Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Wind based power generation by Panama Wind Energy Private Limited in Maharashtra, India
Version number of the PDD	2.0
Completion date of the PDD	14/08/2015
Project participant(s)	Panama Wind Energy Private Limited
Host Party	India
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral scope: 01 Selected Methodology: ACM0002 "Consolidated baseline methodology for grid connected electricity generation from renewable sources. (Version 12.3.0)
Estimated amount of annual average GHG emission reductions	186,270 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The purpose of project activity:

The purpose of the project activity is to generate power using renewable energy source (wind) and sell the power generated to the state grid. The proposed 100.8 MW wind power project is also known as Project Sky. The project activity uses Wind Turbine Generators (WTGs) manufactured by General Electric (GE). The project activity generates electricity using wind potential and converts it into kinetic energy using Wind turbines, which drives the alternators to generate energy. The generated electricity is exported to the regional grid system which is under the purview of the NEWNE grid of India. The project aims to install 100.8 MW by March 2012. The project is planned to be installed in four phases[1]. The project implementation schedule is given as below:

Expected Commissioning date	No. of days	Capacity (MW)
31.12.2011	92	19.2
31.01.2012	61	25.6
29.02.2012	32	25.6
31.03.2012	1	30.4
TOTAL		100.8

The power produced displaces an equivalent amount of power from the grid, which is fed mainly by fossil fuel fired power plants. Hence, it results in reduction of GHG emissions. The net average annual power generation is 196.363 GWh/annum from the project and the average emission reduction achieved annually is 186,270tCO2/annum. Emission sources and gases are described in section B.3 below. Monitoring equipment and location is described in section B.7 below.

Baseline scenario:

Since the project activity is a the installation of a new grid connected renewable power plant hence in the baseline scenario the electricity delivered to the grid by the project activity would have otherwise been generated in the grid connected power plant. The baseline scenario and pre-project scenario is same for this project activity.

The project scenario:

The project activity consist of setting up of wind turbine generators (WTG) of a total capacity of 100.8 MW (1.6 MW X 63 Nos) in Satara district Maharashtra by Panama Wind Energy Private Limited.

The annual Green House Gas (GHG) emission reduction through this 100.8 MW wind farm project is estimated to be 186,270 tonnes of CO2 equivalent per annum.

Contribution of the project activity to sustainable development:

The project activity contributes to the sustainable development goals of the host country in the following ways:

- **Social well-being:** The project activity generates clean power, without emitting any GHGs during its operations. Hence, it leads to a cleaner environment, reducing the adverse impacts of GHG emissions on the people. It also reduces a part of the energy deficit being faced by the country.

- **Economic well-being:** The project activity generates additional employment as people are required for its operations, manufacture, etc. The project attracts new industries

[1] As per the project schedule provided by GE to PWEPL dated 17.02.2011.

due to the availability of electricity and improvement in grid frequency and economic activities like cottage industries, shops, hotels etc. to be setup in the area thereby resulting in more local employment, ultimately leading to overall development.

- **Environmental well-being:** The electricity generated shall replace an equivalent amount of electricity from the respective state grids, which are mainly supplied by fossil fuel fired power plants. Generation of electricity by WTGs does not result in any type of GHG emissions, leading to a cleaner environment.

- **Technological well-being:** The generation of electricity by the project activity will improve availability of electricity to the NEWNE grid and also it will provide more opportunities for industries to invest in such cleaner technologies.

A.2. Location of project activity

A.2.1. Host Party

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India

A.2.2. Region/State/Province etc.

>>
State: Maharashtra

A.2.3. City/Town/Community etc.

>>
District: Satara

A.2.4. Physical/Geographical location

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Project Sky is located in the state of Maharashtra, within the Satara district, about 350 kms to the south of Mumbai. Approach roads are available from Bangalore-Pune National Highway no 4, from Pune 165 km to Karad and a further 45km up to the project site at Sahayadri via the Karad – Patan state highway. The precise geo-coordinates of the WTGs are as follows:

Sr. No	Location No	Coordinate in Lat/Long		Date of Commissioning
		Latitude	Longitude	
1	Location No 1	N17 17 42.4	E73 46 33.3	Yet to commission
2	Location No 2	N17 17 51.2	E73 46 32.5	
3	Location No 3	N17 17 59.8	E73 46 32.3	
4	Location No 21	N17 18 19.7	E73 47 02.1	
5	Location No 24	N17 18 36.8	E73 46 59.5	
6	Location No 29	N17 19 08.7	E73 47 31.3	
7	Location No 30	N17 19 09.1	E73 47 48.7	
8	Location No 33	N17 19 18.1	E73 47 27.0	
9	Location No 35	N17 18 59.5	E73 47 54.8	
10	Location No 36	N17 19 06.7	E73 48 09.0	
11	Location No 44	N17 19 00.2	E73 48 37.4	
12	Location No 53	N17 18 40.9	E73 48 53.1	
13	Location No 54	N17 18 48.5	E73 48 57.0	
14	Location No 59	N17 18 32.6	E73 49 17.6	
15	Location No 60	N17 18 40.6	E73 49 20.4	
16	Location No 39	N17 19 50.4	E73 48 40.3	
17	Location No 57	N17 19 12.7	E73 49 08.7	

18	Location No 58	N17 19 22.7	E73 49 15.5	
19	Location No 4	N17 18 18.2	E73 47 19.8	01/01/2014
20	Location No 5	N17 19 52.2	E73 48 58.8	02/07/2013
21	Location No 6	N17 19 37.4	E73 48 50.2	02/07/2013
22	Location No 7	N17 18 56.2	E73 49 19.9	02/07/2013
23	Location No 8	N17 18 43.3	E73 46 48.0	22/04/2013
24	Location No 9	N17 18 49.6	E73 46 37.0	22/02/2013
25	Location No 10	N17 18 56.3	E73 46 42.8	22/02/2013
26	Location No 11	N17 19 02.3	E73 46 49.5	22/02/2013
27	Location No 12	N17 19 09.8	E73 46 53.0	22/02/2013
28	Location No 13	N17 19 16.1	E73 46 59.4	22/02/2013
29	Location No 14	N17 19 22.5	E73 47 05.5	10/05/2013
30	Location No 15	N17 19 28.6	E73 47 12.8	06/03/2013
31	Location No 16	N17 19 34.8	E73 47 19.5	22/04/2013
32	Location No 17	N17 19 39.8	E73 47 28.0	10/05/2013
33	Location No 18	N17 19 00.7	E73 49 33.5	28/05/2013
34	Location No 19	N17 19 30.8	E73 47 35.6	06/03/2013
35	Location No 20	N17 19 36.6	E73 47 45.0	22/04/2013
36	Location No 22	N17 18 26.1	E73 47 14.7	28/05/2013
37	Location No 23	N17 18 27.7	E73 47 27.0	28/05/2013
38	Location No 25	N17 18 45.3	E73 47 00.6	06/03/2013
39	Location No 26	N17 18 53.0	E73 47 04.7	10/05/2013
40	Location No 27	N17 18 59.8	E73 47 10.7	06/03/2013
41	Location No 28	N17 19 06.7	E73 47 18.1	06/03/2013
42	Location No 31	N17 18 56.4	E73 50 01.9	13/06/2013
43	Location No 32	N17 18 33.6	E73 48 31.8	26/10/2013
44	Location No 34	N17 18 10.1	E73 47 24.3	28/05/2013
45	Location No 37	N17 18 41.0	E73 48 37.3	28/05/2013
46	Location No 38	N17 19 44.8	E73 47 37.7	22/04/2013
47	Location No 40	N17 19 39.7	E73 48 33.6	13/02/2014
48	Location No 41	N17 19 44.9	E73 48 56.0	28/05/2013
49	Location No 42	N17 19 31.8	E73 49 09.3	07/07/2013
50	Location No 43	N17 18 54.7	E73 47 25.7	22/04/2013
51	Location No 45	N17 19 08.6	E73 48 40.5	13/06/2013
52	Location No 46	N17 19 16.4	E73 48 43.0	28/05/2013
53	Location No 47	N17 19 19.9	E73 48 52.8	13/06/2013
54	Location No 48	N17 19 27.6	E73 48 59.3	13/06/2013
55	Location No 49	N17 18 50.6	E73 47 56.6	01/01/2014
56	Location No 50	N17 18 20.0	E73 48 54.6	13/02/2014
57	Location No 51	N17 18 25.2	E73 48 47.2	13/02/2014
58	Location No 52	N17 18 31.6	E73 48 53.1	01/01/2014
59	Location No 55	N17 18 57.1	E73 49 02.3	28/05/2013
60	Location No 56	N17 19 04.4	E73 49 07.2	01/01/2014
61	Location No 61	N17 18 48.5	E73 49 22.2	07/07/2013
62	Location No 62	N17 18 49.0	E73 49 40.0	01/01/2014
63	Location No 63	N17 18 52.9	E73 49 51.8	28/05/2013

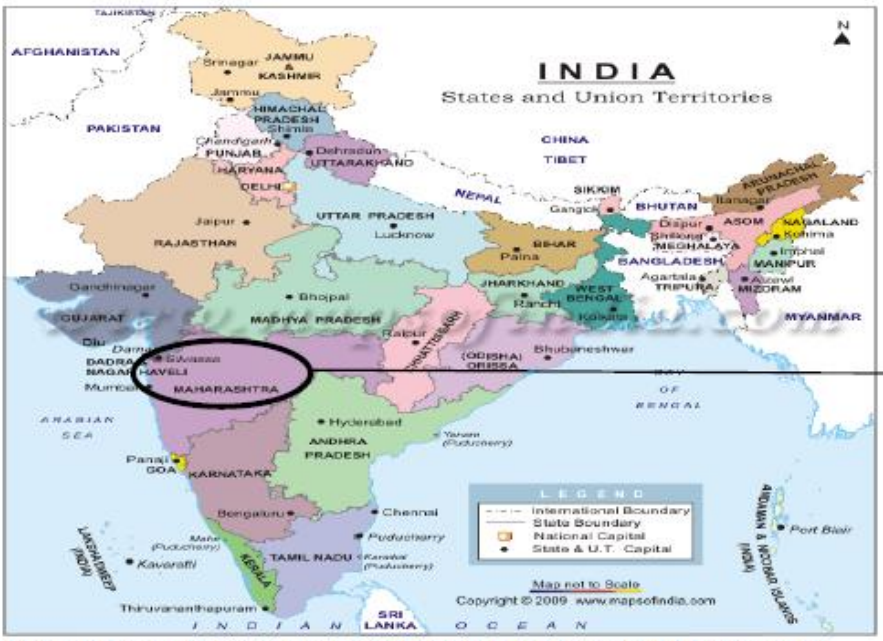

Fig 1: Map of India indicating the location of state of Maharashtra

Fig 2: District map of state of Maharashtra

A.3. Technologies and/or measures

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The project activity involves WTG supplied by GE. The WTGs are GE XLE 1.6 MW machines. The WTGs implemented in this project have been supplied by GE as complete unit without any technology transfer. The post implementation operation and maintenance will be carried out by GE. It is to be noted that unlike other conventional wind projects, the roles and responsibilities of WTG supplier is different in the present project activity. GE is responsible for supply, erection & commissioning of the WTG, O&M of the WTGs. However, the activities like site identification, wind assessment, construction of power evacuation facility, land acquisition, project feasibility study, due-diligence, obtaining necessary clearances for the wind project are being carried out and executed by Panama Wind Energy Private Limited. The Project activity utilises the velocity of the wind in the atmosphere for power generation by using of WTGs. The WTG incorporates advanced load controls which reduces the loads on the blades and other mechanical components to allow increased power production while maintaining a 20 year[2] design life. The plant load factor is 22.238%. Power generated by the WTGs of each site is monitored in the feeder meters located at

[2] GE fact sheet submitted to PWEPL.

sub-station. There are 4 feeders dedicated for WTGs covered under this project activity only. Pair of check meters and main meters is provided at each of the four feeders. The main meter reading at the 4 feeders at sub-station is jointly undertaken by MSEDCL and project proponent representatives. In case of any connectivity issues, manual reading at the WTG data display system is done. Monthly data is compiled and stored electronically.

The technical details of the WTG are as follows[3]

Rotor:	
Diameter	82.5 m
Number of blades	3
Swept area	5346m2
Rotor speed range	9-18 rpm
Rotational direction	Clockwise looking downwind
Maximum tip speed	77.2 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering
Pitch System:	
Principle	Independent blade pitch control
Actuation	Individual electric drive
Yaw System:	
Yaw rate	0.5 degree/s

Wind energy based power generation from WTG is a proven technology and there is neither any emission nor any significant noise pollution from these WTGs. The wind mills have been supplied by GE who is the pioneers of wind energy in India. Hence the technology used in the project activity is environmentally sound and safe. The project activity comprises of 63 WTGs with an installed capacity of 100.8 MW. Power generated by the WTGs is collected at 33 kV and fed to pooling (sub) station near Nerale Village (8 kms away), where it is stepped up to 220 kV (national grid). The pooling station itself is then connected to existing 2X220 kV single circuit lines (750m away) from Koyana (Pophali) to Karad and Pedambe to Karad.

Since the project activity is a the installation of a new grid connected renewable power plant hence in the baseline scenario the electricity delivered to the grid by the project activity would have otherwise been generated in the grid connected power plant. The baseline scenario and pre project scenario is same for this project activity

A.4. Parties and project participants

Party involved (host) indicates 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	Private entity Panama Wind Energy Private Limited	NO

A.5. Public funding of project activity

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No public funding from Annex I Party is involved in this project activity.

[3] Source: Technical documentation of WTG supplied by GE.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Title: ACM0002: Consolidated baseline methodology for grid connected electricity generation from renewable sources.
Reference: Version 12.3.0, EB 66 (valid from 17th September 2010)[4]

The following tools have been used for the project activity under consideration –

- **Tool to calculate emission factor for an electricity system[5]**

Reference: Version 02.2.1/EB – 63, Annex 19

- **Tool for the demonstration and assessment of additionality[6]**

Reference: Version 06.0.0, EB- 65, Annex 21

B.2. Applicability of methodology and standardized baseline

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Applicability Conditions in the ACM0002/Version12.3.0	Applicability to this project activity
This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The project activity consists of installation of new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity. Thus, it meets the said applicability condition.
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The project activity is the installation of 63 numbers of wind turbine generators (WTGs). Hence, meets this criterion.
In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or units(s) is not affected : the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	The project activity does not involve capacity additions. Hence this criterion is not applicable to the project activity.

[4] http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT

[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

• In case of hydro power plants, At least one of the following conditions must apply: o The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; Or o The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity; or The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity.	The project activity is not a hydro power plant. Hence this applicability criterion is not relevant to the project activity.
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 after the implementation of the project activity all of the following conditions must apply: o The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2; o All reservoirs and hydro power plants are located at the same river and were designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; o The water flow between the multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; o The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 W/m^2, is lower than 15 MW; o The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.	The project activity is not a hydro power plant. Hence this applicability criterion is not relevant to the project activity.

The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the reservoir is less than $4W/m^2$.	Project activity does not involve: • Switching from fossil fuels to renewable energy sources at the site of the project activity. • Biomass fired plants. • Construction of new reservoir or increase in an existing reservoir. Hence this criterion is not applicable.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The project is not a retrofit, replacements or capacity addition; hence this applicability criterion is not relevant.
In addition, the applicability conditions included in the tools referred to above apply.	Applicability conditions of the applied tool are justified

From the above it is concluded that the project activity meets all the applicability conditions of the methodology ACM0002 version 12.3.0 "Consolidated baseline methodology for grid connected electricity generation from renewable sources".

The project activity also meets the following applicability conditions of "Tool to calculate the emission factor for an electricity system".

Sl No	Applicability condition	Applicability to this project activity
1	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand side energy efficiency projects).	The project activity substitutes grid electricity by supplying power to grid. Hence this criterion is applicable.
2	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Since the project electricity system is not located partially or totally in Annex I country hence this criterion is not applicable.

The project activity also meets the applicability conditions given in "Tool for the demonstration and assessment of additionality".

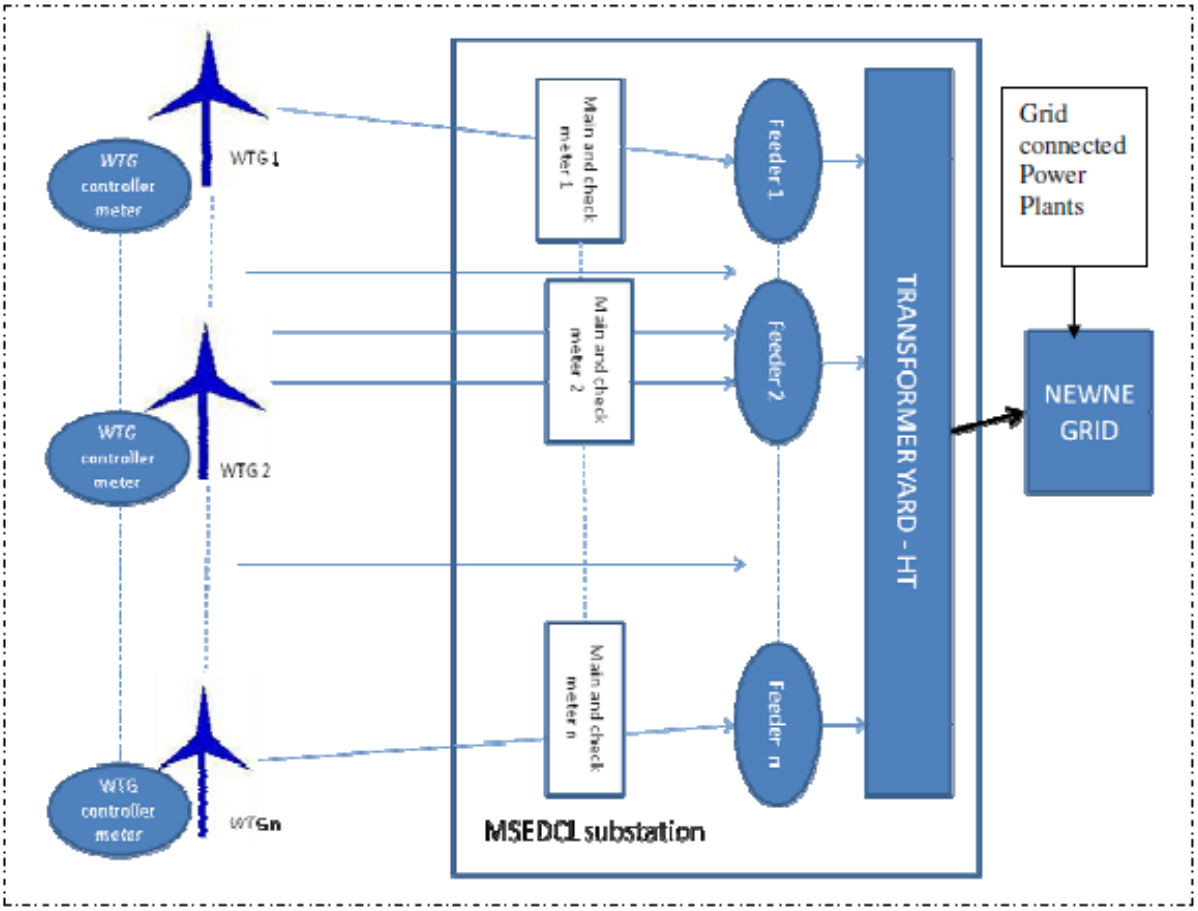
Other tools mentioned in the methodology are not applicable for this project activity.

B.3. Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project scenario	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	As per ACM 0002 project emissions are not considered for wind power project.
		CH_4	No	As per ACM 0002 project emissions are not considered for wind power project.
		N_2O	No	As per ACM 0002 project emissions are not considered for wind power project.
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	As per ACM 0002 project emissions are not considered for wind power project.
		CH_4	No	As per ACM 0002 project emissions are not considered for wind power project.
		N_2O	No	As per ACM 0002 project emissions are not considered for wind power project.
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	As per ACM 0002 project emissions are not considered for wind power project.
		CH_4	No	As per ACM 0002 project emissions are not considered for wind power project.
		N_2O	No	As per ACM 0002 project emissions are not considered for wind power project.

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 is graphically represented below[7]:

[7] Main meter and check meters are located at each of the four feeders.



B.4. Establishment and description of baseline scenario

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As per the approved consolidated methodology ACM 0002,

If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

The project activity involved setting up of WTGs to harness the power of wind to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the state grid (part of NEWNE regional grid), which is fed mainly by fossil fuel fired plants. In the absence of the project activity, the equivalent amount of power would have been drawn from the state grid. Hence, the baseline for the project activity is the equivalent amount of power from the NEWNE regional grid.

For determining the baseline emissions, the tool to calculate the emission factor for an electricity system has been used.

As per ACM 0002, baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by

existing grid- connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr)

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

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The key parameters used for emission reduction calculations are as follows:

Parameter	NEWNE grid (tCO_2/ MWh)
OM, Operating Margin – weighted generation	0.9941
BM, Build Margin	0.8123
CM, Combined Margin	0.9486

Determination of emission factor figures have been calculated and provided in section B.6.1. of this PDD.

B.5. Demonstration of additionality

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

As per the selected methodology ACM0002, the project developer is required to establish that the GHG emission reductions due to the project activity are additional to those that would have occurred in the absence of the current project activity as per the "Tool for the demonstration and assessment of additionality" (Version 06.0.0, EB 65, Annex 21) by employing following steps:

Step 1: Identification of alternatives to the project activity

Step 2: Investment analysis to determine that the proposed project activity is either: 1) not he most economically or financially attractive, or 2) not economically or financially feasible;

Step 3 Barrier analysis; and

Step4. Common Practice analysis.

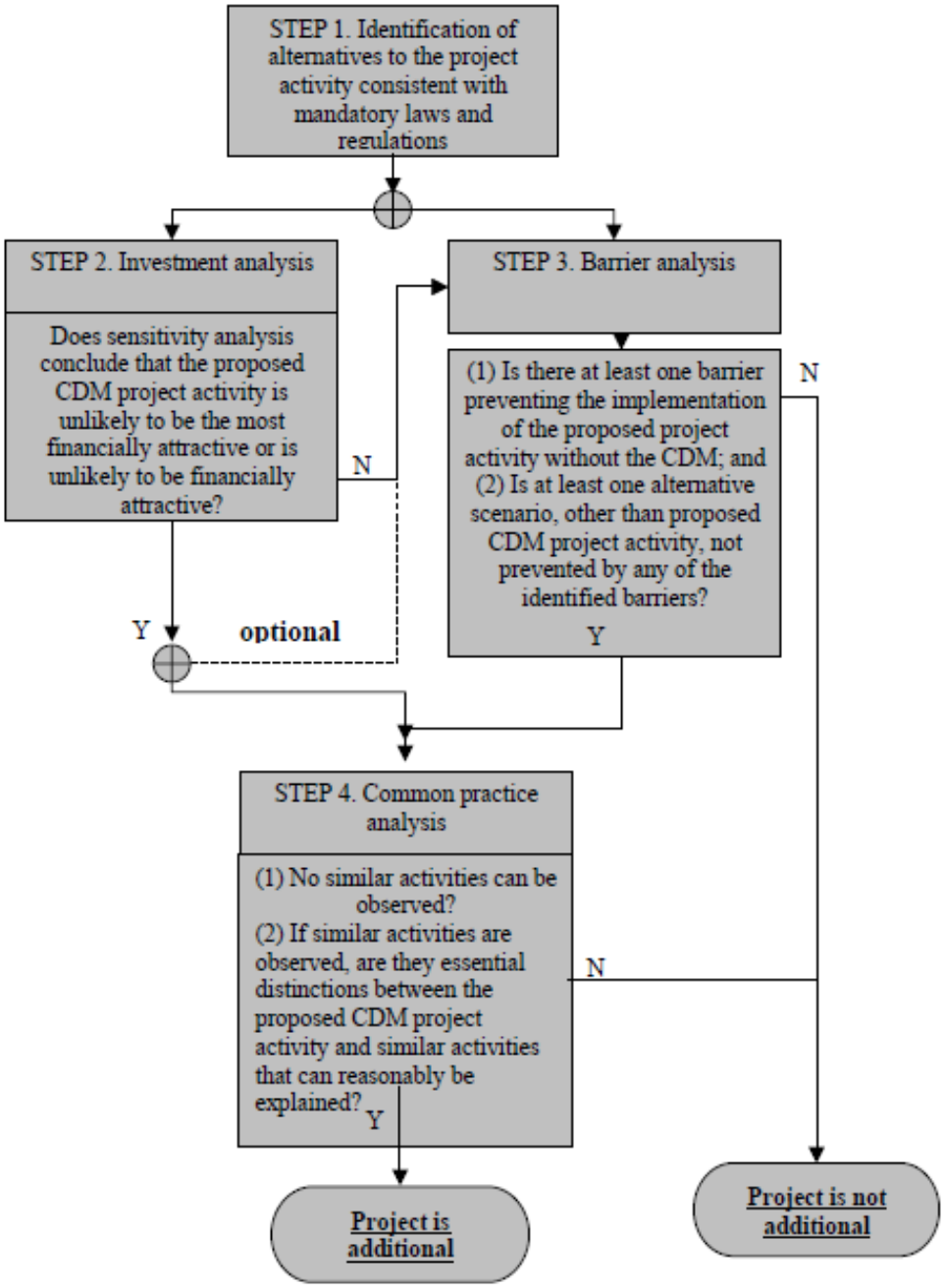


Figure 6 Tool for Demonstration of additionality

Step1. Identification of alternatives to the project activity consistent with current laws and regulations

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

The following potential alternative(s) were identified to the project activity:

Sub-step 1a: Define alternatives to the project activity
The following paragraphs illustrate the alternatives:

Alternative 1- Implementation of the project activity not undertaken as a CDM project activity;

In this alternative, project activity is connected to the Maharashtra State Electricity Distribution Company Limited (MSEDCL) NEWNE grid. Since the project activity has no project emissions, this alternative would not generate carbon dioxide. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

The project proponents may implement the project activity in the state of Maharashtra to generate and sell power to respective State Electricity Boards. This alternative may be a part of the baseline. However this alternative is a financially less attractive alternative, which is demonstrated in the later sections. The investment analysis has been conducted as per Step 2: Investment analysis of the "Tool for the demonstration and assessment of additionality".

Alternative 2- No project activity; Continuation of current situation

In this alternative, project activity is not implemented resulting in the continued current grid mix of NEWNE grid.

In Alternative 2 i.e. in absence of the project activity, an equivalent amount of electricity would be generated by the power plants comprising the NEWNE grid, which are predominantly thermal. An equivalent amount of carbon dioxide would be generated at the thermal power generation end. It is evident from the table below that the share of thermal power in the NEWNE grid and also in the states of Gujarat and Maharashtra is high when compared to hydro and Renewable Energy Sources (RES). Thus it is very clear grid power forms a plausible alternative (baseline) for this project activity.

Table B.2 Installed capacities from various sources as on 31/12/2010[8]

State	Hydro	Thermal				Nuclear	RES
		Coal	Gas	Diesel	Total		
Maharashtra	3331.84	12203.05	3475.93	0	15678.98	690.14	2573.88

This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline. This scenario was the status quo of the existing facility before CDM project implementation.

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

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

[8] http://www.cea.nic.in/reports/planning/power_scenario.pdf

- Electricity generation from wind farm is not a legal requirement or a mandatory choice. There are states and sectoral policies which are primarily framed to encourage wind based power project to attract more private investment as there are many anticipated risks under the project and requires good amount of equity to be involved.
- The Indian Electricity Act of 2003 does not restrict or empower any authority to restrict the fuel choice for power generation. In addition, it may be noted that the draft National Electricity Policy (revised in August2004) asserts 'coal would necessarily continue to remain the major fuel'.
- The applicable environmental regulations do not restrict the use of wind energy for power generation.

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

Step2: Investment Analysis
Determine whether the proposed project activity is 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). To conduct the investment analysis, the following sub-steps were used:

Sub-step 2a: Determine appropriate analysis method
Since the project activity shall generate financial income from sale of power to the grid, we shall rule out Option I (simple cost analysis) and apply either Option II (Investment comparison analysis) or Option III (Benchmark analysis).
As per "***Guidelines on the Assessment of Investment Analysis***" version-05, (EB 62, Annex 5) guidance 19 "*The benchmark approach is suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest*".
As there is no alternative baseline for the project activity and the project proponent is left the option to invest or not to invest. Hence, Option III (Benchmark analysis) is selected as the appropriate method for demonstration of Investment analysis.

Sub-step 2b: Option III - Apply Benchmark analysis
PWEPL has used benchmark analysis to compare the financial returns from the project activity against the standard market returns based on risk and location of project activity. Project IRR is a widely accepted financial indicator used by many corporations and financial institutions for investment decision- making and is a long-established benchmark for investment decisions in the Indian power sector. Moreover the project activity is funded by debt and equity both, hence project IRR has been chosen as the most appropriate financial indicator for the project type and decision making context. A post tax IRR analysis has been done for demonstration of additionality for the project activity.

As per 'Guidance on the Assessment of Investment Analysis' **para 12**, "In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR".

In line with the above mentioned guidelines, PP has considered WACC as a benchmark for the project activity. The benchmark in this case comes out to be 12.18%, as shown below

$$WACC = \frac{E}{V} * Re + \frac{D}{V} * Rd * (1 - Tc)$$

Where,
E/V – Equity component of the project cost

D/V- Debt component of the project cost
Re- Return on equity
Rd- Cost of debt
Tc-Corporate tax

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

Calculation of benchmark:

Estimation of Required Rate of Return:

The para 13 of the Guidance also suggests that in cases where the project can be developed by an entity other than the project participant, the benchmark should be based on parameters that are standard in the market is suitable in the context of the underlying project activity.

Considering the above, the project participant has considered the benchmark based on equity indices. The Cost of equity has been estimated based on Capital Asset Pricing Model (CAPM). As per the model, Cost of Equity or Required Return on Equity can be estimated as below –

Re = Rf + Beta x (Market Return – Rf) Where,
Re = Cost of equity
Rf = Risk free return

The Capital Asset Pricing Model (CAPM) is a well-accepted methodology for estimating the expected return on equity. As per CAPM, the required return on equity investment is risk free return plus beta times the difference between market return and risk free return. CAPM is based on the portfolio theory of finance in which risks are classified into:

- Systematic Risk: Risk applicable to the market as a whole, such as inflation, tax rises, interest rates, etc.
- Specific Risk: Residual risk unique to an individual firm or a small group of companies that form a subset of the market.

Hence, CAPM is the relationship between risk and return. Therefore, CAPM can highlight the relationship between the overall market scenario and its effect on an individual or group of companies.

Risk Free Return:
The risk free rate of return is a benchmark figure against which all the investments in an economy should be measured. In India, RBI is the most appropriate public source for data on Government bonds. Central government securities have been considered for the assessment of Yield to Maturity (YTM). YTM for 20 years maturity period has been used for risk free return considering the life time of 20 years of the project activity. The value for risk free return published in January 2011 was 8.392%[9]. This was the latest value available at the time of investment decision.

Risk Premium:
The market risk premium, as measured and applied in practice is the premium above the risk free rate that investors expect to earn on a portfolio of equities. Equity indices are indicator of expected market return. With a view to eliminating the unsystematic risk associated with the projects totally, index containing 500 companies has been taken to represent the market return. A period starting since Feb 1999 to January 2011 has been considered to remove the impact of short term volatility.

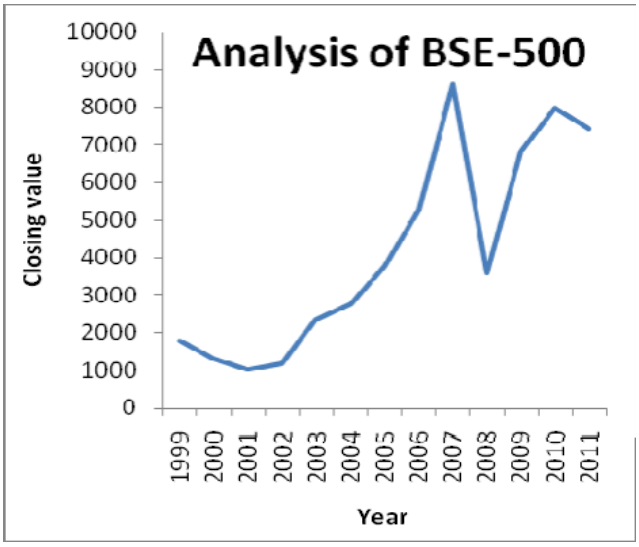
Justification for suitability of selection of BSE 500 as index:-
Bombay Stock exchange (BSE) is one of the largest stock exchanges in Asia and has the largest number of listed companies in the world. There are thousands of companies listed at the stock exchange and they are divided into different categories depending on various factors including

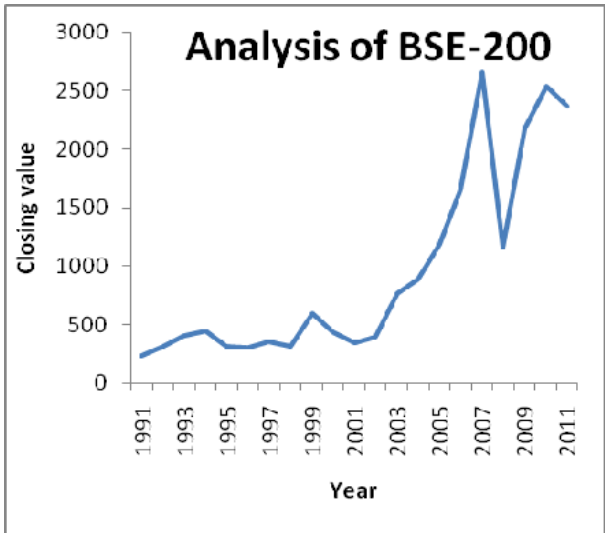
[9] http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/26CT_BUL070111.pdf

market capitalization, parameters set by the Securities and Exchange Board of India or the SEBI, number of years of listing at the exchange, equity capital of the company, liquidity of the company and so many other factors. Depending upon the market capitalization stock indices are broadly divided into six categories –

SENSEX, MIDCAP, SMLCAP, BSE-100, BSE-200 and BSE-500[10]. As compared to the other indices in BSE, BSE 500 covers more number of listed companies, more number of power sector companies[11] and this index (BSE 500) also represents nearly 93%[12] of the total market capitalization on BSE. Hence this index is more stable compared to other indices and PP has selected this index for benchmarking purpose.

Justification for suitability of time period: - After 1999, most of the power sector companies got listed on BSE and the electricity act 2003 also came after 1999. After the electricity act 2003 the power sector in India went through significant changes. The market also started picking up from 2003 and the same trend can be observed in BSE 500 and BSE 200 indices[13] (as shown in the below figures). In other words the indices have performed consistently for the last 10 years period (except few instances where market has meltdown but recovered soon). Hence it is appropriate to consider the period where the sector related policies were at place and the indices have performed consistently.





PP has considered all power companies operating and listed on the BSE in the country at the time of decision making. Power Trading companies are excluded from the analysis as these companies would have a different risk profile than the power generating companies. The risk premium thus calculated comes out to be 9.24%.

Beta:

The project participant has estimated equity beta values for a number of power companies in India. Equity beta measures the risk that cannot be eliminated in a systematic, well balanced and diversified portfolio. The Beta values are estimated by regressing return on stock against the local index (BSE 500). The length of estimation period is adopted from the book "The Corporate Finance Theory and practice" by Aswath Damodaran (Chapter 4[14]). The book suggests that most Beta

[10] http://www.bseindia.com/indices/indiceshighlights.aspx?expandable=0

[11] http://www.bseindia.com/indices/DispIndex.aspx?iname=BSE500&sensid=500&type=SENS&graphpath=/sensexview/charts/graf_appBSE500.gif&page=1533E211-BF12-4DDA-963E-B89DFB22C010

[12] http://www.bseindia.com/indices/DispIndex.aspx?iname=BSE500&sensid=500&type=SENS&graphpath=/sensexview/charts/graf_appBSE500.gif&page=1533E211-BF12-4DDA-963E-B89DFB22C010

13 The index BSE 200 provides data for 20 years period similar to the project life time duration

[14] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/AppldCF/derivn/ch4deriv.html#ch4.6

estimations either use five years or two years data. Accordingly PP has calculated the beta values for all identified companies for 2 years, 3 year, 4 years and 5 years. It was found that the average of beta of all the companies based on 2 years data is conservative compared to 3, 4 and 5 years data and hence the same has been considered in the assessment. PP has also not considered those companies whose beta value are higher than 2. This will further ensure the conservativeness of the model.

The beta of equity is calculated as the covariance between its return and the return on a well-diversified market portfolio, divided by the variance of the return on a well-diversified market portfolio.

Equity Beta (βe) = Covariance (r, rm) / Variance (rm)

Where:
r is the return from the equity investment in a single stock
rm is the return from the equity investment in the well-diversified market portfolio

The equity beta is 1.23.
The cost of equity (Re) is thus calculated as:

Re = 8.392% + 1.23 X (17.63% – 8.392%) = 19.75%

Cost of debt:

As per EB 62, annex 5, para 16, "If the benchmark is based on parameters that are standard in the market, the cost of debt should be calculated as the cost of financing in the capital markets (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on documented evidence from financial institutions with regard to the cost of debt financing of comparable projects". Hence PP has considered the cost of debt from MERC tariff order which is applicable for similar types of project in Maharashtra, India. As per MERC tariff order dated 14/07/2010, the cost of debt published for 2009-10 was 13.37% and this was applicable for the project activity as the decision was taken in the next financial year i.e. 2010-11 (investment decision date is 23/02/2011).

Cost of debt = 13.37%[15]

Corporate tax:
The corporate tax rate provided by government of India has been considered for estimation of benchmark.
Corporate tax rate[16] = 33.218%

Based on the above values, the benchmark of the project activity has been calculated as 12.18 %.

Calculation of Financial Indicator:
Financial Analysis:
The project proponents have used **Project Internal Rate of Return (IRR)** as the financial indicator to identify the investment barriers for the project activity. The IRR is then compared to the chosen benchmark. The spreadsheet versions of the calculations shall be provided to the DOE during validation.

[15] As per MERC order dated 14.07.2010, page 28, http://www.mercindia.org.in/pdf/Order%2058%2042/Case_20_of_2010Final_RE_Order.pdf

[16] http://www.nair-co.com/indiaminimumalternatetax.aspx

The parameters and assumptions used for calculations have been mentioned below.

- The input values used in the financial analysis were valid at the time when the investment decision was made.
- The IRR has been calculated for a period of 20 years, the expected operational lifetime of the project activity as per option II (a) and II (c) of Annex 15 EB 50.

Parameter	Unit	Cost	Source
Project cost	INR million	7010.80	Project feasibility report (PFR),page25[17]
Debt	INR million	4,907.56	As per PFR, page 24
Equity	INR million	2,103.24	As per PFR, page 24
Insurance premium	INR million/annum	10.0	As per PFR, page25
Total WTG capacity	MW	100.80	As per PFR, page25
O & M cost[18]	INR million/WTG/year	2.37	As per PFR, page25
Escalation in O & M[19]	%	5.00	
Repayment schedule	Years	10.00	As per PFR, page25
Admin cost	INR million/year	20.00	As per PFR, page26
Escalation in admin cost	%	5.00	As per PFR, page26
Generation Based Incentive (GBI)	INR/KWh	0.50	As per IREDA guidelines[20]
GBI incentives	INR million/MW	1.55	As per IREDA guidelines
GBI cap	INR million/annum	6.20	As per IREDA guidelines
Interest Rate	%	13.37%	As per PFR, page25
Tariff rate	Rs./kWh	5.33	As per PFR, page25
Corporate Tax rate	%	33.218	Income Tax Act 2010-11
Depreciation rate[21]	%	5.28	As adopted by the company in its books, SLM
MAT rate	%	19.93	IT act 2010-11
Service tax[22]	%	10.30	IT act2010-11

*1 million=10lacs

The details of the technical parameters are below:

Parameters	Values	Units	Source
WTG capacity	1.60	MW	As per PFR, page25
No. of WTG	63		As per PFR, page25
CUF	22.238	%	As per PFR, page25
Derating after 10th year of operation	5.00	%	As per PFR, page25

[17] Contingency of 100 million INR has been removed while calculating the project cost. Debt and equity has been calculated accordingly on project cost without contingency cost

[18] Contract is for 10 years. Thereafter, to be decided mutually

[19] From 4th year onwards

[20] http://www.ireda.gov.in/pdf/OPERATIONAL%20GUIDELINES%20for%20Wind%20GBI%20and%20AD%20as%20on%2026.05.2010.doc

[21] SLM for 20 years

[22] http://www.servicetax.gov.in/

Working days	365	Days/annum	
Working hours	24	Hours/day	
Grid emission factor	0.9486	tCO2/MWh	Latest CEA database, ver-6.0

The details of the project cost are given below:

Particulars	**Values (INR million)**	**Source**
Land and site development	332.0	***As per PFR, page23***
Private land purchased	225.00	
Forest Land	50.0	
Internal Roads	20.00	
External Roads	37.00	
EHV, substation and other infrastructure	**737.49**	***As per PFR, page23***
100 MVA EHV substation	383.68	
220/33KV transmission line	152.65	
33KV unit/switching station	191.16	
LT line	10.00	
WTG with foundation	**5372.01**	***As per PFR,page23***
Statutory payments	101.1024	
MEDA application charges	0.3024	
MEDA processing fees	30.24	
infrastructure development)	50.40	
MEDA security deposit	20.16	
Other cost	**147.12**	***As per PFR,page23***
Project management cost	80.00	
Trilegal contract negotiations	2.50	
Team costs	56.487	
Insurance	8.13	
Financing cost including IDC	**321.076**	
Total	**7010.80**	***Calculated***
Depreciated cost	**6728.80**	***Calculated***

Based on the above parameters and assumptions, the project IRR (without CDM benefits) for the project activity comes out to be 9.40%.

Sub-Step 2d: Sensitivity analysis

The purpose of sensitivity analysis is to conclude that financial un-attractiveness is robust to reasonable variations in the critical assumptions. For this project activity following parameter is selected as sensitive parameters to check financial attractiveness.

A sensitivity analysis for Project IRR has been carried out for various parameters. As per para 21 of guidance on investment analysis (EB 62 Annex 5), a sensitivity analysis is carried out “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 relevance of the selected parameters is explained individually below. Each of the parameters have been subjected to a sensitivity of +10% and -10%, in line with para 21 of EB 62 Annex 5, which states that “the sensitivity analysis should at least cover a range of +10% and -10%”. Thus the identified parameters for sensitivity analysis are:

- Project Cost
- CUF (has an impact on the total revenues)
- Tariff rate (has an impact on the total revenues)
- O&M cost

Project Cost:
Variation in the Project cost can have a direct impact on the returns to the project activity. The results of the sensitivity analysis of the IRR w.r.t project cost are as follows:

% Change in project cost	IRR
10%	7.90%
-10%	11.15%

The project IRR crosses the benchmark when the project cost is decreased by 15.13%. However it is not possible as PP has already placed purchase orders or work orders for most of the project related costs and it works out to be 6678.29 Million INR which is 4.74% lower than the project cost considered at the time of investment decision. The actual project cost will further increase by the time of commissioning of machines as some of the work orders/purchase orders are yet to be placed.

CUF:
The generation achieved by a WTG depends largely on the wind flow. Any change in wind flow will have a direct effect on the performance of the WTG. Less performance would mean less generation than expected, thereby having a direct impact on the return of the project activity. Thus, a sensitivity analysis has been carried out w.r.t. the changing CUF values. The results of the sensitivity analysis are given below:

% change in CUF	IRR
10%	11.17%
-10%	7.48%

From the results of the sensitivity analysis, it is clear that the Project IRR of the project activity does not cross the benchmark value even after a 10 % increase in CUF. The IRR crosses the benchmark when CUF increases by 15.87% i.e; 25.77%. Such a case is impossible. As per the MERC tariff order also, dated 14.07.2010, the CUF for wind zone I wind project is considered as 20%.

Tariff Rate:
The tariff at which electricity generated is sold to the grid has a direct impact on the returns of the project activity. As per the MERC tariff order dated 14/07/2010, page 26 and 30, the tariff is 5.07 Rs/kwh for wind zone I (applicable for project activity) and tariff period is 13 years. PP has considered a higher tariff of 5.33 Rs/kwh provided in draft CERC tariff order dated September 2010 for Maharashtra for wind zone I. Since the PPA is yet to be signed hence sensitivity for change in tariff rate has been carried out.

% change in tariff	IRR
10%	11.15%
-10%	7.50%

Thus, we see that the project is financially not attractive on its own. The IRR of the project activity is below the chosen benchmark. The IRR crosses the benchmark when tariff is increased by 16.12% i.e; INR 6.19/kWh. As per the latest MERC tariff order dated[23] 30/03/2012 the tariff has been revised to 5.67 Rs/kwh (increase of 6.38% on base tariff of 5.33 Rs/kwh). Since the tariff has been revised recently and the wind mills are about to be commissioned, hence a further hike in tariff is not possible.

Operation and Maintenance (O&M) cost:

Variation in the Project cost can have a direct impact on the returns to the project activity. The results of the sensitivity analysis of the IRR w.r.t project cost are as follows:

23 http://www.mercindia.org.in/pdf/Order%2058%2042/MERC_RE%20Tariff%20Order%20%28SuoMotu%29_for%20FY2012-13_Case%20No.%2010%20of%202012.pdf

% Change in O&M	IRR
10%	9.02%
-10%	9.76%

The project IRR crosses the benchmark when O&M cost is decreased by 81.72%. However, such a situation is not possible as PWEPL has already entered into an O&M agreement for next 10 years with the supplier. The actual O&M cost for 1st year is 1.2 million INR per WTG per year which is 49.37% lower compared to the information provided in the offer letter by WTG supplier. After 10th year of operation, the O&M cost is likely to further increase due to wear and tear of WTG equipment. Hence, any reduction in the O&M Cost after 10th year of operation is also not realistic

Thus, we see that the IRR of the project activity is below the chosen benchmark. Since the IRR of the project activity without CDM benefits is below the chosen benchmark, the project activity is financially not attractive without additional revenues.

Step 4 Common Practice Analysis

As per para 47 of "Tool for the demonstration and assessment of additionality", version 6.0.0, the common practice analysis has to demonstrated by following steps for measures that are listed in paragraph 6. The present project activity falls under measure 2 defined under para 6 of the tool and hence as per para 47 of the tool, the following steps have been applied to prove that the proposed project activity is not a common practice within the applicable geographical area. The applicable geographical area has been defined as the host country, India, as default as defined in para 5 of the tool.

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

The design capacity of the proposed project activity is 100.8 MW. Hence, the applicable output range for analysis has been calculated as 50.4 MW to 151.2 MW.

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

The total number of plants in India, which deliver power to grid and having the capacities within 50.4 MW to 151.2 MW, are identified. All these plants were commercially operated before 01/03/2011 (start date of the project). The registered CDM project activities and project activities undergoing validation were excluded from the list and have been summarized below:

Technology Area[24]	**Projects excluding CDM projects in applicable cap range, N(all)**
Thermal	220
Hydro	204
Wind	3
Nuclear	1
Solar	0
Biomass	0
Mechanical & Thermal	0
Geothermal	0
Total	428

[24] Detailed analysis on each technology area will be provided to the DOE for validation.

As per the analysis, N_{all} = 428.

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

Since the source of energy for the project activity is wind, all other technologies like thermal, hydro, solar, biomass, tidal, geothermal have been identified as different.

Hence, N_{diff} = 425[25]

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

Hence, for the proposed project activity,

Factor, F = 1- (425/428)
= **0.007 (less than 0.2)**
N_{all}- N_{diff} = 428- 425
= 3

As per the guidelines, the proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and
(b) N_{all}-N_{diff} is greater than 3.

Since the factor F for the proposed project activity is less than 0.2, hence the project activity is not a "common practice" within a sector in the applicable geographical area.

Hence as per the tool of additionality version 6 the project is **additional**.

CDM consideration:
Early consideration of CDM for the project activity has been demonstrated using the "Guidelines on the Demonstration and Assessment of Prior Consideration of the CDM", version 04 (EB 62, Annex 13).

As per para 2 of guidance on the demonstration and assessment of prior consideration of CDM: *"for project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and/or the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity".*

Following the guidelines, the project proponent sent intimations to both the host party DNA and the UNFCCC (emails dated 27/04/2011 sent to UNFCCC and to the host DNA) about the project activity and intentions of the project proponent to apply for registration under the Clean Development Mechanism of UNFCCC.

Following is the chronology of events for the project activity:

[25] Refer to the CPA spreadsheet

Stage of project implementation	Date	Remarks
Assessment of wind power density	16/08/2010	C-WET letter to PWEPL regarding the assessment of wind power density
Proposal from GE	10/2/2011	Proposal for supply of equipment and related services for GE wind turbines generator along with O&M cost
Project scheduling	17/2/2011	Project scheduling submitted by GE.
Board resolution	23/02/2011	The board of directors of the company decided to go ahead with the project activity, while considering CDM benefits for the same.
CDM intimation	27/04/2011	PP informs UNFCCC and MoEF about its intension of seeking CDM benefits for the project activity.
Purchase order issued for power transformers	01/03/2011	Purchased order for supply of power transformers (Start date of project activity)
Contract for supply of WTGs	4/5/2011	Contract for power generation services between PWEPL and GE India Industrial Pvt.Ltd

Based on the above, it is evident that PP took substantial steps towards CDM registration of the project along with the implementation of it.

Hence, it has been demonstrated that the project proponent was aware of the CDM benefits during the conceptualization of the project activity and took adequate steps towards achieving the same.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Project emissions:

As per ACM 0002 version 12.3.0, "for most renewable power generation project activities, PEy = 0".

Hence, project emissions for the project activity are considered to be zero.

Baseline Emissions:

Baseline Methodology procedure:

Step1. Identify the relevant electricity systems:

A **project electricity system** is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

Also, *"if the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If this information is not available, project participants should define the project electricity system and any connected electricity system, and justify and document their assumptions in the CDM-PDD".*

The Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into two regional grids[26]. This is the national grid definition for the electricity grids of India.

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

NEWNE Grid				Southern Grid
Northern	Eastern	Western	North-Eastern	Southern
Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar & Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Pondicherry
Punjab	Andaman-Nicobar	**Maharashtra**	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttarakhand				

The WTGs in the project activity lie in the state of Maharashtra. The state forms a part of the NEWNE grid (as per the latest CEA guidelines). Hence, relevant Operating margins and Build margins shall be used for calculations.

Step2. Choose whether to include off-grid power plants in the project electricity system (optional):

For calculating the grid emission factor for the project activity, "Option I (only grid power plants are included in the calculation)" of this step has been chosen. PP has chosen not to include off-grid power plants in the project electricity system.

Step3. Select a method to determine the Operating Margin (OM):
For the purpose of this project activity, the simple OM method has been used. However, 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.

As per CEA Data, the share of low cost must run sources for the five most recent years are as follows[27]

Year	2005-06	2006-07	2007-08	2008-09	2009-10	Average
NEWNE	18.0%	18.5%	19.0%	17.4%	15.9%	**17.8%**

Hence, simple OM can be used as the share of low cost must run sources are less than 50% for the NEWNE grid of India.

For OM calculations, "a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period" option shall be used.

Step4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units.

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

For the project activity, the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission has been considered. The data is published annually by the Central Electricity Authority. Thus:

	2007-08	2008-09	2009-10	Source/ Remarks
Simple OM including Import	0.999903554	1.006552982	0.97773624	Database Ver 06
NEWNE Net Generation in OM (GWh)	401642	421803	458043	Database Ver 06
Net electricity import from Southern Regional grid (GWh)	3252	0	0	Database Ver 06
Electricity import from other countries (GWh)	5230	5897	5341	Database Ver 06
Net generation incl imports (GWh)	410124	427700	463384	
OM	0.9941			

STEP 5. Calculate the build margin emission factor ($EF_{grid, BM,y}$)

The value of the BM has been taken from the data published by the CEA. The BM has been calculated as per option 1 (*Calculate the Build Margin emission factor $EF_{BM,y}$* ***ex-ante*** *based on the most recent information available on plants already built for sample group m at the time of PDD submission.* BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

As per the CEA CO2 Baseline Database version 6, the BM for the 2009-10 has been calculated to be $EF_{grid, BM,y}$

BM	NEWNE Grid
2009-10	0.8123

STEP 6. Calculate the combined margin (CM) emissions factor ($EF_{grid, CM, y}$)

The combined margin emission factor is calculated as follows:

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

Where:

$EF_{grid, OM,y}$ = Build Margin CO2 emission factor in the year y (tCO2/GWh)

$EF_{grid, BM,y}$ = Operating Margin CO2 emission factor in the year y (tCO2/GWh)

W_{OM} = Weighting of operating margin emission factor (%)
W_{BM} = Weighting of build margin emission factor (%)

Owing to their intermittent and non-dispatch able nature, the default weights for wind and solar projects are as follows: W_{OM} = 75% and W_{BM} = 25%

In the project activity, combined margin has been chosen as the baseline emission factor for grid emission factor. The value chosen is taken from relevant official sources and is publicly available[28].

Parameter	NEWNE grid
OM, Operating Margin – Generation weighted	0.9941
BM, Build Margin	0.8123
CM, Combined Margin (tCO2/ MWh), $EF_{grid,CM,y}$	**0.9486**

The combined margin thus obtained shall be fixed ex-ante for the entire crediting period of the project activity.

The OM and BM have been fixed *ex-ante* for the entire crediting period of the project activity.

$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$

Where:

BE_y = Baseline emissions in year y (tCO2)

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

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

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for (a) greenfield plants, (b) retrofits and replacements, and (c) capacity additions.

(a) Greenfield renewable energy power plants

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$EG_{PJ,y} = EG_{facility,y}$

Where:

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

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Leakage:

As per ACM 0002, "no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing and transport). These emissions sources are neglected".

Hence, leakage emissions are considered to be zero.

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

Emission reductions
Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$

Where:
ER_y = Emission reductions in year y (t CO2e/yr)
BE_y = Baseline emissions in year y (t CO2/yr)
PE_y = Project emissions in year y (t CO2e/yr)
Since $PE_y = 0$;

Emission reductions can be calculated as:

$ER_y = BE_y$

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**$EF_{grid,OM,y}$**
Unit	tCO_2/MWh
Description	This is the operating margin for the NEWNE grid of India
Source of data	"CO2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI. Weblink: www.cea.nic.in
Value(s) applied	0.9941
Choice of data or Measurement methods and procedures	Calculated as per ACM0002 with 3 years vintages (2007-08,2008-09,2009-10) data obtained from "CO2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI, which is based on " tool to calculate emission factor for an electricity system, version 2.2.1"
Purpose of data	Calculation of baseline emissions
Additional comment	This is fixed ex-ante and it will remain same throughout during the crediting period.

Data / Parameter	**$EF_{grid,BM,y}$**
Unit	tCO_2/MWh
Description	This is the build margin for the NEWNE grid of India
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI. Weblink: www.cea.nic.in
Value(s) applied	0.8123
Choice of data or Measurement methods and procedures	Calculated as per ACM0002 with year 2009-10 data obtained from "CO2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI. Which is based on "tool to calculate emission factor for an electricity system, version 2.2.1"
Purpose of data	Calculation of baseline emissions
Additional comment	This is fixed ex-ante and it will remain same throughout during the crediting period.

Data / Parameter	**$EF_{grid,CM,y}$**
Unit	tCO_2/MWh
Description	This is the combined margin for the NEWNE grid of India
Source of data	CEA database version 6
Value(s) applied	0.9486

Choice of data or Measurement methods and procedures	Combined margin emission factor has been calculated by the Central Electricity Authority in accordance with CDM methodology: ACM0002 and tool to calculate the emission factor for an electricity system.
Purpose of data	Calculation of baseline emission
Additional comment	This is fixed ex-ante and it will remain same throughout during the crediting period.

B.6.3. Ex ante calculation of emission reductions

>>

Baseline emissions:

Net power exported to the grid, $EG_{facility,y}$ = 196,363 MWh/ annum

Baseline emission factor, $EF_{grid,CM,y}$ = 0.9486 tCO2/MWh

Hence, Baseline emissions, BE_y = 196,363 × 0.9486 = 186,270tCO2/annum.

As explained in Section B.6.1, $ER_y = BE_y$ (Since PE_y and leakage are zero)

Emission reductions:

Hence, total emission reductions for the project activity, ER_y = 186,270tCO2 per annum

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year A	186,270	0	0	186,270
Year B	186,270	0	0	186,270
Year C	186,270	0	0	186,270
Year D	186,270	0	0	186,270
Year E	186,270	0	0	186,270
Year F	186,270	0	0	186,270
Year G	186,270	0	0	186,270
Year H	186,270	0	0	186,270
Year I	186,270	0	0	186,270
Year J	186,270	0	0	186,270
Total	186,2700	0	0	186,2700
Total number of crediting years	10 Years			
Annual average over the crediting period	186,270	0	0	186,270

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Credit note/ reports generated by MSEDCL
Value(s) applied	196,363

Measurement methods and procedures	Monitoring equipment: Electronic tri-vector energy Meters are used for monitoring. Accuracy Class: 0.2s Recording Frequency: Monthly from Energy Meter, Summarized Annually Archiving Policy: Paper & Electronic For measuring the energy delivered by the project activity, one set of main meters (part of interconnection facilities) and check meters will be provided at each of the 4 feeders by the project proponent and respective electricity distribution company (MSEDCL). Monthly joint meter readings of the main meters and check meters located at 4 feeders (sub-station) will be taken by the designated officials of the company and MSEDCL. The summation of all 4 feeder meters reading will be used for billing and emission reduction calculation purpose. Monthly joint meter readings will be taken by the designated officials of the two parties on the synchronisation date of each unit as well as once during the monthly cycle.
Monitoring frequency	Continuously
QA/QC procedures	The main and check meters will be of accuracy class 0.2S and shall be calibrated at least once in three years. The records will be cross-checked with the records of sold electricity to MSEDCL.
Purpose of data	Calculation of baseline emission.
Additional comment	The readings of each of the main meters located at 4 feeders will be used for emission reduction calculation purpose. These 4 feeders will be connected to the WTGs covered in the project activity only.

B.7.2. Sampling plan

>>

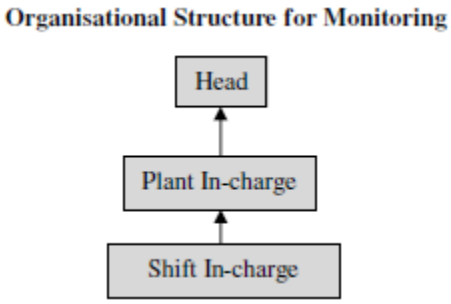
There are no parameters in section B.7.1 that are to be determined by sampling approach.

B.7.3. Other elements of monitoring plan

>>

Roles & Responsibility Structure:

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities and is proposed for grid-connected wind power project being implemented in Maharashtra, India. The monitoring plan, which will be implemented by the project proponent describes about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.



The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project proponent. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members:

PP has assigned the responsibility of operation and maintenance of WTGs to GE India Industrial private limited.

Responsibilities of Head: Overall functioning and maintenance of the project activity.

Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data (calibration of equipments).

Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day log book for monitored data.

QA/QC procedures:
The energy meters at the feeders are maintained and owned by MSEB. Neither the project proponent nor the site personnel have any control over it. The records will be cross-checked with the records of sold electricity to MSEDCL. The meters are calibrated by MSEB at-least once in three years.

Data Archiving:
Monthly data shall be archived electronically and in paper form and stored for the entire crediting period and two years thereafter.

Training and maintenance requirements:
Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the WTGs, it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that O&M team is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. Each and every site personnel is provided with proper training to meet the requirements of the Operations and maintenance. This ultimately leads to creativity in problem solving.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Date of Completion: 28/11/2012

Details of contact information of responsible persons/entities:-
Entity: - Panama Wind Energy Private Limited
Contact Person: - Mr. Dinesh Jagdale
Designation: - Director & Chief Operating Officer
Address: - 1st Floor, Lunkad Towers, Viman Nagar,
Pune, Maharashtra PIN - 411 014.

Contact details:-
Email ID: - djagdale@panama-group.com
Telephone: - +91 20 26125060
Fax: - + 91 20 26120580

This entity is also the project participant listed in Appendix 1

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
01/03/2011 (Date of Purchase order for supply of Power transformers)

C.1.2. Expected operational lifetime of project activity

>>
20 years 00months

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Fixed crediting period

C.2.2. Start date of crediting period

>>
03/12/2012 or the date of submission of the project activity to UNFCCC by the DOE)

C.2.3. Length of crediting period

>>
10 years 00 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
As per the EIA notification number S.O. 1533[29], the generation of electricity using WTGs does not require a prior EIA assessment and environmental clearances.

Apart from that, the project proponents have acquired all the necessary consents and approvals required for the installation and operation of the WTG.

D.2. Environmental impact assessment

>>
Generation of electricity using wind power is a clean process and does not involve any type of emissions during its operations. There are no significant negative environmental impacts of the project activity.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
The stakeholders of the project activity were invited to attend the stakeholder meeting on 07/05/2011 through newspaper advertisement (in Sakal, dated 04/05/2011). Stakeholders were also informed about the meeting by the local panchayat through announcements and Public Notice. Personal invitations were also sent to the prominent members of the regions in the vicinity.

A stakeholder meeting was held at Karad, District Satara on 07/05/2011, involving the local stakeholders. The meeting was attended by local villagers, panchayat members and representatives of PWEPL.

[29] http://envfor.nic.in/legis/eia/so1533.pdf

The stakeholders were explained about the project activity and the various benefits arising out of the project activity. A discussion was held in which the views of the local stakeholders were addressed.

E.2. Summary of comments received

>>
The villagers were happy with the fact that the installation of such a project would bring about development in the region. The queries raised by the local stakeholders were:

- Will the project affect ground water level?
- Will the earthings used in the WTGs make the ground unsafe to walk on? Will the earthings have any negative effect on the ground water?
- Do wind power project affect rainfall?
- How do other sources of energy lead to pollution?

E.3. Report on consideration of comments received

>>
The queries of the stakeholders were answered satisfactorily by the project proponent representatives through scientific and logical explanations. The stakeholders were informed that there is no scientific evidence that WTGs effect ground water table or rainfall patterns.

SECTION F. Approval and authorization

>>
The project activity has received host country approval from Indian DNA. A copy of the same has been provided to DOE for validation.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Panama Wind Energy Private Limited
Street/P.O. Box	Viman Nagar
Building	1st Floor, Lunkad Towers
City	Pune
State/Region	Maharashtra
Postcode	411 014
Country	India
Telephone	+91 20 26125060
Fax	+ 91 20 26120580
E-mail	
Website	
Contact person	
Title	Director & Chief Operating Officer
Salutation	Mr.
Last name	Jagdale
Middle name	
First name	Dinesh
Department	
Mobile	+91 9822035814
Direct fax	+ 91 20 26120580
Direct tel.	+91 20 67287405
Personal e-mail	djagdale@panama-group.com

Appendix 2. Affirmation regarding public funding

There is no public funding involved in the project activity.

Appendix 3. Applicability of methodology and standardized baseline

The detailed information on selected methodology is provided in section B.2.

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

Ex-ante calculation of emission reduction is provided in section B.6.3.

Appendix 5. Further background information on monitoring plan

Detailed monitoring plan for the project activity is provided in section B.7.3.

Appendix 6. Summary of post registration changes

Referring to the section “A.2.4. of the registered PDD, corrections are required to indicate accurate geographical coordinates of the WTGs registered under the project sky. Latitude and Longitude details, as mentioned in the registered PDD are approximations, as the project was under conceptual stage.

However, geo-coordinates details, later to the commissioning of the WTGs, is been précised in the section “***A.2.4.****”* of the revised PDD version 2 dated 14/08/2015. It is observed that, out of 63 no. of WTGs, registered under the project sky, corrections in geo-coordinates of 41 WTGs is required. These corrections, also includes 18 WTGs which are under the implementation stage.

This change is in accordance to the *Appendix 1, sub point 1, of the Project Standard Version 9*, and does not require a prior approval from the CDM EB.

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Document information

Version	*Date*	*Description*
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document