use this value for the apportionment calculation and the PP does not have any role in the calculation.
Measurement methods and procedures	The meter reading at ABT meter at substation is taken jointly by the representatives of Suzlon and State Utility on monthly basis.
Monitoring Frequency	Continuous monitoring, hourly measurement and monthly recording
QA/QC procedures	The ABT meter at the substation is of 0.2S accuracy class and is maintained by GETCO (Gujarat Energy Transmission Corporation Limited). Calibration of the substation meter is done by GETCO at least once in 3 years.
Purpose of data	Baseline emission calculation
Additional comment	The data will be archived both electronically and on paper till a period of two years from the end of the crediting period or the date of last issuance, whichever occurs later.

Data / Parameter	$EG_{GETCO, Import}$
Unit	MWh
Description	Electricity Imported from the grid by the Project Activity and the other PPs connected to the same sub-station
Source of data	Jointly taken by the representatives of Suzlon and State Utility in the form of JMR on monthly basis.
Value (s) applied	This data will not be directly used for the calculation of emission reduction. State Utility will use this value for the apportionment calculation and the PP does not have any role in the calculation.
Measurement methods and procedures	The meter reading at ABT meter at the substation is taken jointly by the representatives of Suzlon and State Utility on monthly basis.
Monitoring Frequency	Continuous monitoring, hourly measurement and monthly recording
QA/QC procedures	The ABT meter at the substation is of 0.2S accuracy class and is maintained by GETCO (Gujarat Energy Transmission Corporation Limited). Calibration of the substation meter is done by GETCO at least once in 3 years.
Purpose of data	Baseline emission calculation
Additional comment	The data will be archived both electronically and on paper till a period of two years from the end of the crediting period or the date of last issuance, whichever occurs later.

Data / Parameter:	$EG_{yard,y}$
Unit	MWh
Description	The electricity generated by wind mills of the project activity, recorded by the yard meters near the wind mill.
Source of data	Reading taken by Suzlon.
Value (s) applied	This data will not be directly used for the calculation of emission reduction. State Utility will use this value for the apportionment calculation and the PP does not have any role in the calculation.
Measurement methods and procedures	Each WTG is equipped with a yard meter. The generation data of individual WTG can be monitored through these meters.
Monitoring Frequency	Continuous monitoring, hourly measurement and monthly recording
QA/QC procedures	Meters will be calibrated once in a three year. Accuracy of these meters is also 0.2S
Purpose of data	Baseline emission calculation
Additional comment	The data will be archived both electronically and on paper till a period of two years from the end of the crediting period or the date of last issuance, whichever occurs later

B.7.2. Sampling plan

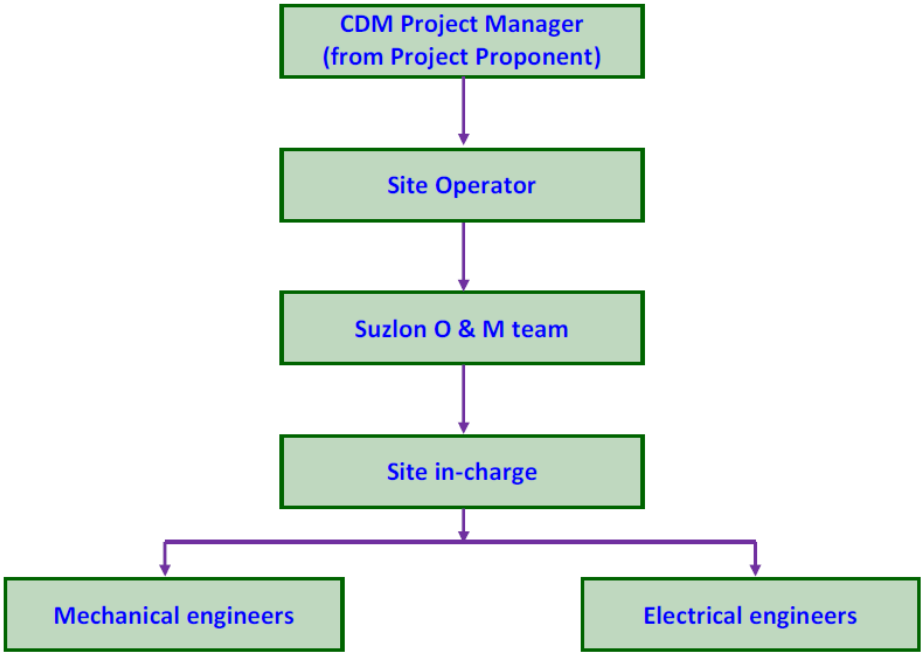
Sampling is not required for the given project activity.

B.7.3. Other elements of monitoring plan

The monitoring plan for the proposed project activity is developed as per the procedure for AMS 1.D (version 17). The monitoring plan will be implemented by the project proponent.

To ensure trouble free operations and efficient generation through the wind turbines, the project proponent has entered into a comprehensive Operation and Maintenance agreement with the manufacturer of the turbine. The contractor Suzlon Energy Limited, under the O & M contract with the project proponents would be responsible for the operation and maintenance of the project activity. Suzlon is an ISO 9001:2008 certified organization. To comply with the standard specifications, Suzlon Energy Limited is bound to provide the best quality services which ensure reliability. The authority and responsibility for monitoring, measurement and reporting, lies with the project proponent.

Project Participant has formulated a project team to ensure proper and continuous monitoring of the performance of wind turbines and generation of power. The same has been outlined in the organization flowchart as follows:



Responsibilities:

- CDM Project Manager: In the project management structure CDM Project Manager is responsible for the project management.
  - He is responsible to plan and allocate the annual budget for operation, estimation of the likely operating cost, electricity dispatch, organizing third party contractors, revenue collection etc.
  - He will check the monthly electricity generated and annual emission reduction calculations.

- Site Operator: The site operator appointed and trained by Suzlon will perform the following tasks and report to the CDM Project Manager.
  - Send Daily / Monthly Generation Report with additional parameters of Performance.
  - Provide necessary suggestions to the Maintenance Contractor at site to minimize down time and fault hours.
  - Provide the data on Power Generation Pattern of similar capacity wind power plants installed in the vicinity.
  - Check the effectiveness of maintenance by concern O & M Team.
  - Highlight the malfunctioning of components, if any, observed

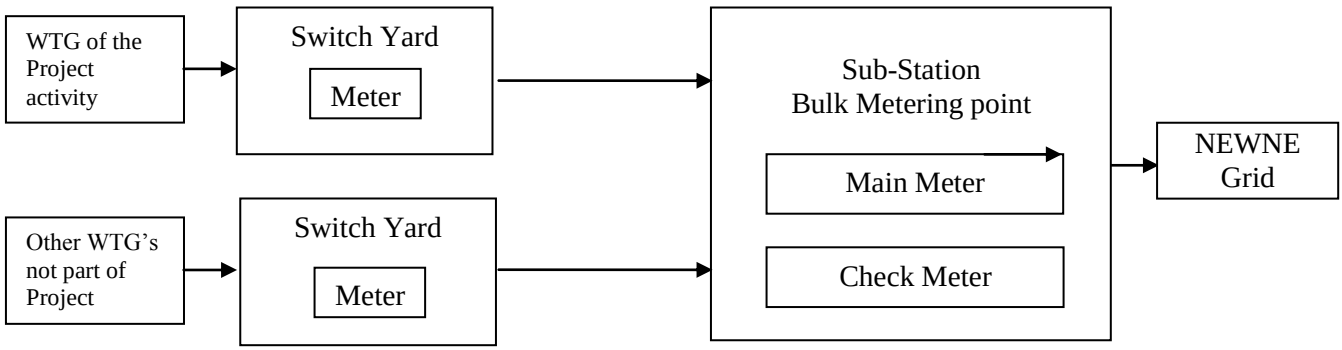
- Suzlon O & M team: Operation and maintenance of wind generators will be done by Suzlon Energy Limited and they will be responsible to the CDM Project Manager.
  - Data logging for power generation, grid availability, machine availability.

- Preparation and submission of monthly/daily performance report in agreed format.
- Taking monthly meter reading jointly with GUVNL/GETCO/GEDA and the site operator, for the power generated and supplied to the grid from the meters maintained by GETCO
- Coordinate to obtain necessary certificates for share of electricity.

Parameters requiring monitoring:

- The monitoring plan requires monitoring of power exported to the grid. Necessary documents required for verification of the data will be maintained for later archiving. Using the power exported to the grid, emission reductions will be estimated as illustrated in Section B.6.3. Emission reductions generated by the project will be monitored at regular intervals.
- The joint measurement will be carried out once in a month at meter at sub-station in presence of both parties (the developer's representative and officials of the state power utility). Both parties will sign the recorded reading.
- Metering equipment – Metering is carried out through electronic trivector meters of accuracy class 0.2 required for the project. The ABT meter, main meter and check meters shall be installed and owned by GETCO. The metering equipments are maintained in accordance with electricity standards.
- Meter readings – The monthly meter readings of ABT meter at sub-station site shall be taken jointly by the parties on the particular day of the following month. At the conclusion of each meter reading an appointed representative of GETCO and the company signs a document indicating the number of kWh exported to the grid.
- The O&M team shall take meter reading of meter at WTG switch yard

Apportioning Procedure:



The apportionment procedure for the project activity is done by State Utility based on the meter readings of the various yard meters of various project owners connected to substation and substation meter reading

(ABT meter), connecting all the machines of the project activity and other project developers. PP does not have any role in the apportionment procedure.

The reading at yard meter and substation meter are directly monitored on continuous basis. Hence, the apportioning of the electricity is based on the meter reading that are directly monitored and measured. The meter recording at yard meters of the project activity are done on monthly basis by the O & M personnel.

$EG_y = EG_{Export,y} - EG_{Import,y}$

Where:

$EG_{Export,y} = EG_{GETCO, Export} X (EG_{yard,y} / EG_{yard, Project \& Non project WTGs})$
And
$EG_{Import,y} = EG_{GETCO, Import} X (EG_{yard,y} / EG_{yard, Project \& Non project WTGs})$

where:

EG_y	Net Electricity exported by the project activity to the grid, calculated
$EG_{Export,y}$	Electricity exported by the project activity to the grid, calculated
$EG_{Import,y}$	Electricity imported by the project activity to the grid, calculated
$EG_{GETCO, Export}$	Electricity exported by all WTGs connected to the substation (project activity WTGs and non-project activity WTGs), as recorded by the ABT meter at substation (MWh)
$EG_{GETCO, Import}$	Electricity imported by all WTGs connected to the substation (project activity WTGs and non-project activity WTGs), as recorded by the ABT meter at substation (MWh)
$EG_{yard,y}$	Net electricity exported by WTG of the project activity, as measured at yard meters (MWh)
$EG_{yard, Project \& Non project WTGs}$	Net electricity exported by all WTG of the project owners connected to the substation (MWh) measured at switchyard meters.

Only the monitoring parameters $EG_{GETCOExport}$, $EG_{GETCO,Import}$ and $EG_{yard,y}$ are included as readings of $EG_{GETCO,Export}$ & $EG_{GETCO,Import}$ are recorded in JMR and JMR copies are available with State Utility and are provided to the PP as per official request and reading of $EG_{yard,y}$ is the reading of the WTG of PP.

<u>QA and QC procedures</u>:

- Reliability of the monitoring system is governed by accuracy of the meters installed on substations (grid interconnection point). So the measuring instruments will be calibrated as per manufacturer's instructions to ensure reliability of the system.
- All the instruments associated with the project activity will be calibrated by an independent agency (accredited by a govt. agency), thereby ensuring reliability.

- The meters at the substation will be in custody of State Electricity Transmission Utility (GETCO). GETCO officials will take the readings from these meters and the same readings may be used to determine the net power wheeled to the user and determine the extent of mitigation of GHG over a crediting period.
- The plant personnel will take care about the generation data of the wind mill on hourly; daily as well as monthly basis by using of Central Monitoring Station (CMS) at the project site.
- Any error found during reporting will be notified to the CDM project manager. Specialists will be appointed to review the implications of the error and suggest and implement the requisite corrective actions. The DOE will be notified of the error and of the proposed correction procedures.

There are one ABT meter and two trivector meters (one main meter and one check meter) of 0.2s accuracy class beside ABT meter. If some defect occurs to ABT meters, these trivector meters can be used to obtain the reading. All meters (ABT, main and check and yard meter of WTG of PP) meters are calibrated at least once in a three year by GETCO or its representatives.

The measurement results will be cross checked with adjustments made monthly electricity bills of industrial unit where electricity is wheeled.

Data storage and archiving:

- The data will be recorded in a daily log sheet which will be archived for a period of crediting period +2 years after the end of crediting period or till the last issuance of CERs for this project activity whichever occurs later.
- The data will be summarized monthly and annually, which will be used for emission reduction calculations.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

Start date of the project activity is the earliest purchase order date among both WTGs i.e. 16/07/2009 (The First Purchase Order date among both WTGs)

C.1.2. Expected operational lifetime of project activity

25 Years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Renewable crediting period of 7 years have been opted for the project activity. This is the first crediting period of the project activity.

C.2.2. Start date of crediting period

15/05/2014 or the date of submission of complete request for registration by the DOE whichever is later.

C.2.3. Length of crediting period

7 Years 00 Months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

As per the notification from MoEF dated September 14, 2006[14] and its amendment notification S.O.-3067(E) dated 1/12/2009[15], the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed small scale project activity type as it involves wind power generation. Hence the proposed project activity does not require any Environmental impact analysis. Thus no EIA was conducted.

[14] http://www.envfor.nic.in/legis/eia/so1533.pdf
[15] http://moef.nic.in/downloads/rules-and-regulations/3067.pdf

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

Project proponent decided to conduct the stakeholder meeting as per the requirement of CDM Small Scale Project activity and Project proponent have discussed about stakeholder meeting with local stakeholders such as grampanchayat, local community etc. and they suggested there is no need to publish any advertisement as most of the village/community people are illiterate. Thus, the PP published a pamphlet and communicates the local people by visiting door to door. So that they can participate actively in stakeholder meeting and suggest feedback for implementation of the project activity. The other people i.e. officials of local govt., GEDA & GETCO have been personally invited to come for the stakeholder.

- PP have organize all stakeholders for discussion on CDM project
- Promoting concept of CDM approach among stakeholders and presenting information pertaining to CDM Project Activity"
- Discuss and highlight about the positive impacts due to CDM Project activity in the detail and documenting their feedbacks.

About 100 Pamphlets have been distributed by the local people in the nearby area .Stakeholder meeting was conducted on 7/10/2010 at Maliya, Miyana, Village Vershamedi and Adodar, Porbandar. Total number of people attended the stakeholder meeting are 26 at Maliya, Miyana Vershamedi and 25 at Adodar. People who have attended the stakeholder meeting are officials from GEDA, GETCO, Villagers and Employees of technology supplier and project proponent.

The stakeholders were presented, in vernacular, with an overview of the project activity as well as the technological, economic, environmental and social issues associated with it. The stakeholders were asked to come forward with their comments, suggestions and concerns regarding the project activity. The minutes of the meeting were duly recorded and attested by the PP.

E.2. Summary of comments received

Following are the queries raised by various stakeholders that were responded by CDM consultant and the project proponent.

Query	Response
Mr. Naresh asked if the project would affect the rainfall in the surrounding area.	No. There is no evidence which may prove that the wind project affect the rainfall in the area.
Mr. Dalsaniya kisan said that the renewable energy projects are really good for the environment and help reduce the carbon emissions	His positive comments were welcomed by the consultant as well as the project proponent.
Mr. Gadara Hardip bhai asked if the employment opportunities will be given to the local people or people from outside will be brought to the project site.	Preference will be given to the locals for the employment opportunities based on their skills and qualifications.
Mr. Prakash Dhamelia asked if there will be any solid waste generated from the project activity which may be dumped in the areas nearby residential areas which ultimately may generate	There will be no such solid waste generation from the project.

Query	Response
sickness syndrome.	
Has the project affected the ground water level	No, Wind project does not affect either the ground level or drinking water quality of nearby area of the project.
How other source of power generation leads to pollution	As power is generated mainly from fossil fuels, this leads to emission of carbon dioxide and other gases. These are gases which lead to an increase in the temperature of the earth which inturn leads to global warming. This is a phenomena which, if allowed to go or unchecked, can alter the weather cycle, lead to shift in crop pattern and can also lead to natural catastrophes such as floods or flooding of coastal regions, droughts, etc.,

All attendees appreciate the efforts put in by various project developers in the surrounding area and acknowledged the socio economic benefits including the employment opportunities.

All the stakeholders were happy in knowing that a CDM project activity in their locality will be contributing to a global cause and appreciated the project promoter for the environment friendly power generation using wind.

There were no negative comments received for any of the WTG.

E.3. Report on consideration of comments received

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As no negative comments were received, no action has been taken

SECTION F. Approval and authorization

Host Country Approval (HCA) is obtained from the Designated National Authority (DNA) which is National CDM Authority (NCDMA), Ministry of Environment & Forests (MoEF) in India. The Letter of Approval has been received for the project activity by DNA (Host Country India) on dated 11/10/2012 and the same has been submitted to the DOE.

Appendix 1: Contact information of project participants

Organization	Bhagwati Spherocast Pvt. Ltd.
Street/P.O. Box	132/1, GIDC estate, Odhav
Building	--
City	Ahmadabad
State/Region	Gujarat
Postcode	382 415
Country	India
Telephone	+91 (0) 79 2287 0402 / 03 / 04
Fax	+91 (0) 79 2287 0698
E-mail	spherocast@bhagwati.com
Website	bhagwati.com
Contact person	
Title	General Manager (Finance)
Salutation	Mr.
Last name	Adhvaryu
Middle name	--
First name	Sanjiv
Department	--
Mobile	+91 90990 11628
Direct fax	+91 (0) 79 2287 0698
Direct tel.	+91 (0) 79 2287 0402 / 03 / 04
Personal e-mail	spherocast@bhagwati.com

Appendix 2: Affirmation regarding public funding

No Public funding from Party (ies) included in Annex I is involved for the project activity.

Appendix 3: Applicability of selected methodology

Detailed Applicability criterions have been explained in section B.2 of the PDD

Appendix 4: Further background information on ex ante calculation of emission reductions

Justification for selection of grid Emission Factor:

As per paragraph 6.4 of "Tool to calculate the emission factor for an electricity system, Version 4.0, i.e. Step 4: Calculate the operating margin emission factor according to the selected method – 12 of the methodology AMS 1.D (Version 17): *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 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.

The baseline emission factor has been worked out by Central Electricity Authority (CEA), Ministry of Power, Government of India (CO_2 Baseline Database for the Indian Power Sector, User Guide - Version 7.0, January – 2012). This database is official source of information of Government of India and it is based on CDM tool & methodology to calculate emission factor for an electricity system.

As per the stated document, the Indian power sector is divided into two regional grids, namely NEWNE (North, East, West and North Eastern) and Southern grid. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross border imports and exports. The state of Gujarat is part of NEWNE grid.

The approved baseline methodology suggests that the proposed project activity would have an effect on both the Operating Margin and the Build Margin of the selected NEWNE Grid and the net baseline emission factor would therefore incorporate an average of both these elements, i.e. **Combined Margin**. Combined margin emission factor (in tCO_2e / MWh from the most recent statistics available at the time of PDD submission) has been taken as the baseline emission co-efficient/emission factor.

For calculation of Combined Margin (CM) grid emission factor, consisting of the combination of Operating margin (OM) and Build Margin (BM), option (a) as stated above has been considered.

As per the "Tool to calculate the emission factor for an electricity system" (version 04.0), the following six steps have been followed to calculate the Combined Margin (CM) grid emission factor.

Step 1: Identify the relevant electricity systems.

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

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

Step 4: Calculate the operating margin emission factor according to the selected method.

Step 5: Calculate the build margin emission factor.

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

Step 1: Identify the relevant electricity systems

The tool 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), Government of India has divided the Indian Power Sector into two grids; the synchronized NEWNE grid and the Southern Grid. The project activity is located in the Gujarat state and is connected to the NEWNE grid, therefore, emissions generated due to the electricity generated by the NEWNE grid, will serve as the baseline for this project activity.

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

For the project activity the project participants have chosen not to include off grid power plants in the project electricity system.

Step 3: Select a method to determine the Operating Margin (OM)

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.

As per the tool, the simple OM method [option (a)] can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in:

1) Average of the five most recent years, or

2) Based on long-term averages for hydroelectricity production.

Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants. The table below shows share of low cost/must run resources in Indian grids.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation) [16]							
Grid	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	16.8%	18.0%	18.5%	19.0%	17.4%	15.9%	17.6%
South	21.6%	27.0%	28.3%	27.1%	22.8%	20.6%	21.0%
India	18.0%	20.1%	20.9%	21.0%	18.7%	17.1%	18.4%

The above data clearly shows that the average percentage of total grid generation by low cost/must run plants (on the basis of average of six most recent years) for the NEWNE grid is less than 50 % of the total generation. Thus, Simple OM method [option (a)] has been used to calculate the operating margin.

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.
- *Ex post* option: Emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

For the project activity the simple OM emission factor is calculated *ex ante* using 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.

Step 4: <u>Calculate the Operating Margin emission factor according to the selected method</u>

As per the tool, simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

As per the "Tool to calculate the emission factor for an electricity system" (version 04.0), two options can be used to calculate the operating margin.

(a) Based on the net electricity generation and a CO_2 emission factor , of each power unit, or

(b) Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project activity option (a) has been used. Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit.

The data on CO_2 emissions by the grid and the net generation is published annually by the Central Electricity Authority (CEA) of India. The data published by CEA has been used to calculate the operating margin for the project activity. The table below mention 3 year *ex ante* net generation data and the Simple

[16] http://cea.nic.in/

Operating Margin (tCO_2/MWh) (incl. Imports) using the latest database from Central Electricity Authority, Ministry of Power, Government of India (CO_2 Baseline Database for the Indian Power Sector, User Guide – Version 7.0, January – 2012)

	2008-09	2009-10	2010-11	Weighted Average
NEWNE (tCO2/MWh)	1.0066	0.9777	0.9707	0.9842

Under option (a), the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM\,simple,y} = \frac{\sum_m EG_{m,y}\ X\ EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid, OM simple, y}$	Simple Operating 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	All power units serving the grid in year *y* except low-cost / must-run power units
y	The relevant year as per the data vintage chosen in Step 3

$$EF_{grid,OM\,simple,y} = \frac{[(421{,}803\ X\ 1.01) + (458{,}043\ X\ 0.98) + (476{,}987\ X\ 0.97)]}{[(421{,}803) + (458{,}043) + (476{,}987)]}$$

$EF_{grid, OM simple, y}$ = 0.9842 tCO_2/MWh

Step 5: <u>Calculate the Build Margin emission factor</u>

The tool describes that: In terms of vintage of data, project participants can choose between one of the following two options:

(a) For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

(b) For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which

information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante*, as described in option (a) above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option (a) is selected for this project activity.

As per the tool, the Built Margin emission factor is calculated as the generation-weighted average CO_2 emissions per unit of net electricity generation (tCO_2/MWh) of the set of power units that comprise 20% of annual electricity generation during the most recent year "y" for which power generation data is available, calculated as follows:

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

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 electricity generation data is available

The sample group of power units 'm' used to calculate the build margin shall consists of either:

1) The set of five power units that have been built most recently, or
2) The set of power 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 the set of power units that comprises the larger annual generation. Since in India, the installed capacity and corresponding annual generation from power plants is quite high, the sample group containing set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently comprise the sample group with the larger annual generation. Thus, the sample group 'm' consisting of option (2) is used for the estimation of build margin. The CEA has calculated the build margin as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation.

Build Margin emission factor for the most recent year (2009 – 10) is determined *ex ante* using the latest database from Central Electricity Authority.

Description	2010-11
Build Margin (tCO_2/MWh) (not adjusted for imports)	0.8588

$$\mathbf{EF_{grid, BM, y} = 0.8588\ tCO_2/MWh}$$

Step 6: <u>Calculate the combined margin (CM) emissions factor</u>

Calculation of the Combined Margin (CM) emission factor ($EF_{grid, CM, y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option a) is used. Calculation of the same is done as follows:

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

Where:

$EF_{grid, CM, y}$	Combined Margin CO_2 emission factor in the year *y* (tCO_2/MWh)
$EF_{grid, OM, y}$	Operating Margin CO_2 emission factor in the year *y* (tCO_2/MWh)
$EF_{grid, BM, y}$	Build Margin CO_2 emission factor in the year *y* (tCO_2/MWh)
W_{OM}	Weighting of Operating Margin emission factor (%) = 0.75 (for wind and solar power generation project activities)
W_{BM}	Weighting of Build Margin emission factor (%) = 0.25 (for wind and solar power generation project activities)

$$EF_{grid, CM, y} = (0.9842 \times 0.75) + (0.8588 \times 0.25)$$

$$\mathbf{= 0.9528\ tCO_2/MWh}$$

Appendix 5: Further background information on monitoring plan

Please refer section B.7.1 and B.7.2 for information on monitoring

Appendix 6: Summary of post registration changes

Not applicable

History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 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.
02	EB 20, Annex 14 08 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>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		