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

CONTENTS

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:

Title: Grid Connected Wind Power Project by M/s. Giriraj Enterprises in Madhya Pradesh
Version: 02.5
Date: 23/03/2012

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

The proposed project activity is a grid-connected wind power generation in Village- Barda Barkheda, Taluka- Barod, District- Shajapur, State- Madhya Pradesh in India. M/s. Giriraj Enterprises is the owner and developer of the project activity. The total capacity of the project activity is 15 Megawatt (MW) (10 Wind Turbine Generators (WTGs) × 1.50 MW). The project activity employs Wind Turbine Generators (WTGs) of Class S-82 manufactured by M/s. Suzlon Energy Limited.

The project activity will supply the generated electricity to the North East West North-East (NEWNE) Grid of India. The purpose of the project activity is generation of clean electricity by utilizing kinetic energy of wind. The project activity is estimated to generate 25,529 MWh of electricity annually; thus mitigating Green House Gases (GHGs) to the tune of 24,216 tCO_2e / annum for the entire crediting period of 7 years.

The electricity generation is the result of the utilization of kinetic energy in wind to drive the wind turbine blades to generate electricity without emitting any form of GHG in atmosphere. Thus the operation of the wind power project is considered as environmentally safe.

In the absence of the project activity, the electricity supplied 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 NEWNE grid.

The project activity will contribute to sustainable development in various ways. These will be as follows:

Social well-being:

Social well-being focuses on the reflections of the project activity on the neighbouring community. The project activity envisages following social benefits:

- Improved standard of living
- Availability of infrastructure like electricity, roads, medical facilities etc.
- Reduce migration from rural to urban area for the sake of employment
- Awareness about the global issues, their solutions & role of India in the same
- Awareness among local people regarding wind power & its effect on rain and ground water level

It will thus be responsible in bringing social well-being in the region.

Environmental well-being:

The project activity is a clean source of power generation. The environmental aspects in consideration are as follows:

- In comparison to other sources of power generation prevailing in the country, wind power is the cleanest technology.
- As compared to other power plants, less amount of land is required for a single wind turbo-generator.
- Wind power is renewable. It can be used continuously, whenever available. There is no danger of depletion of the raw material used for power generation
- Wind power is a naturally available source of energy. There is no processing required to make it available for power generation

Thus, wind power technology goes hand-in-hand with the environmental well-being of the region.

Technological well-being:

The power generation technology used in this project activity is provided by the M/s. Suzlon Energy Limited. The technological well-being envisaged by the project activity is as follows:

- It will boost the use of such technology by other project developers.
- Successful implementation and operation of this project will give necessary impetus in implementation of similar technology in the region.
- The project activity will lead to transfer of environmentally safe and sound technologies that are comparable to best practices in order to assist in up gradation of the technological base in the local region

Economic well-being:

Economic well being refers to additional investment consistent with the needs of the local community. The project in due course of time will draw additional investment to the region. In general, the project activity envisages following economic benefits:

- Employment opportunities
- Market facilities for local products
- Improvement of local economy
- Flow of goods and services

Although the realization of the above benefits would take a longer time needlessly, the economic development of the region would be attributed to the project operation. The project will contribute to the sustainable development of the region during its entire operational life.

A.3. Project participants:

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 Party)	Giriraj Enterprises (Private Entity)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

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

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

A.4.1.1. Host Party(ies):

India

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

State: Madhya Pradesh

A.4.1.3. City/Town/Community etc:

District: Shajapur
Taluka: Barod
Village: Barda Barkheda

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

The project activity is located at Village: Barda Barkheda, Taluka: Barod, District: Shajapur, State: Madhya Pradesh in India. The details of project location are given below:

Sr. No.	Location Nos.	WTG Capacity, MW	Survey No.	Date of commissioning	Latitude	Longitude
1.	M-12	1.5	1723	31/03/2011	N 23° 51' 55.2"	E 76° 03' 47.5"
2.	M-34	1.5	1403	28/03/2011	N 23° 51' 05.2"	E 76° 03' 39.7"
3.	M-35	1.5	1394	28/03/2011	N 23° 50' 53.8"	E 76° 03' 42.0"
4.	M-36	1.5	1349	28/03/2011	N 23° 50' 45.1"	E 76° 03' 54.6"
5.	M-45	1.5	877	30/03/2011	N 23° 50' 25.2"	E 76° 04' 09.6"
6.	M-55	1.5	998	19/06/2011	N 23° 48' 39.7"	E 76° 05' 11.9"
7.	M-90	1.5	177	07/06/2011	N 23° 50' 05.0"	E 76° 05' 26.5"
8.	M-91	1.5	227	19/06/2011	N 23° 49' 56.9"	E 76° 05' 33.9"
9.	M-92	1.5	227	19/06/2011	N 23° 49' 44.7"	E 76° 05' 38.5"
10.	M-93	1.5	227	19/06/2011	N 23° 49' 34.6"	E 76° 05' 25.5"
Total Capacity		**15 MW**				

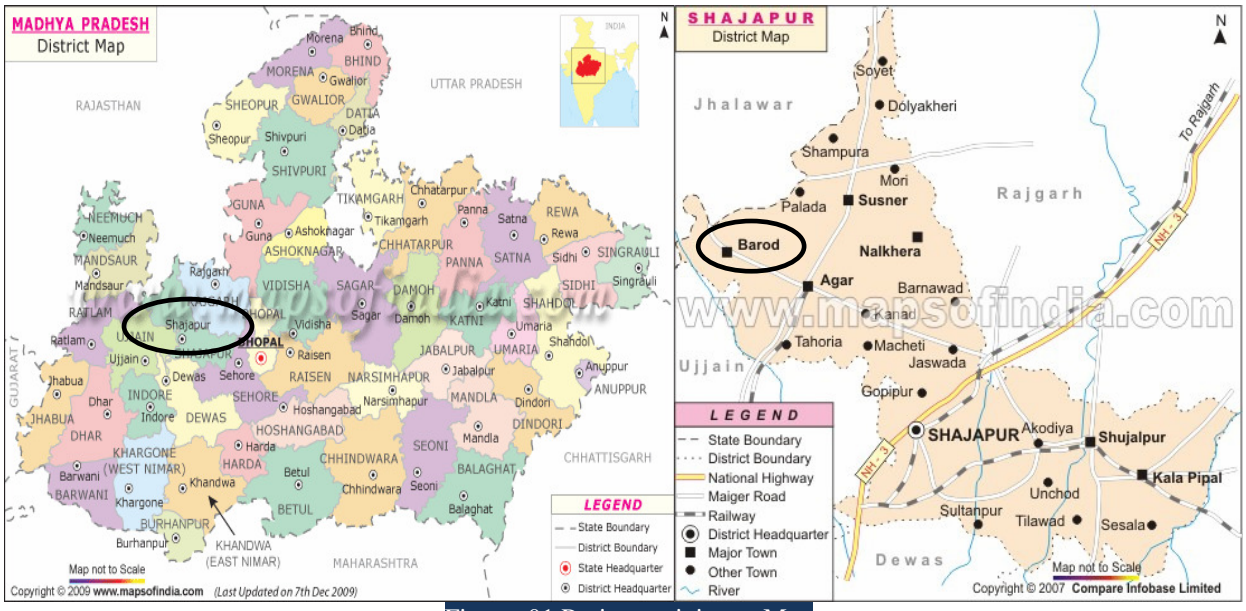

Figure: 01 Project activity on Map

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

Project Type : Type I – Renewable Energy Projects

Project Category[1] : *I.D. – Grid connected renewable electricity generation (Version- 17, Clean Development Mechanism (CDM) Executive Board (EB) meeting - 61)*

Reference[2] : Appendix B Of The Simplified Modalities And Procedures For Small-Scale CDM Project Activities Indicative Simplified Baseline And Monitoring Methodologies For Selected Small-Scale CDM Project Activity Categories

Technology/Measure:

The wind power technology is considered as one of the most environmental friendly technologies available. The operation of the wind turbine does not emit any harmful GHGs or any other harmful gases like conventional power plants during their operation. The electricity generation is the result of the utilization of kinetic energy in wind to drive the wind turbine blades to generate electricity. Thus the operation of the wind power project is considered as environmentally safe.

Technical specifications for Class S-82[3]**:**

1.	Main Data	
	Turbine type	Horizontal axis turbine
	Rated Power	1500 kW

[1] http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X
[2] http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf#page=43
[3] http://www.suzlon.com/products/l2.aspx?l1=2&l2=8

	Rotor Diameter	82 m
	Hub height (including foundation)	Approximately 78.5 m
	Rotational Speed	15.6 to 18.4 rpm
2.	**Rotor**	
	Number of rotor blades	3
	Rotor Orientation	Upwind
	Material	Epoxy bonded fibre glass
3.	**Gear Box**	
	Type of Gear Box housing	One planetary stage / Two helical stages
	Ratio	1: 95.09
	Power	1650 kW
	Type of cooling	Forced oil cooling lubrication system
4.	**Generator System**	
	Generator type	Single speed induction generator with slip rings, variable rotor resistance via Suzlon Flexi slip system
	Rated power	1500 kW
	Speed at rated power	1511 rpm
	Rated voltage	690 V AC (phase to phase)
	Frequency	50 Hz
	Insulation Class	Class H
5.	**Tower**	
	Tower type	Tubular tower (corrosion proof painting on inner and outer surface) with welded steel plates
	Tower Height	76 m
6.	**Operational Parameters**	
	Cut-in wind speed	4 m/s
	Rated wind speed	14 m/s
	Cut-off wind speed	20 m/s
	Survival wind speed	52.5 m/s

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

The chosen crediting period for the project activity is 7 years (renewable). It is estimated that the project activity would generate 24216 tonnes of CO_2 e/annum over the entire crediting period. Annual estimate of emission reductions by the project activity during the first crediting period are furnished below.

Years	**Estimation of annual emission reductions in tonnes of CO_2 e**
2012-13	24,216
2013-14	24,216
2014-15	24,216
2015-16	24,216
2016-17	24,216
2017-18	24,216
2018-19	24,216

Total estimated reductions (tonnes of CO_2 e)	**169,512**
Total number of crediting years	**7**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	**24,216**

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

The project activity is not availing any public funding. Kindly refer Annex 2.

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

As per "*Guidelines on Assessment of Debundling for (Small Scale) SSC Project Activities*" (Version- 03, EB- 54, Annex- 13)[4]:

Debundling is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. The full project activity or any component of the full project activity shall follow the regular CDM modalities and procedures.

This wind power project activity is a separate project activity having installed capacity of 15 MW (1.50 MW × 10 Nos.) and is not a debundled component of any large scale project activity.

Further, as per the guidelines,

A proposed 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*

This small-scale project activity cannot be deemed to be a debundled component of a large project activity as there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participant;
- 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.

[4] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid17.pdf

It therefore satisfies all conditions listed in '*Guidelines on Assessment of Debundling for SSC Project Activities*' (Version- 03, EB- 54, Annex- 13) regarding debundling. Thus, project proponent hereby confirms that the project activity is not a debundled component of another larger project activity.

SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline and monitoring methodology for small scale project activity, AMS- I.D. (Version- 17, EB- 61), has been applied to this wind power project activity. The title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity is as below –

Title of Methodology : Grid connected renewable electricity generation (Version- 17, EB- 61)
Reference[5] : AMS- I.D.

Tools & guidelines referred to design project baseline & additionality:

- *Tool to calculate the emission factor for an electricity system (Version- 02.2.1, EB- 63, Annex- 19)*[6]
- *Attachment A of Appendix B, (Version 08, EB 63, Annex 24)*[7]
- *Guidelines on the Assessment of Investment Analysis (Version- 5, EB- 62, Annex- 5)*[8]
- *General Guidelines to SSC CDM methodologies (Version 17)*[9]

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

Project Type : Type I – Renewable Energy Projects
Project Category : AMS *I.D. – Grid connected renewable electricity generation* (Version- 17, EB- 61)

The project activity is having capacity of 15 MW & is within the SSC limit of 15 MW. It will remain under the limits of small scale project activity types during every year of the crediting period.

The qualifying criteria for the chosen project category AMS- I.D. (Version- 17, EB- 61) and its subsequent justification are given in the table below:

Sr. No.	Criteria	Project Scenario
1.	*This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:*	The project activity comprises wind (renewable) power units

[5] http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X
[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf
[7] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf
[8] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf
[9] https://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid06.pdf

	(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.*	that will supply electricity to the national grid i.e. NEWNE Grid (option a).
2.	*Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies is included in Table 2.*	According to the applicability conditions, AMS-I.D. is applicable for the project activity as the project activity supply electricity to the national grid
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; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).*	The project activity is a Greenfield project (option 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.*	As it is wind power project activity, the criteria is not applicable.
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, the capacity of the entire unit shall not exceed the limit of 15 MW.*	Project activity has only renewable component with a capacity of 15 MW.
6.	*Combined heat and power (co-generation) systems are not eligible under this category.*	As it is wind power project activity, the criteria is not applicable.
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 from the existing units.*	Not applicable, as it is a Greenfield project activity.
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.*	Not applicable, as it is a Greenfield project activity.

Thus the project activity is complying with requisite criteria for AMS- I.D. (Version-17, EB-61)

B.3. Description of the project boundary:

As per paragraph 9 of the chosen project category AMS- I.D. (Version- 17, EB- 61), ''*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 activity is located in the State of Madhya Pradesh and is supplying generated electricity to the NEWNE Grid of India. The project boundary consists of project activity, evacuation facility, on site metering point and connectivity to the NEWNE Grid. The schematic diagram of project boundary is as follows:

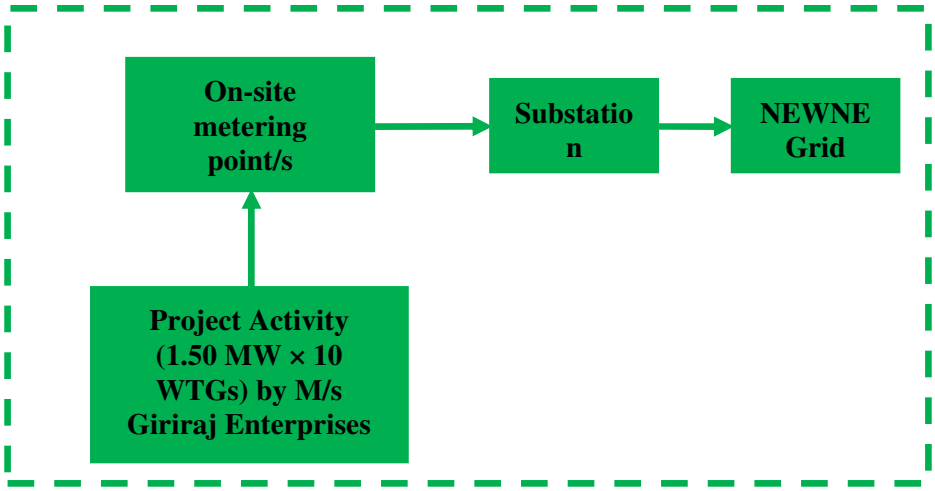

Figure 02: Project Boundary

B.4. Description of baseline and its development:

Baseline Estimation:

Baseline methodology for project category *I.D* has been detailed in paragraphs 10-12 of the approved small scale methodology AMS- I.D. (Version- 17, EB- 61).

As per paragraph 10:

"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."

Further, as per paragraph 11:

'*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.*'

$BE_y = EG_{BL,y} \times EF_{CO2,grid,y}$[10]

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* (Megawatt hour (MWh))
$EF_{CO2,grid,y}$	=	CO_2 Emission Factor of the grid in year y; (t CO_2 / MWh)

Further, as per paragraph 12:

'*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 t CO_2/MWh) 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 emission factor has been calculated using option '*a*' above i.e. *combined margin*.

Following information is used for the calculation of baseline emissions:

1. Net electricity supplied by the project activity to the grid in year y taken from *Monthly Report on Generation & Compensation*

2. CO_2 Baseline Database (Version- 6.0, Date- March 2011) published by Central Electricity Authority (CEA), Government of India under *Baseline Carbon Dioxide Emissions From Power Sector*[11].

Sr. No.	Parameters	Unit	Value	Details
1.	$EF_{grid,OM,y}$	tCO_2/ MWh	0.9941	Operating margin CO_2 emission factor. The value is calculated for year 2007-08, 2008-09 & 2009-10.
2.	$EF_{grid, BM,y}$	tCO_2/ MWh	0.8123	Build margin CO_2 emission factor. The value is calculated for year 2009-10.
3.	$EF_{CO2,grid,y}$[12]	tCO_2/	0.9486	CO_2 Emission Factor of the grid in year y

[10]PP has calculated the grid emission factor by combine margin method, so as per the '*Tool to calculate the emission factor for an electricity system*' (Version- 02.2.1, EB- 63, Annex- 19). PP has also used grid emission factor notation as $EF_{grid,CM,y}$ in the PDD appropriately.

[11] http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip

		MWh		

The combined margin emissions factor is calculated as per equation 13 of *Tool to calculate the emission factor for an electricity system*' (Version- 02.2.1, EB- 63, Annex- 19) as follows:

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

Where

$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor (tCO_2/MWh)
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor (tCO_2/MWh)
W_{OM}	=	Weight of operating margin emission factor (%)
W_{BM}	=	Weight of build margin emission factor (%)

The steps are detailed under section B.6.1

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:

National policies and circumstances relevant to the baseline of the project activity:

The Electricity Act (EA), 2003 provides an enabling framework for accelerated and more efficient development of the power sector. The EA seeks to encourage competition with appropriate regulatory intervention. Competition is expected to yield efficiency gains and in turn result in availability of quality supply of electricity to consumers at competitive rates.

The Section 3 (1) of the Electricity Act 2003 requires the Central Government to formulate, inter alia, the National Electricity Policy in consultation with Central Electricity Authority (CEA) and State Governments. The provision is quoted below[13]:

"The Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy".

Further, as per section *5.2.12* of the National Electricity Plan[14]:

Even with full development of the feasible hydro potential in the country, coal would necessarily continue to remain the primary fuel for meeting future electricity demand.

[12] As per '*Tool to calculate emission factor for an electricity system*' $EF_{CO2,grid,y}$ also refers as — *Combined margin CO_2 emission factor in year y* ($EF_{grid,CM,y}$). Both these notations are interchangeably used in PDD as per delineation/requirement of both methodology and '*Tool to calculate emission factor for an electricity system*'.

[13] http://www.powermin.nic.in/acts_notification/electricity_act2003/pdf/The%20Electricity%20Act_2003.pdf (Page-8)

[14] http://www.powermin.nic.in/indian_electricity_scenario/national_electricity_policy.htm

The National Electricity Plan also emphasizes the use of other fossil fuel like gas, Liquefied Natural Gas (LNG), Lignite, other imported fossil fuels in meeting the future electricity need. It further emphasize on the Renovation and Modernization (R&M) of the low performing thermal power stations in the country. This will enable to achieve improved PLF of the thermal power plant. The implementation of the National Electricity Plan is clearly evident from the installed capacity in the project boundary i.e. the NEWNE Grid:

As per CEA Report, the installed capacity (in MW) of NEWNE Grid region as on 31/03/2010[15] is as follows:

Sr. No.	Power Sources	Installed Capacity, MW	Percentage, %
1	Thermal	79229.36	68.29
2	Nuclear	3460	02.98
3	Hydro	25756.37	22.20
4	RES	7576.99	06.53
5	**Total**	**116022.7**	**100.00**

The graphical representation of the above statistics is given below:

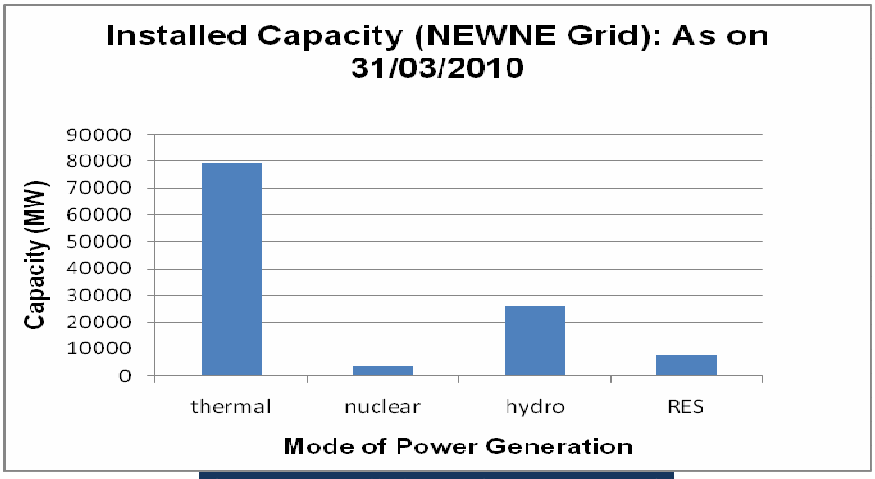

Figure 03: Installed Capacity, NEWNE Grid

It can be observed from the above statistics that NEWNE Grid Region is dominated mostly by fossil fuel based thermal power plants. The share of thermal based power generation is 79229.36 MW (68.29%) as against the contribution of Renewable Energy Sources (RES) i.e. 7576.99 MW (6.53%). The percentage of hydro power is also substantial in the project boundary i.e. 22.2 %.

Thus, the national policy clearly prefers the installation of the fossil fuel based power plants, which forms the basis of the project activity.

[15] http://cea.nic.in/ (Reference: Monthly Review of Power Sector Reports/March 2010/Sr. No. 06/Chapter: All India generating installed capacity- region wise/Page 8)

Project Additionality:

The additionality of the project activity is demonstrated by PP in accordance with *Attachment A of Appendix B (Version: 08, EB: 63, Annex: 24) & Guidelines on the Assessment of Investment Analysis* (*Version- 5, EB- 62, Annex- 5*).

Attachment A of Appendix B

Project participant (PP) shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a. Investment barrier
b. Technological barrier
c. Barrier due to prevailing practice
d. Other barriers

PP has chosen *Investment barrier* to prove project additionality.

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

Investment Barrier:

The investment analysis for this project activity is done as per the *Guidelines on the Assessment of Investment Analysis* (*Version- 5, EB- 62, Annex- 5*).

The project proponent is required to determine that the project activity is not:

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

As per paragraph 19 of '*Guidelines on the Assessment of Investment Analysis' (Version- 5, EB- 62, Annex- 5) - If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.* Hence, project promoter has considered Benchmark analysis to prove the additionality of the project.

Further, since the project is funded through mix of own fund and debt, PP has considered *project IRR* as suitable financial indicator.

Suitability of Benchmark:

The *'Guidelines on the Assessment of Investment Analysis' (Paragraph- 12, Version- 5, EB- 62, Annex- 5)* states that – *Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project Internal Rate of Return (IRR)*, hence PP has selected Commercial Lending Rate of Bank of Baroda applicable at the time of project conceptualization stage, as bench mark

of the project. The Commercial Lending Rate of Bank of Baroda at the time of project conceptualization was 13.25%[16], which has been considered as benchmark of the project.

Calculation and comparison of financial indicators:

PP has calculated Project IRR of the project for its life time. Key assumptions of the project are as under:

Sr. No.	Particulars	Unit	Value	Basis
1.	Project Capacity	MW	15	Proposal from Supplier
2.	Gross annual generation	Million kWh	27.75	Proposal from Supplier
3.	Machine unavailability	%	5	Proposal from Supplier
4.	Transmission/Line loss	%	3	Proposal from Supplier
5.	Net Annual Generation	Million kWh	25.53	Proposal from Supplier
6.	Derating in 11th year	%	5	As per TERI Wind Report 2005-2006
7.	Tariff Rate for 20 years	INR/kWh	4.35	As per Madhya Pradesh Electricity Regulatory Commission (MPERC) Order, May-2010
8.	Free O&M	years	1	Proposal from Supplier
9.	Operation & Maintenance (O & M) Cost[17]	INR Million	17.00	Proposal from Supplier
10.	Service Tax @ 10.30%	INR Million	1.75	
11.	Total O & M Cost	INR Million	18.75	
12.	Escalation in O & M Expenses	%	5.00	
13.	Insurance @ 0.15%	INR Million	1.33	Sheet no. 31 under Risk code 70 , Rate code 05 of Tariff Advisory Committee (TAC) order http://iib.gov.in/IRDA/tac/tariffs/AIFT2001.pdf
14.	Interest Rate	%	10.50	As per previous term loan sanction letter of Bank of Baroda.
15.	Cost of Project	INR Million	887.45	(Total of 16 to 23) Proposal from Supplier
16.	Land cost	INR Million	17	Proposal from Supplier
17.	WTG	INR Million	602.09	Proposal from Supplier
18.	Tubular Tower	INR Million	115	Proposal from Supplier
19.	Transformer	INR Million	11.36	Proposal from Supplier
20.	Civil Works	INR Million	66.16	Proposal from Supplier

[16] http://www.moneycontrol.com/stocks/stock_market/corp_notices.php?autono=391989
[17] O & M is free for first 1 year

21.	Erection and installation	INR Million	24.23	Proposal from Supplier
22.	Electrical works	INR Million	47.94	Proposal from Supplier
23.	Loan processing fee	%	0.5	As per previous loan sanction letter
24.	Term Loan	INR Million	665.59	As per previous term loan sanction letter of Bank of Baroda.
25.	Residual Value	%	10	As per MPERC Policy, May-2010
26.	Promoters Contribution	INR Million	221.86	As per previous term loan sanction letter of Bank of Baroda.
27.	Repayment Period including moratorium period	Months	78	As per previous term loan sanction letter of Bank of Baroda.
28.	Moratorium Period	Months	6	As per previous term loan sanction letter of Bank of Baroda.
29.	Service tax	%	10.30	Proposal from Supplier
30.	Composite tax	%	4.12	Proposal from Supplier
31.	Income Tax	%	30.90	Section 143 of Income Tax Act 1961
32.	Depreciation as per Income Tax Act	%	1st year: 80 2nd Year: 16 3rd Year: 3.20 4th Year: 0.80	As per Income Tax Act
33.	Project IRR	%	8.64	Calculated

The project IRR value for the project activity has been calculated for the life time of the project. The project IRR *without* CDM benefits comes to 8.64%, which is lower than the benchmark rate of 13.25%.

Thus, we can conclude that the proposed project activity cannot be considered as financially attractive. Hence, successful CDM registration of this project activity is important to make it financially attractive.

Sensitivity analysis:

The *Guidelines on the Assessment of Investment Analysis (Version- 5, EB- 62, Annex- 5, paragraph 20),* states that 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.

The different parameters that affect the viability of a wind power project as per above clause are mentioned below –

Parameters	**Comments**
Electricity Generation	*This is the most important and critical parameter for any Power Project & hence viability of the project will be affected by any fluctuation in this parameter. Sensitivity analysis has therefore been carried out for it.*
Project Cost	*This is other important and critical parameter for any Power Project & hence viability of the project will be affected by any fluctuation in this parameter. Sensitivity analysis has therefore been carried out for it.*

O & M Cost	*This does not add to 20% of either total project cost or total project revenues, even then sensitivity analysis is conducted out to show the effect on viability of the project.*
Tariff	*This is the most important and critical parameter for any Power Project & hence viability of the project will be affected by any fluctuation in this parameter. Although the PPA is signed for a period of 25 years and chances of variation are nil, still PP has considered this parameter under Sensitivity analysis.*

Outcome of Sensitivity analysis:

Sensitivity Analysis based on Electricity Generation, Project Cost and O & M Cost					
Variation	-10%	-5%	0%	5%	10%
• Electricity Generation	6.78%	7.68%	8.64%	9.57%	10.47%
• Project Cost	10.19%	9.38%	8.64%	7.96%	7.34%
• O & M Cost	9.08%	8.86%	8.64%	8.42%	8.18%
• Tariff	6.78%	7.68%	8.64%	9.57%	10.47%

From the above table it can be concluded that, if the electricity generation increased by 10%, project cost decreased by 10%, O & M cost decreased by 10% and tariff increased by 10%, financial indicator will not cross the benchmark selected by the PP. The project activity is clearly unattractive in absence of CDM income. Hence the project activity is additional.

The successful registration of the project as CDM project is imperative in order to make it financially more attractive.

Prior CDM Consideration:

As per paragraph 02 of the *Guidelines On The Demonstration And Assessment Of Prior Consideration Of The CDM (Version: 04, EB: 62, Annex: 13),* the PP has intimated to both UNFCCC & DNA on 10/02/2011 regarding intentions to seek CDM benefits for the project activity. The start date of the project activity is considered as 03/01/2011 (Purchase Order date of Wind Turbine Generators). The intimation is within six months of the project start date.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline Emissions (BE_y):

Baseline methodology for project category *I.D* has been detailed in paragraphs 10-12 of the approved small scale methodology AMS- I.D. (Version- 17, EB- 61).

As per paragraph 10,

"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."

Further, as per paragraph 11:

'*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.*'

$$BE_y = EG_{BL,y} \times EF_{CO2,grid,y}$$

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)

Further, as per paragraph 12:

'*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 t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.*

The emission factor has been estimated using option (a) above by using the following steps of "*Tool to calculate the emission factor for an electricity system*" (Version- 02.2.1, EB- 63, Annex- 19):

Step 1: Identify the relevant electricity systems

Central Electricity Authority, Ministry of Power, Government of India (Host Country) has given the delineations of the project electricity system and the connected electricity system in India. As per CEA, the Indian power system is divided into two regional grids, viz. NEWNE Grid & Southern Grid. Each grid covers several states as given in the following table. As the project activity is located in the State of Madhya Pradesh, NEWNE Grid is the relevant electricity system.

Geographical Scope of Electricity Grid System:

NEWNE Grid				Southern Grid
Northern	Eastern	Western	North-Eastern	
Delhi	Jharkhand	Gujarat	Arunachal Pradesh	Andhra Pradesh

Haryana	Orissa	Daman & Diu	Assam	Karnataka
Himachal Pradesh	West Bengal	Dadra & Nagar Haveli	Manipur	Kerala
Jammu & Kashmir	Sikkim	***Madhya Pradesh***	Meghalaya	Tamil Nadu
Punjab	Andaman-Nicobar	Maharashtra	Mizoram	Pondicherry
Rajasthan	-	Goa	Nagaland	Lakshadweep
Uttar Pradesh	-	-	Tripura	-

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

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

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

The PP has chosen "*Option I: Only grid power plants are included in the calculation"* as the grid system in India is stable enough and off-grid generation is not significant.

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

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

Out of the above options, the simple OM method (option a) is used in India. The Dispatch data analysis OM is not used as off-grid generation is not significant in India as per step 2 above. Other methods cannot be applied in India due to lack of necessary data.

As per "*Tool to calculate the emission factor for an electricity system" (Version- 02.2.1, EB- 63, Annex-19)*, 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.

As per option (1), in India most recent five years data is available with CEA. As per CEA data, the low-cost/must-run resources constitute 17.76% which is less than 50% of total grid generation.

NEWNE Grid: Share of low cost / Must- run (% of net generation)					
Year	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**
Share of low cost / Must-run (% of net generation)	17.95%	18.46%	19.04%	17.41%	15.94%

Average of most recent 5 years	17.76%
Table reference- CEA CO_2 Baseline Database (Version- 6.0, Date- March 2011)	

For the simple OM, the emissions factor is calculated using the *ex ante* option. As per this option, the emission factor has been determined once at the validation stage, thus no monitoring and recalculation of the emission factor during the crediting period is required.

As the project is a grid connected power plant, 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 has been used.

CEA has considered the CDM registered projects in the calculation of the operating margin (OM).

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

The simple OM emission factor is calculated as the generation-weighted average CO_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.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:

(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

The simple OM is calculated as per Option B below.

Option B: Calculation based on total fuel consumption and electricity generation of the system

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$\mathbf{EF}_{\mathbf{grid,\,OMsimple,y}} = \frac{\sum_i (\mathbf{FC}_{\mathbf{i,y}} \times \mathbf{NCV}_{\mathbf{i,y}} \times \mathbf{EF}_{\mathbf{CO2,i,y}})}{\mathbf{EG}_{\mathbf{y}}}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

For this approach (simple OM) to calculate the operating margin, the subscript *m* refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid. Electricity imports should be treated as one power plant *m*.

OM values have been referred from CEA Database which has referred the "*Tool to calculate the emission factor for an electricity system"*. The value of operating margin emission factor is 0.9941 tCO_2/MWh.

OM calculation has been done *ex-ante* and hence OM value will remain fixed and need not be monitored during the crediting period.

Step 5: Calculate the build margin (BM) emission factor

As per the "*Tool to calculate the emission factor for an electricity system" (Version- 02.2.1, EB- 63, Annex- 19)*, project participant can choose between one of the following two options:

Option 1: *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.*

Option 2: *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 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.*

The PP has opted for Option 1.

Capacity additions from retrofits of power plants are not included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin is determined as per below procedure:

- Identify set of five power units that have been built most recently excluding CDM registered power units; or
- Identify set of power units that comprise 20% of the system generation excluding CDM registered projects and that have been built most recently.
- Project participant should use the set of power units that comprises the larger annual generation.
- If set do not comprises any power unit older than 10 years, then use this set for build margin calculation
- If set comprises any power unit older than 10 years, then replace this power unit/s with power unit registered as CDM till set comprises 20% generation & then use this set for build margin calculation
- In case the set do not comprise 20% generation then include power units older than 10 years unit the set comprises 20% generation. Use the resulting set for build margin calculation

As per CEA, 20% net generation (GWh) & Net Generation in Build Margin (GWh) for NEWNE Grid are as follows:

20% of Net Generation (GWh)

Year	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**
20% of Net Generation (GWh)	87,575	93,072	99,224	102,139	108,983
Table reference- CEA CO_2 Baseline Database (Version- 6.0, Date- March 2011)					

Net Generation in Build Margin (GWh)

Year	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**
Net Generation in Build Margin (GWh)	87, 764	93, 524	100, 707	102,589	109,064
Table reference- CEA CO_2 Baseline Database (Version- 6.0, Date- March 2011)					

The value of BM has been referred from CEA CO_2 Baseline Database (Version- 6.0, Date- March 2011) which has been calculated by "*Tool to calculate the emission factor for an electricity system" (Version- 02.2.1, EB- 63, Annex- 19).*

As per the "*Tool to calculate the emission factor for an electricity system" (Version- 02.2.1, EB- 63, Annex- 19)*, the build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which electricity generation data is available, calculated as follows:

$$\mathbf{EF}_{\mathbf{grid,BM,y}} = \frac{\sum_{m} \mathbf{EG}_{m,y} \times \mathbf{EF}_{EL,m,y}}{\sum_{m} \mathbf{EG}_{m,y}}$$

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 value of the BM has been calculated by CEA as 0.8123 tCO_2/MWh. BM calculations has been done *ex-ante* and hence BM value will remain fixed and need not be monitored during the crediting period.

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

The 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) should be used as the preferred option. The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation; and

- The data requirements for the application of step 5 above cannot be met.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

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

Where

$EF_{grid,OM,y}$	=	Operating Margin CO_2 Emission Factor (tCO_2/MWh)
$EF_{grid,BM,y}$	=	Build Margin CO_2 Emission Factor (tCO_2/MWh)
W_{OM}	=	Weighting of operating margin emission factor (%)
W_{BM}	=	Weighting of build margin emission factor (%)

The following default values should be used for W_{OM} and W_{BM}:

- Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;

- All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period , and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period,6 unless otherwise specified in the approved methodology which refers to this tool.

Alternative weights can be proposed, as long as $W_{OM} + W_{BM} = 1$, for consideration by the Executive Board, taking into account the guidance as described below. The values for $W_{OM} + W_{BM}$ applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

The PP has opted for weighted average CM. Thus, the combined margin emissions factor is calculated as follows:

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

Where

$EF_{grid,OM,y}$ = Operating Margin CO_2 Emission Factor (tCO_2/MWh)
$EF_{grid,BM,y}$ = Build Margin CO_2 Emission Factor (tCO_2/MWh)
W_{OM} = Weighting of operating margin emission factor (%)
W_{BM} = Weighting of build margin emission factor (%)

Thus, the grid emission factor for NEWNE Grid is calculated *ex ante* as below:

$$EF_{grid,CM,y} = 0.75 \times EF_{grid,OM,y} + 0.25 \times EF_{grid,BM,y}$$
$$= 0.75 \times 0.9941 + 0.25 \times 0.8123$$
$$= 0.9486\ tCO_2/MWh$$

Baseline Emissions (BE_y):

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.

$$BE_y = EG_{BL,y} \times EF_{CO2,grid,y}$$

Project Emissions (PE_y):

As per paragraph 20 of approved methodology AMS- I.D. (Version- 17, EB- 61), *For most renewable energy project activities, PE_y = 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002.*

- *Emissions related to the operation of geothermal power plants (e.g. non-condensable gases, electricity/fossil fuel consumption)*
- *Emissions from water reservoirs of hydro power plants*

As the project activity is a wind power generation, the project emissions are considered zero.

Leakage Emissions (LE_y):

As per paragraph 22 of the approved methodology AMS- I.D. (Version- 17, EB- 61), *If the energy generating equipment is transferred from another activity, leakage is to be considered.* The leakage emissions may be considered as zero tCO_2 as no such equipment shall be transferred from another project activity.

Emission Reductions (ER_y):

The emission reductions (ER_y) are calculated as per paragraph 23 of AMS- I.D. (Version- 17, EB- 61).

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

Where

ER_y = Emission reductions in year y (tCO_2/y)
BE_y = Baseline Emission in year y (tCO_2/y)
PE_y = Project Emission in year y (tCO_2/y)
LE_y = Leakage Emission in year y (tCO_2/y)

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

Data / Parameter:	$EF_{grid,CO2,y}$
Data unit:	tCO_2 / MWh
Description:	CO_2 Emission Factor of the grid in year y
Source of data used:	CEA CO_2 Baseline Database (Version- 6.0, Date- March 2011). The value is calculated for year 2007-08, 2008-09 & 2009-10.
Value applied:	0.9486
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *CO_2 Baseline Database* is the most authentic data available in India since it has been prepared & published by Central Electricity Authority, Government of India. The $EF_{grid, CM, y}$ calculation is based on equation 13 of the '*Tool to calculate the emission factor for an electricity system*' (Version- 02.2.1, EB- 63, Annex- 19) which is given below as: $EF_{grid,CM,y} = 0.75 \times EF_{grid,OM,y} + 0.25 \times EF_{grid, BM,y}$
Any comment:	The calculation is done as *ex ante.*

Data / Parameter:	$EF_{grid, OM, y}$
Data unit:	tCO_2/MWh
Description:	Operating margin CO_2 emission factor for the project electricity system.
Source of data used:	CEA CO_2 Baseline Database, (Version- 6.0, Date- March 2011). The value is calculated for year 2007-08, 2008-09 & 2009-10.
Value applied:	0.9941
Justification of the choice of data or description of	The *CO_2 Baseline Database* is the most authentic data available in India since it has been prepared & published by Central Electricity Authority, Government of India.

measurement methods and procedures actually applied :	The $EF_{grid, CM, y}$ calculation is based on the guidelines in '*Tool to calculate the emission factor for an electricity system*' *(Version- 02.2.1, EB- 63, Annex- 19)*
Any comment:	The calculation is done as *ex ante.*

Data / Parameter:	$EF_{grid, BM, y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor for the project electricity system.
Source of data used:	CEA CO_2 Baseline Database, (Version- 6.0, Date- March 2011). The value is calculated for year 2009-10.
Value applied:	0.8123
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *CO_2 Baseline Database* is the most authentic data available in India since it has been prepared & published by Central Electricity Authority, Government of India. The $EF_{grid, CM, y}$ calculation is based on the guidelines in '*Tool to calculate the emission factor for an electricity system*' *(Version- 02.2.1, EB- 63, Annex- 19)*
Any comment:	The calculation is done as *ex ante.*

B.6.3 Ex-ante calculation of emission reductions:

The Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh) is calculated using the following parameters:

Sr. No.	Project Parameters	Details
1.	Location	Barda Barkheda, Madhya Pradesh
2.	Grid	NEWNE Grid
3.	Capacity per WTG	1.50 MW
4.	Total no. of turbines	10
5.	Total Capacity	15 MW
6.	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	25,529 MWh

Baseline Emissions (BE_y), tCO_2:

$$BE_y = EG_{BL,y} \times EF_{CO2,grid,y}$$
$$= 0.9486 \times 25,529$$
$$= 24216\ tCO_2$$

The project emissions (PE_y) & leakage emissions (LE_y) are zero as explained in Section B.6.1. Thus,

ER_y = BE_y
= 24216 tCO_2

Thus, the project activity is estimated to achieve emission reductions of 24216 tCO_2e per annum over the entire crediting period of 7 years.

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

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2012-13	0	24216	0	24216
2013-14	0	24216	0	24216
2014-15	0	24216	0	24216
2015-16	0	24216	0	24216
2016-17	0	24216	0	24216
2017-18	0	24216	0	24216
2018-19	0	24216	0	24216
Total	**0**	**169512**	**0**	**169512**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{BL,y}$
Data unit:	kWh/y
Description:	*Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y*
Source of data to be used:	*Monthly Report on Generation & Compensation*
Value of data	25,529,000
Description of measurement methods and procedures to be applied:	**Metering at site metering point:** The electricity generated by the project activity WTGs along with non-project WTGs is metered at feeder-wise site metering point/s. The metering point consists of a main meter, having accuracy of 0.2s. The respective check meter is installed at substation. These check meter is having accuracy class of 0.2s. The main meter at a given site metering point measures parameters like export & import for all the connected WTGs. The export reading for a given metering point for a given billing month is obtained by subtracting initial reading (taken in previous month) from the final reading (taken in billing month). The difference is multiplied by the applicable meter constant. Similar procedure is followed to arrive the import reading.

	The monitoring & measurement[18] of electricity at project metering point/s is being done on continuous basis; while recording is being done on monthly basis as *Joint Meter Reading* by the representatives of State Utility & PP. **Calculation of Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y:** The export & import by the project activity WTG/s connected at a given metering point is calculated by apportioning of the electricity at feeder level by the state utility. The apportioning of the electricity is based on the monthly *generation ratio* (ratio of controller reading of project activity WTG/s to the controller reading for all WTGs connected to the applicable metering point) at the given metering point and the electricity reading (export, import etc) recorded by the main meter at the given metering point on monthly basis. It gives monthly values of export & import for project activity WTG/s. The net export for any given month by the project activity WTG/s to the grid is then obtained by subtracting import from export. Thus, Net export for any given month by the project activity WTG/s to the grid = Export kWh – Import kWh The values of the monthly net electricity supplied to the Grid by the project activity WTGs are aggregated annually to get quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y i.e.* $EG_{BL,y}$. The value of $EG_{BL,y}$ is converted to MWh before the calculation of emission reductions. **Metering at substation:** The project metering point/s further evacuates the electricity to the substation. The substation provides respective feeder-wise back- up metering (check meters) facility. These check meters are having accuracy class of 0.2s. The monthly JMR is taken by the representative of PP & State Utility.
QA/QC procedures to be applied:	The meters shall be approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration will be annual. The monthly electricity supplied/exported by the project activity in the JMR report will be cross checked with the monthly invoices of sale. In the absence of the meter calibration— *Guidelines For Assessing Compliance With The Calibration Frequency Requirements* will be applied appropriately to confirm the conservativeness of metering.
Any comment:	Data will be archived in paper & electronic form for two years after the end

[18]The meters are capable of measuring the electricity parameters (export, import etc.) on real time basis. It complies the hourly measurement requirement as per the monitoring methodology.

	of crediting period or of the last issuance of CERs for this project activity, whichever occurs later.

B.7.2 Description of the monitoring plan:

Monitoring of the project activity:

The monitoring of the project activity is given as below:

Metering at site metering point:

- The electricity generated by the project activity WTGs along with non-project WTGs is metered at feeder-wise site metering point/s. The metering point consists of a main meter, having accuracy of 0.2s. The respective check meter is installed at substation. These check meter is having accuracy class of 0.2s.
- The main meter at a given site metering point measures parameters like export & import for all the connected WTGs. The export reading for a given metering point for a given billing month is obtained by subtracting initial reading (taken in previous month) from the final reading (taken in billing month). The difference is multiplied by the applicable meter constant. Similar procedure is followed to arrive the import reading.
- The monitoring & measurement of electricity at project metering point/s is being done on continuous basis; while recording is being done on monthly basis as *Joint Meter Reading* by the representatives of State Utility & PP.

Calculation of Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y:

- The export & import by the project activity WTG/s connected at a given metering point is calculated by apportioning of the electricity at feeder level by the state utility. The apportioning of the electricity is based on the monthly generation ratio (ratio of controller reading of project activity WTG/s to the controller reading for all WTGs connected to the applicable metering point) at the given metering point and the electricity reading (export, import etc) recorded by the main meter at the given metering point on monthly basis. It gives monthly values of export & import for project activity WTG/s. The net export for any given month by the project activity WTG/s to the grid is then obtained by subtracting import from export. Thus,

  Net export for any given month by the project activity WTG/s to the grid = Export kWh – Import kWh

- The values of the monthly net electricity supplied to the Grid by the project activity WTGs are aggregated annually to get quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y i.e.* $EG_{BL,y}$.
- The value of $EG_{BL,y}$ is converted to MWh before the calculation of emission reductions.

Metering at substation:

- The project metering point/s further evacuates the electricity to the substation. The substation provides respective feeder-wise back- up metering (check meters) facility. These check meters are having accuracy class of 0.2s. The monthly JMR is taken by the representative of PP & State Utility.
- The meters shall be approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration will be annual. The monthly electricity supplied/exported by the project activity in the JMR report will be cross checked with the monthly invoices of sale. In the absence of the meter calibration— *Guidelines For Assessing Compliance With The Calibration Frequency Requirements* will be applied appropriately to confirm the conservativeness of metering.
- Data will be archived in paper & electronic form for two years after the end of crediting period or of the last issuance of CERs for this project activity, whichever occurs later.

Sample Apportioning Procedure:

The apportioning of the electricity is the responsibility of the State Utility. The sample apportioning procedure adopted for any given WTG for any given month is given below:

Generation Ratio at site metering point:

The generation ratio is the ratio of controller reading of project activity WTG/s to the controller reading for all WTGs connected to the applicable metering point.

$$\mathbf{G_{R,\ metering\ point} = EG_{Controller,\ WTG} / EG_{Controller,\ metering\ point}} \quad (a)$$

Where:

$G_{R,\ metering\ point}$	:	Generation Ratio at metering point
$EG_{Controller,\ WTG}$	:	Electricity generated by installed WTG of PP connected to the applicable metering point
$EG_{Controller,\ metering\ point}$	:	Total generation by all the connected WTGs to the applicable metering point

Calculation of net electricity export by project activity WTG/s to the grid:

The main meter at the applicable metering point measures number of parameters including export and import for all the connected WTGs.

The import, kWh by the project WTG at the metering point is calculated in the following manner:

$$\mathbf{Import,\ kWh = G_{R,\ metering\ point} \times EG_{Total\ Import,\ metering\ point}} \quad (b)$$

Where:

$G_{R,\ metering\ point}$	:	Generation Ratio at metering point
$EG_{Total\ Import,\ metering\ point}$	:	Total Import, kWh by all the WTGs at the metering point

The export, kWh by the project WTG at the metering point is calculated in the following manner:

$$\textbf{Export, kWh} = G_{R,\text{ metering point}} \times EG_{\text{Total Export, metering point}} \quad \text{(c)}$$

Where:

$G_{R,\text{ metering point}}$: Generation Ratio at metering point
$EG_{\text{Total Export, metering point}}$: Total Export, kWh by all the WTGs at the metering point

The net electricity supplied/exported by the by project activity WTG/s to the grid is calculated by subtracting equation (b) from (c). Thus:

$$= \textbf{Export, kWh – Import , kWh} \quad \text{(d)}$$

These apportioned values viz import, export and net export kWh can be referred from the *Monthly Report on Generation & Compensation.*

Operation & Maintenance of the Project:

Suzlon is providing O & M services to the project promoter. Following services are provided by Suzlon:

Routine Maintenance Services:

Routine maintenance labour work involves making available suitable manpower for operation and maintenance of the equipment and covers periodic preventive maintenance, cleaning and upkeep of the equipment including –

- Tower torquing
- Blade cleaning
- Nacelle torquing and cleaning
- Transformer oil filtration
- Control panel & LT panel maintenance
- Site and transformer yard maintenance

Security Services:

This service includes watch and ward and security of the wind turbines and the equipment.

Management Services:

- Data logging for power generation, grid availability, machine availability.
- Preparation and submission of monthly performance report in agreed format.
- Taking monthly meter reading jointly with utility of power generated at promoter's wind turbines and supplied to grid from the meter/s maintained by utility for the purpose and co-ordinate to obtain necessary power credit report/ certificate**.**

Technical Services:

- Visual inspection of the WTGs and all parts thereof.
- Technical assistance including checking of various technical, safety and operational parameters of the equipment, trouble shooting and relevant technical services

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: 01/12/2011

Name of person/entity determining the baseline:

M/s. Giriraj Enterprises

Prafulla Khinvasara
M/s. Giriraj Enterprises
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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:

03/01/2011 (Date of Purchase Order of Wind Turbine Generators)

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

20 years and 0 months

[19] M/s MITCON Consultancy & Engineering Services Ltd. is not the project participant listed in Annex 1.

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

The project activity has chosen renewable crediting period.

C.2.1. Renewable crediting period

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

The starting date of the crediting period shall be 01/04/2012 or date of submission for registration whichever is later.

C.2.1.2. Length of the first crediting period:

7 years and 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not Applicable

C.2.2.2. Length:

Not Applicable

SECTION D. Environmental impacts

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

The guidelines on Environmental Impact Assessment have been published by Ministry of Environment and Forests (MoEF), Government of India (GOI) under Environmental Impact Assessment notification 14/09/2006[20]. Further amendments to the notification have been done on 01/12/2009[21]. As per the notification:

"*The following projects or activities shall require prior environmental clearance from the concerned regulatory authority, which shall hereinafter referred to be as the Central Government in the Ministry of Environment and Forests for matters falling under Category 'A' in the Schedule and at State level the State Environment Impact Assessment Authority (SEIAA) for matters falling under Category 'B' in the said Schedule, before any construction work, or preparation of land by the project management except for securing the land, is started on the project or activity:*

(i) All new projects or activities listed in the Schedule to this notification;

[20] EIA Notification 2006: http://envfor.nic.in/legis/eia/so1533.pdf
[21] EIA Amended Notification dated 01/12/2009: http://moef.nic.in/downloads/rules-and-regulations/3067.pdf

(ii) Expansion and modernization of existing projects or activities listed in the Schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, that is, projects or activities which cross the threshold limits given in the Schedule, after expansion or modernization;

(iii) Any change in product - mix in an existing manufacturing unit included in Schedule beyond the specified range."

As the wind power generation projects are not listed in any of the categories of the schedule, it does not require Environmental Impact Assessment.

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:

Wind energy projects are considered environmentally safe and as per Host party- India no EIA is required.

SECTION E. Stakeholders' comments

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

The details stakeholder consultation meeting for the project activity are as follows:

- Date of meeting : 02/02/2011
- Place of meeting : Suzlon CMS Centre at Mahuria site, District: Shajapur

The stakeholder meeting was arranged at the Mahuria site to invite comments from the stakeholders on the project activity. The stake holders were invited by Public Notice dated 17/01/2011 & personal invitation letters. The meeting was coordinated by Suzlon Energy Limited. On behalf of the PP, Suzlon welcomed the people present at the meeting & explained them the purpose of the meeting. They were then explained the benefits of wind power projects as a source of renewable and clean power comparing it with conventional sources of power generation in India. The stakeholders were then briefed regarding the climate change – its effects & remedies. They were then explained how wind projects contribute in reducing the global warming.

Comments from the stakeholders were then invited. After satisfying the queries, the meeting ended with Suzlon & PP giving vote of thanks to the villagers for their time, effort & support to the project activity.

E.2. Summary of the comments received:

After giving a brief description about the project activity, the comments from stakeholders were invited in the meeting. The queries by stakeholders and their responses are summarized below.

One of elderly & respected villager, *Thakursaheb*, expressed satisfaction about the project activity for bringing development & employment opportunities in their area. He ensured PP that the project activity will have full support from the village.

Another stakeholder, *Mr. Giriraj*, pointed out that the project activity will also reduce voltage problem of the village. One of the villagers queried if the electricity produced by the project can be supplied to the village. To this, Suzlon answered that once the electricity is fed to the grid, the state utility decides where to send it further.

All the present villagers acknowledged the importance of project activity in giving international recognition to their area which was previously hardly known.

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

No negative comments were received on the project activity, so no additional measures are required by the PP.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
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Salutation:	Mr.
Last Name:	Khinvasara
Middle Name:	
First Name:	Prafulla
Department:	-
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Direct FAX:	-
Direct tel:	-
Personal E-Mail:	-

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project activity is not availing any public funding.

Annex 3

BASELINE INFORMATION

The baseline is explained under section B.6.

Annex 4

MONITORING INFORMATION

The monitoring information is detailed under section B.7

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