**Project design document form**
**(Version 10.1)**

*Complete this form in accordance with the instructions attached at the end of this form.*

| BASIC INFORMATION | |
|---|---|
| **Title of the project activity** | Wind Power Project in Madhya Pradesh by OBWPPL |
| **Scale of the project activity** | ☒ Large-scale<br>☐ Small-scale |
| **Version number of the PDD** | 5.0 |
| **Completion date of the PDD** | 22/03/2018 |
| **Project participants** | Orange Bercha Wind Power Private Limited |
| **Host Party** | India |
| **Applied methodologies and standardized baselines** | ACM0002: Grid-connected electricity generation from renewable sources --- Version 17.0 |
| **Sectoral scopes linked to the applied methodologies** | 1 : Energy industries (renewable - / non-renewable sources) |
| **Estimated amount of annual average GHG emission reductions** | 107,058 $tCO_2e$ |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

>>

The project activity is installation of 50 MW wind power project, promoted by Orange Bercha Wind Power Private Limited. The purpose of the project activity is to generate clean electricity with utilization of wind energy. The project consists of 25 numbers of Gamesa G97 Wind Turbine Generators (WTGs) of 2.0 MW capacities each. OBWPPL is installing WTGs in and around the village of Sandla in Ratlam district of Madhya Pradesh in India.

The project has been already commissioned as of 05/05/2016 and all the WTGs are currently operational. A total of all the 25 WTGs under the project activity were commissioned on the same day.

**How the proposed activity reduces GHG emissions**

The electricity generated by the project is exported to the Indian electricity grid. The project activity will therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. Since wind power is Greenhouse Gas (GHG) emissions free, the power generated will prevent the anthropogenic gas emissions generated by fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. Hence, the generation by the proposed activity is non-GHG source and thus reduces the proportion of fossil fuel based generation in the grid leading to lesser carbon intensive grid.

**Scenario existing prior to the implementation of project activity:**

There was no activity at the site prior to implementation of the project activity. Hence the scenario existing prior to the project activity is same as baseline scenario which is continual use of highly carbon intensive electricity in the regional grid.

**Baseline Scenario:**

As the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following as per applied methodology: 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” – version 6.0, EB 97, Annex 7. Hence, pre-project scenario and baseline scenario are the same.

The estimation of GHG reductions by this project is limited to carbon dioxide (CO2) only. Thus the project activity leads to an emission reduction of 749,406 $tCO_2e$ for the chosen crediting period of 7 years renewable with the annual average emission reduction of 107,058 $tCO_2e$

**Project Contribution to Sustainable development:**

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development[1] in the interim approval guidelines for CDM project.

a) Social well-being
b) Economic well-being
c) Environmental well-being
d) Technological well-being

These project activity contributions towards the sustainable development are as follows;

[1] http://envfor.nic.in/divisions/ccd/cdm_iac.html

**Economic well-being:**

- The project activity would help in alleviation of poverty in the area as it creates employment opportunities to the local people.
- The project activity would bring in additional investment to the region which would have not been possible in the absence of project activity. The development of project activity would contribute significantly towards infrastructure development of the region which ultimately leads to rural area development.
- The project activity evacuating power to the nearest regional grid would lead to improvement of electricity availability as the electricity is fed into a deficit grid.

**Social well-being:**

- The project activity would improve the local infrastructure development.
- Power generated from this project activity can be used for small scale industries in the region, thus would generate employment opportunities.

**Environmental well-being:**

- Wind is one of the cleanest form of renewable energy and power generation does not involve any fossil fuels.
- The project activity by replacing electricity generated from fossil fuels would result in reduction of both GHG emissions and air borne pollutants, such as oxides of nitrogen, oxides of sulphur, carbon monoxide and particulates.
- Produces electricity without any GHG emissions.

**Technological well-being:**

- The project would use the environmental safe and sound technologies in Wind Power sector.
- It will improve the power quality and the improvement of transmission and distribution congestion.

The successful implementation and operation of the project would serve as demonstration for harnessing wind potential and encourage setting up of similar projects in future.

### A.2. Location of project activity

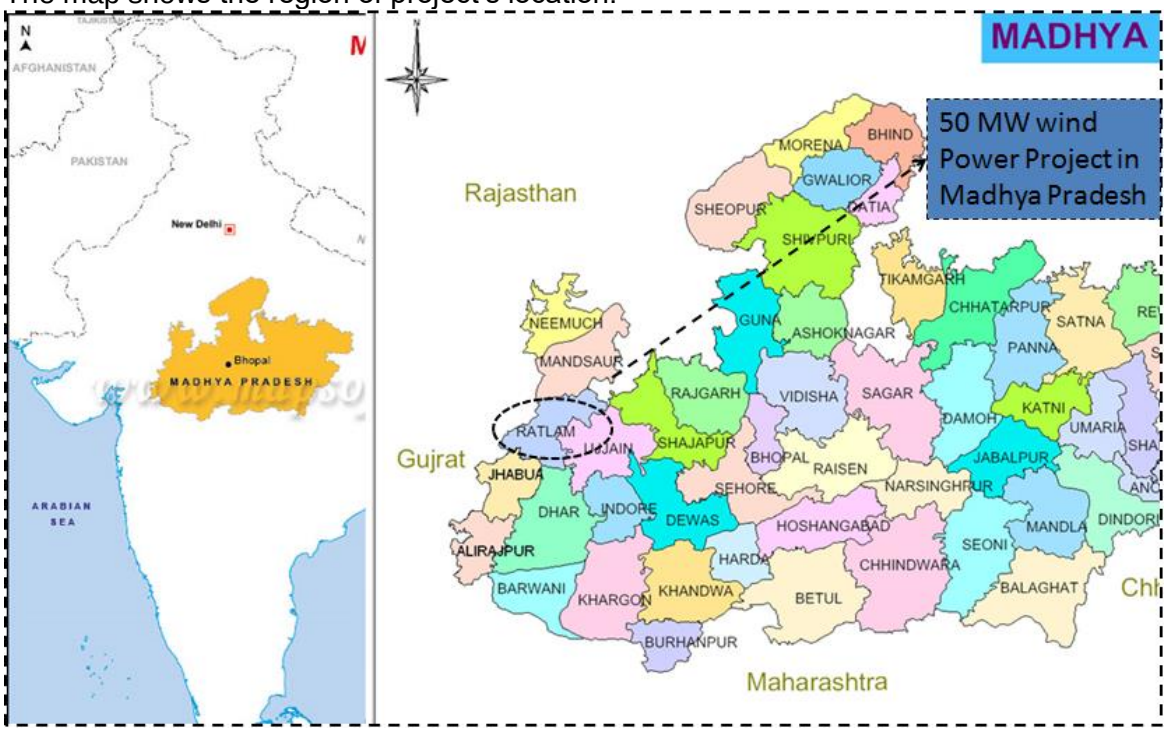
>>

The project activity is located in the villages of Jhar, Sandala, Dhanesra, Kamed villages of Ratlam district, in the state of Madhya Pradesh, India. Details of co-ordinates of each WTGs are given below:

| No | WTG ID | Latitude N | Longitude E | Tehsil/ District | Village | State |
|---|---|---|---|---|---|---|
| 1 | B 16 | 52.2298 | 25.7294 | Ratlam | Jhar | Madhya Pradesh |
| 2 | B 4 | 52.3946 | 25.7375 | Ratlam | Sandala | Madhya Pradesh |
| 3 | B 1 | 52.1672 | 25.7515 | Ratlam | Sandala | Madhya Pradesh |
| 4 | B 72 | 52.3437 | 25.7426 | Ratlam | Jhar | Madhya Pradesh |
| 5 | B 90 | 52.5259 | 25.7525 | Ratlam | Jhar | Madhya Pradesh |
| 6 | B 92 | 52.7864 | 25.7393 | Ratlam | Jhar | Madhya Pradesh |
| 7 | B 89 | 52.5573 | 25.7325 | Ratlam | Sandala | Madhya Pradesh |
| 8 | B 86 | 52.5976 | 25.7415 | Ratlam | Sandala | Madhya Pradesh |
| 9 | B 73 | 52.8737 | 25.7434 | Ratlam | Sandala | Madhya Pradesh |
| 10 | B 79 | 52.8032 | 25.7356 | Ratlam | Sandala | Madhya Pradesh |
| 11 | B 38 | 52.5999 | 25.7551 | Ratlam | Dhanesra | Madhya Pradesh |
| 12 | B 87 | 52.4506 | 25.7245 | Ratlam | Dhanesra | Madhya Pradesh |
| 13 | B 80 | 52.608 | 25.737 | Ratlam | Dhanesra | Madhya Pradesh |
| 14 | B 82 | 52.7876 | 25.7563 | Ratlam | Dhanesra | Madhya Pradesh |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15 | B 91 | 52.608 | 25.737 | Ratlam | Dhanesra | Madhya Pradesh |
| 16 | B 33 | 52.6708 | 25.7399 | Ratlam | Dhanesra | Madhya Pradesh |
| 17 | B 71 | 52.8647 | 25.7629 | Ratlam | Kamed | Madhya Pradesh |
| 18 | T1 | 52.7818 | 25.7614 | Ratlam | Kamed | Madhya Pradesh |
| 19 | T2 | 52.7876 | 25.7563 | Ratlam | Kamed | Madhya Pradesh |
| 20 | B 77 | 52.8648 | 25.7588 | Ratlam | Kamed | Madhya Pradesh |
| 21 | B 83 | 52.8737 | 25.7434 | Ratlam | Kamed | Madhya Pradesh |
| 22 | B 78 | 52.8747 | 25.7401 | Ratlam | Kamed | Madhya Pradesh |
| 23 | B 85 | 52.8032 | 25.7356 | Ratlam | Kamed | Madhya Pradesh |
| 24 | B 75 | 52.7864 | 25.7393 | Ratlam | Kamed | Madhya Pradesh |
| 25 | B 84 | 52.735 | 25.7416 | Ratlam | Kamed | Madhya Pradesh |

The map shows the region of project's location:




## A.3. Technologies/measures

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The technology employed, converts wind energy to electrical energy. In wind power generation, energy of wind is converted into mechanical energy and subsequently into electrical energy. The project activity is the installation of an environmentally safe and sound technology since there are no GHG emissions associated with the electricity generation.

The technical specifications of the WTGs have been provided as below.

| Gamesa G-97 | |
|---|---|
| Rated power | 2000 kW |
| Average Annual Wind speed | 7.5 m/s |
| Turbulence Intensity I15% | 18 m/s |

| | |
|---|---|
| Reference 10 minute wind speed for 50 years | 37.5 m/s |
| Survival wind speed | 52.5 m/s |
| **POWER** | |
| Rated power | 2000 kW |
| Average Annual Wind speed | 7.5 m/s |
| Turbulence Intensity I15% | 18 m/s |
| Reference 10 minute wind speed for 50 years | 37.5 m/s |
| Survival wind speed | 52.5 m/s |
| **GENERATOR** | |
| Type | Doubly-fed with coil rotors and slip rings |
| Rated power | 2.0 MW |
| Voltage | 690 V AC |
| Frequency | 50Hz/60Hz |
| Protection class | IP 54 |
| Power Factor | 0.95 CAP – 0.95 IND throughout the power range |
| **ROTOR** | |
| Diameter | 97 m |
| Swept area | 7390 sq.m |
| Speed range (variable) | 9:19 rpm |
| **TOWER AND FOUNDATION** | |
| Hub height | 104 m |
| Design | Tubular, Four sections |
| Foundation type | Floating foundation |
| **GEAR BOX** | |
| Type | 1 Planetary stage & 2 Parallel stage |
| Ratio | 1:106.8 (50 Hz), 1:127.2 (60 Hz) |
| **TOWER AND FOUNDATION** | |
| Hub height | 104 m |
| Design | Tubular, Four sections |
| Foundation type | Floating foundation |
| **GEAR BOX** | |
| Type | 1 Planetary stage & 2 Parallel stage |
| Ratio | 1:106.8 (50 Hz), 1:127.2 (60 Hz) |

The average lifetime of the WTGs under project activity is around 25 years as per the equipment supplier specifications. The plant load factor assessed by third party for WTGs at project site is 25%.

In the absence of the project activity the equivalent amount of electricity sold to grid would have been generated by grid connected power plants (which is predominantly based on fossil fuels) and by the addition of new generation sources. Hence baseline scenario of the project activity is the grid based electricity system, which is also the pre-project scenario.

Please refer section B.7.3 for the details of monitoring equipment, their location and technical specifications.

### A.4. Parties and project participants

| Parties involved | Project participants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (Host) | Orange Bercha Wind Power Private Limited | No |

### A.5. Public funding of project activity

>>
There is no public funding from Annex 1 countries and no diversion of Official Development Assistance (ODA) involved in the project activity.

### A.6. History of project activity

**>>**

1. The PP hereby Confirms that:
   (a) The proposed project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA); and
   (b) The proposed project activity is not a project activity that has been deregistered.

2. The PP would like to Declare that:
   (a) The proposed project activity was not a CPA that has been excluded from a registered CDM PoA;
   (b) The project is not "A registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity".

**3.** Since the declaration on 2(a) or 2(b) above is negative thus no further demonstration required.

### A.7. Debundling

>>
Not Applicable

## SECTION B. Application of selected methodologies and standardized baselines

### B.1. Reference to methodologies and standardized baselines

>>
**Title**: Grid-connected electricity generation from renewable sources

**References**: Approved Large Scale Consolidated Methodology: ACM0002 "Grid-connected electricity generation from renewable sources" (Version 17.0, EB 89)[2]

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

- Methodological Tool: Tool to calculate the emission factor for an electricity system - Version 6.0, EB 97, Annex 7[3].
- Methodological Tool: Tool for the demonstration and assessment of additionality - Version 07.0.0, EB 70 Annex 8[4].

[2] http://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

[3] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v6.pdf/history_view

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

## B.2. Applicability of methodologies and standardized baselines

>>

This methodology applies to project activities that include retrofitting, rehabilitation (or refurbishment), replacement or capacity addition of an existing power plant or construction and operation of a Greenfield power plant.

The project activity meets the applicability conditions of the approved consolidated baseline and monitoring methodology ACM0002, version 17.0, as described below:

| Applicability Criteria | Applicability status |
|---|---|
| This methodology is applicable to grid-connected renewable power generation project activities that:<br><br>(a) install Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing plant(s)/unit(s); (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (d) involve a replacement of (an) existing plant(s)/unit(s) | The proposed project activity is a Green field, Indian grid connected renewable power plant.<br><br>Therefore, it confirms to the said criteria |
| The methodology is applicable under the following conditions:<br>The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without 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 a new grid connected renewable wind power project. Thus, it meets the first applicability condition |
| In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity | The proposed project activity is the installation of a new wind power plant/unit. Therefore, the said criteria is not applicable |
| In case of hydro power plants, one of the following conditions shall apply:<br><br>(a) The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or<br><br>(b) The project activity is implemented in an existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3) is greater than 4 W/m2; or<br><br>(c) The project activity results in new single or multiple reservoirs and the power density calculate equation (3), is greater than 4 W/m2.<br><br>(d) The project activity is an integrated hydro power project involving multiple reservoirs, | The proposed project activity is the installation of a wind power plant/unit. Therefore, the said criteria is not applicable |

| | |
|---|---|
| where the power density of any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, all of the following conditions shall apply.<br><br>(i) The power density calculated using the total installed capacity of the integrated project, as per equation (4) is greater than 4W/m2;<br><br>(ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br><br>(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2shall be:<br><br>(a) Lower than or equal to 15 MW; and<br><br>(b) Less than 10% of the total installed capacity of integrated hydro power project | |
| In the case of integrated hydro power projects, project proponent shall:<br><br>Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or<br><br>Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability indifferent seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity. | The proposed project activity is the installation of a wind power plant/unit. Therefore, the said criterion is not applicable |
| The methodology is not applicable to:<br><br>(a) 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;<br><br>(b) Biomass fired power plants; | The proposed project activity is the installation of a wind power plant/unit. Therefore, the said criteria is not applicable |
| In the case of retrofits, rehabilitations, 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, that is 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 proposed project activity is the installation of a green field wind power plant. Therefore, the said criterion is not applicable. |
| **In addition, the above applicability conditions the applicability conditions of tool referred in the methodology ACM0002, version 17 has been referred here under:** | |

| | |
|---|---|
| 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 that is 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). | This condition is applicable. OM, BM and CM are estimated using the tool under section B.6.1 for calculating baseline emissions. |
| Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity. | Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly. |
| 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. | The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity |
| Under this tool, the value applied to the $CO_2$ emission factor of bio fuels is zero | The project activity is a grid connected wind power project and therefore, this criterion is not applicable for the project activity |

Note: The project activity is not going with CDM currently and only for Gold Standard

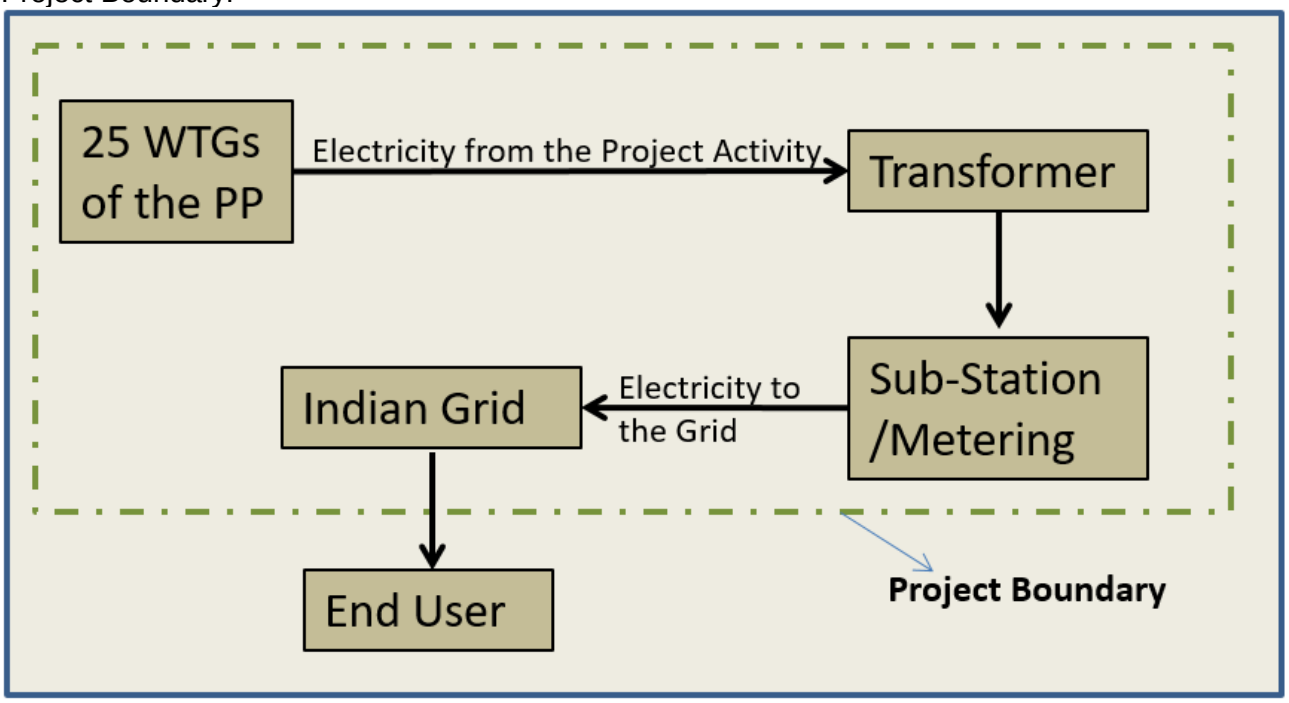
## B.3. Project boundary, sources and greenhouse gases (GHGs)

>>

As per Para 22 of applied baseline and monitoring methodology ACM0002, Version-17 / EB 89 the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the project power plant is connected to. This includes the wind turbine installation, pooling and sub-stations.

The proposed project activity evacuates the power to the Indian grid. Therefore, all the power plants contributing electricity to the Integrated grid have been considered in the project boundary for the purpose of baseline estimation. The project activity targets reduction of $CO_2e$ as main GHG greenhouse gas in baseline, there are no GHG emission associated with project activity.

Project Boundary:




| | Source | GHGs | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 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 activity | For dry or flash steam geothermal power plants, emissions of CH4 and CO2 from noncondensable gases contained in geothermal steam | $CO_2$ | No | Main emission source |
| | | $CH_4$ | No | Main emission source |
| | | $N_2O$ | No | Minor emission source |
| | For binary geothermal power plants, fugitive emissions of CH4 and CO2 from noncondensable gases contained in geothermal steam | $CO_2$ | No | Main emission source |
| | | $CH_4$ | No | Main emission source |
| | | $N_2O$ | No | Minor emission source |
| | For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers | Low GWP hydrocarbon/ refrigerant | No | Main emission source |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | $CO_2$ | No | Main emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| | For hydro power plants, emissions of CH4 from the reservoir | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | Main emission source |
| | | $N_2O$ | No | Minor emission source |

## B.4. Establishment and description of baseline scenario

>>

As per the approved consolidated Methodology ACM0002 (Version 17.0, EB 89, Annex 1) para 24:

*"If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

The 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 to the electricity grid by the operation of grid-connected power plants (mainly by fossil fuel fired plants) and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

Hence, the baseline for the project activity is the equivalent amount of power from the Indian grid.

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available.

The combined margin of the Indian grid used for the project activity is as follows:

| Parameter | Value | Nomenclature | Source |
|---|---|---|---|
| $EF_{grid,CM,y}$ | 0.9777 $tCO_2/MWh$ | Combined margin $CO_2$ emission factor for the project electricity system in year y | Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline $CO_2$ Emission Database, Version 11.0 published by Central Electricity Authority (CEA), Government of India |
| $EF_{grid,OM,y}$ | 0.9941 $tCO_2/MWh$ | Operating margin $CO_2$emission factor for the project electricity system in year y | Calculated as the last 3 year (2012-13, 2013-14 & 2014-15) generation-weighted average, sourced from Baseline $CO_2$Emission Database, Version 11.0, published by Central Electricity Authority (CEA), Government of India |
| $EF_{grid,BM,y}$ | 0.9285 $tCO_2/MWh$ | Build margin $CO_2$emission factor for the project electricity system in year y | Baseline $CO_2$ Emission Database, Version 11.0, published by Central Electricity Authority (CEA), Government of India |

## B.5. Demonstration of additionality

>>

The table below is only applicable if the proposed project activity is a type of project activity which is deemed automatically additional, as defined by the applied approved methodology or standardized baseline.

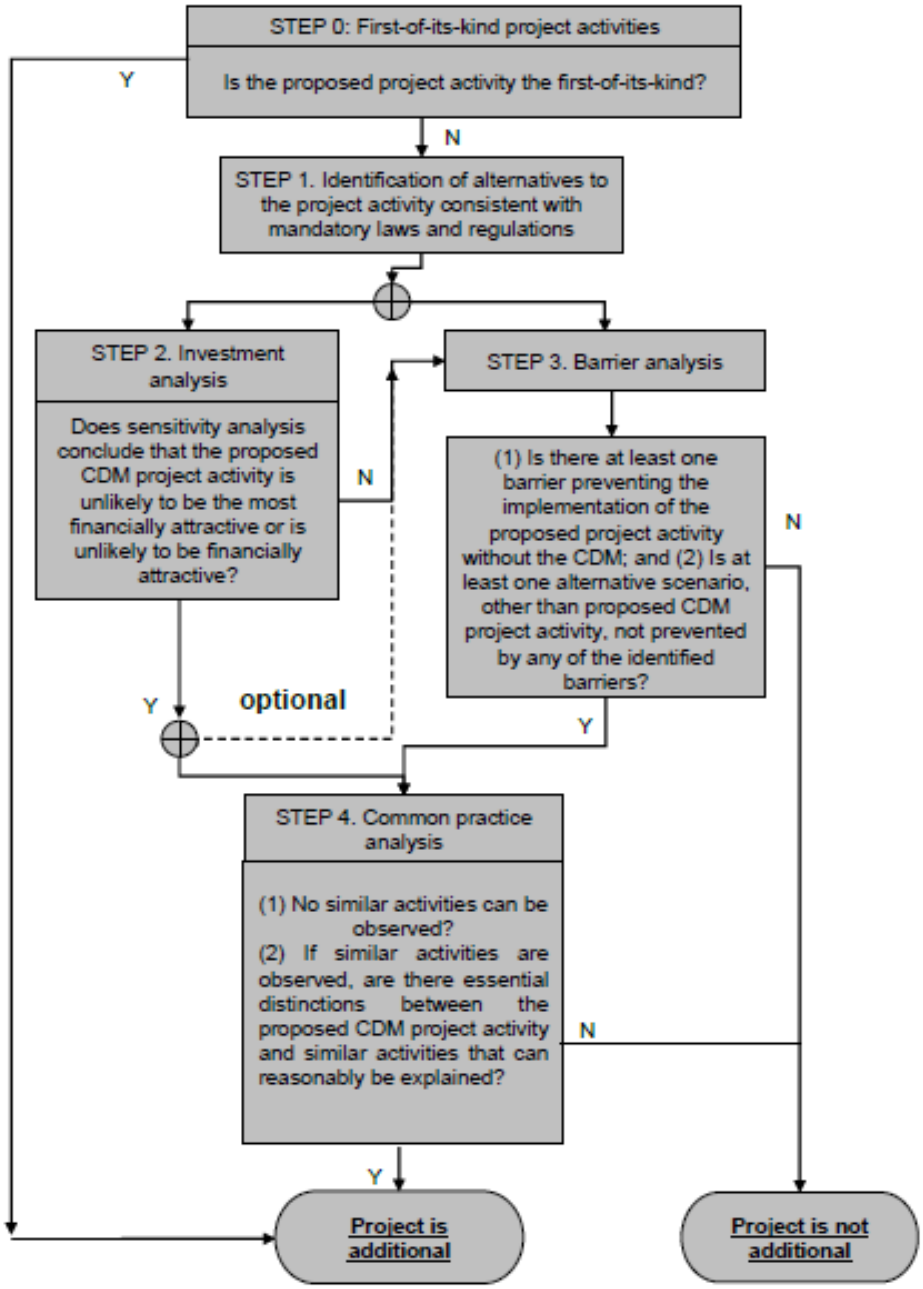
| | |
|---|---|
| Specify the methodology or standardized baseline that establish automatic additionality for the proposed project activity (including the | N/A |

| | |
|---|---|
| version number and the specific paragraph, if applicable). | |
| Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology or standardized baselines. | N/A |

The proposed project generates power using wind energy which is a renewable, zero emission source of energy. Baseline considerations for the project are based on approved consolidated baseline methodology ACM0002 (Version 17.0).

The project follows section 5.3.2 which requires the project proponent to determine the additionality based on "Tool for the demonstration and assessment of additionality", Version 07.0.0.

The step-wise approach to establish additionality of the project activity has been followed, details of which are provided in the following paragraphs:



As per the applied methodology requirement, Additionality of the project activity is demonstrated using the Methodological tool "Demonstration and assessment of additionality" Version 07.0.0. The tool defines the following steps:

**Sub Step 0: Demonstration whether the proposed project activity is the first-of-its-kind**

The proposed project activity is not the first of its kind as implementation of wind power project in the State of Madhya Pradesh is not first of its kind.

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

As per the applied ACM 0002 version 17.0; Para 24, *if the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plant and by the addition of new generation sources.*

As *the baseline scenario is prescribed by applied methodology, hence no further analysis is carried out to identify alternatives*.

**Step 2: Investment Analysis**

As per para 29 of "Tool for the demonstration and assessment of additionality" v7.0.0, it is determined that the proposed project activity is not an economically attractive or financially feasible option.

To conduct the investment analysis, Methodological tool: Investment analysis, version 8.0, EB 97 Annex 8 has been referred.

**Sub-step 2a: Determine appropriate analysis method**

As per "Tool for the demonstration and assessment of additionality" (version 07.0.0), for financial analysis of the project, the following three options are available:

Option I: Simple Cost Analysis
Option II: Investment Comparison Analysis
Option III: Benchmark Analysis

The project will generate revenues from sale of electricity, therefore Option I is not applicable in line with para 32 of the Methodological tool: "Tool for the demonstration and assessment of additionality", version 7.0.

Since, identified baseline for the proposed project activity is continuation of current practice (i.e. equivalent amount of energy would be generated by grid electricity system through its currently operating power plants and by new capacity addition) and which is outside the direct control of the project participant, hence benchmark analysis (option III), where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country is selected as the most appropriate method.

***Sub-step 2b: Option III. Apply benchmark analysis***

As per Para 15 of EB97, Annex 8 states that Required/expected returns on equity are appropriate benchmarks for equity IRR. The project participant has chosen benchmark analysis to demonstrate the additionality of the project. The project is promoted by limited company and hence the return on equity and the risks associated with the investments for their shareholder is of primary concern. Hence, in order to analyse the financial viability of the project activity, the prime financial indicator that has been used is the post-tax equity IRR of the project activity.

**Selection of Appropriate Benchmark**

The benchmark has been considered in accordance with Guidance 17 and 18 of EB97, Annex 8, "The values in the table in the Appendix may also be used, as a simple default option".

Methodology deployed for arriving at a suitable value of Benchmark using Default Value has been described below:

- As the proposed project activity generates power utilizing wind energy, Group 1 as per para 5a of Appendix of EB97, Annex 8 has been identified as a suitable category.
- The investment analysis has been carried out in Nominal terms. Accordingly, Default value as given in table under the Appendix, EB97, Annex 8 has been adjusted by adding suitable forecasted inflation rate taken from RBI (Central Bank, India).
- In case of inflation data from RBI, Benchmark has been calculated based on WPI median inflation rate. As per Para 16 of EB97, Annex 8, the inflation forecast should be for the duration of the crediting period. However, since RBI provides forecast inflation only for 5 & 10 years, the project investor has calculated benchmark using 5 year & 10 Years forecast and the most conservative value is considered as Benchmark for the project activity.

  The benchmark has been computed in the following manner:

**Default Value Benchmark:**

The cost of equity is determined by selecting the values provided in the table of the Appendix, i.e. Default values for cost of equity (expected return on equity) in the 'Methodological tool: Investment analysis'.

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

Nominal Benchmark[5] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where:

Default value for Real Benchmark = 10.73% (as per Appendix of EB97, Annex 8)
Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India) for India.

**Benchmark estimation:**

The Cost of Equity has been considered using the "Methodological tool: Investment analysis" available at the time of decision making as well as the latest available value. As a conservative approach, the minimum value of benchmark has been considered as calculated using these 2 approaches.
Table under Appendix in EB97, Annex 8 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **10.73%**[6]

Thus, minimum cost of equity considered for calculation of Benchmark = 10.73%

Inflation Forecast for India as per RBI website[7] and corresponding benchmark values:

| Project Promoters' Name | Inflation Forecast | | Benchmark | |
|---|---|---|---|---|
| | 5 Years | 10 Years | 5 Years | 10 Years |
| Orange Bercha Wind Power Private Limited | 5.00% | 4.70% | 16.27% | 15.93% |

As a conservative approach, benchmark of **15.93%** has been selected for this project activity.

[5] As per Pg. 320 of Corporate Finance, Second Edition of Aswath Damodaran

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v7.0.pdf

[7] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=16710

**Sub-step 2c: Calculation and comparison of financial indicators**

The period considered for Post Tax Equity IRR calculations is 25 years, which corresponds to the operational lifetime of the project activity.

Depreciation, and other non-cash items related to the project activity, which have been deducted in estimating gross profits on which tax is calculated, is added back to net profits for the purpose of calculating the financial indicator.

The following table illustrates the assumptions used for the calculation of the financial indicator i.e. Post Tax Equity IRR for the given project activity. The use of these parameters indicating if they are assumed or based on actual figures is explained in the table. All the relevant costs and revenues for the project activity have been considered for calculation of Post Tax Equity IRR.

| Particulars | Value | Unit | Source/Remarks |
|---|---|---|---|
| No. of wind turbines | 25 | nos | Detailed Project Report (DPR) Dated December 2015 by SBI CAPs |
| Capacity of each wind turbine | 2 | MW | DPR Dated December 2015 by SBI CAPs |
| Capacity of the project | 50 | MW | Calculated |
| Plant Load Factor | 25.00% | % | DPR Dated December 2015 by SBI CAPs |
| Annual Net generation | 109.500 | GWh | Calculated |
| Project cost | 3883.00 | INR Million | DPR Dated December 2015 by SBI CAPs |
| Debt | 75% | % | DPR Dated December 2015 by SBI CAPs |
| Equity | 25% | % | |
| Debt | 2912.25 | INR Million | Calculated |
| Equity | 970.75 | INR Million | Calculated |
| Interest rate | 12.50% | % | DPR Dated December 2015 by SBI CAPs |
| Debt Repayment tenure | 12 | years | DPR Dated December 2015 by SBI CAPs |
| Moratorium | 0 | year | |
| Operation and Maintenance (First Two years) | 0.0 | INR Million | DPR Dated December 2015 by SBI CAPs |
| Operation and Maintenance (3rd year) per WTG | 2.2 | INR Million/WTG | DPR Dated December 2015 by SBI CAPs |
| Operation and Maintenance (3rd year) | 53.8 | INR Million | Calculated |
| Escalation in O & M | 5% | % | DPR Dated December 2015 by SBI CAPs |
| Service tax on O & M fees | 0.00% | % | As per prevailing tax rates |
| Insurance premium | 0.02 | INR Million / Yr | As per quotation received from Insurance companies for this project activity |
| Tariff | 4.78 | Rs/kWh | DPR Dated December 2015 by SBI CAPs |
| Depreciation Rate (Book) (First 10 years) | 7.00% | % | MERC Tariff order dated March 2013 |
| Depreciation Rate (Book) (Remaining 15 years) | 1.33% | % | MERC Tariff order dated March 2013 |
| IT Depreciation Rate | 7.69% | % | http://ireda.gov.in/writereaddata/Operational%20Guidelines.pdf |
| Income tax rate (Inclusive of surcharge & Cess) | 34.61% | % | Calculated |
| MAT rate (Inclusive of surcharge & Cess) | 21.34% | % | Calculated |
| Salvage Value | 10% | % | MERC Tariff order dated March 2013 |
| GBI BENEFIT | | | |
| GBI Benefit | 0.5 | Rs/kWh | MNRE GBI Guidelines, 04.09.2013 |

| | | | |
|---|---|---|---|
| Max duration for GBI | 10 | years | (http://mnre.gov.in/file-manager/grid-wind/gbi-scheme.pdf ) |
| GBI cumulative cap | 10 | INR Million per MW | |
| Max. GBI allowed in a year | 2.5 | INR Million per MW | |
| GBI cumulative cap | 500 | INR Million | Calculated |
| Max. GBI allowed in a year | 125 | INR Million | Calculated |
| TAX RATES | | | |
| Financial Year | FY 2015-16 | | |
| Income tax rate (%) | 30.00% | Indian IT Act for FY 2015-16 | https://taxguru.in/income-tax/income-tax-slab-financial-year-201516.html |
| MAT (%) | 18.50% | Indian IT Act for FY 2015-16 | |
| Service Tax (%) | 14.50% | Indian IT Act for FY 2015-16 | https://www.taxdose.com/service-tax-rate-chart-for-fy-2015-16-w-e-f-15-nov-2015-with-new-service-tax-rate-14-5/ |
| Surcharge (%) | 12.00% | Indian IT Act for FY 2015-16 | https://taxguru.in/income-tax/income-tax-slab-financial-year-201516.html |
| Education cess (%) | 3.00% | Indian IT Act for FY 2015-16 | |

Post Tax Equity IRR for the WTGs under proposed project activity against the benchmark values are shown in table below. Thus, it is evident that the project is not financially attractive as the equity IRR is less below the benchmark value.

| | |
|---|---|
| Post tax Equity IRR | 10.51% |
| Benchmark Value | 15.93% |

**Sensitivity Analysis**

The robustness of the conclusion drawn above, namely that the project is not financially attractive, has been tested by subjecting critical assumptions to reasonable variation. As required by Annex 08 of EB 97, 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. PP has identified the total revenue from the project activity is dependent on the Tariff, Plant Load Factor, Project Cost and O&M Costs constitute more than 20% of the project costs. These factors have been subjected to a 10% variation on either side and the results of the sensitivity analysis so conducted are given in the following tables.

| Variation % | -10% | Normal | 10% | Variation required to reach benchmark | Value required to reach benchmark |
|---|---|---|---|---|---|
| Tariff | 7.73% | 10.51% | 13.26% | 19.38% | 5.706 (INR/kWh) |
| PLF | 7.63% | 10.51% | 13.35% | 18.68% | 29.67% |
| Project Cost | 13.84% | 10.51% | 7.94% | -15.02% | 3299.77 INR (in Mn) |
| O&M Cost | 10.82% | 10.51% | 10.20% | NA | NA |

An analysis has been done to identify the percentage variation at which the financial indicators will equal/breach the benchmark and the probability of its occurrence. Based on sensitivity analysis it can be concluded that the proposed project activity is additional with reasonable variation in values and is not likely to reach the benchmark value. The occurrence of these events is unlikely for the following reasons:

a) Tariff: The Tariff rate of electricity used for investment analysis i.e. 4.78 INR/kWh is sourced from the DPR estimate applicable at the time of investment decision. Furthermore, the project will breach the benchmark value at a tariff variation of 19.38%. However, the electricity tariffs are fixed for the lifetime of the project activity and PPA has already been signed for the tariff rate of 4.78 INR/kwh; hence this is not a likely scenario.

b) PLF: The PLF value considered is based on Third Party PLF report i.e. 25% and the IRR will breach the benchmark value at a PLF variation of more than 18.68%. The increase in PLF value to breach the benchmark is highly unlikely as the normative PLF for the state of Madhya Pradesh published by state electricity regulatory commission as 20.00%[8] & 23.00[9]% and equity IRR at normative PLF values are less than the benchmark value and given the analysis above its highly unlikely that PLF will increase above breaching value.

c) Project Cost: The project cost considered for investment analysis i.e. 3883.0 million INR. The selected project WTGs, which is state of art technology and hence slightly costlier. The cost is sourced from DPR which is based on the negotiations with Gamesa. A variation of -15.02% is required for IRR to breach benchmark which is not possible as the project is already commissioned. The actual cost incurred in commissioning of the project is realized at 3592.0 million INR which is within the sensitivity applied.

d) O&M Costs: The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely. The actual value of O&M is same of estimated value of INR 2.15 Mn/WTG from the 3rd year onwards.

The above analysis proves that varying the parameters does not lead to a Post Tax Equity IRR without carbon credits revenue, which will cross the benchmark value.

The carbon revenue from the project activity would provide significant amount of returns from the sale of the Emission Reductions accrued from the project activity and in turn increase the financial attractiveness of the project activity and hence make the project activity more financially viable.

**Step 3: Barrier analysis**
Barrier analysis has not been used.

**Step 4: Common practice analysis**
Stepwise approach for common practice analysis has been carried out as per Methodological tool "Common Practice", version 03.1 EB84, Annex 7:

*(a) The projects are located in the applicable geographical area;*
*(b) The projects apply the same measure as the proposed project activity;*
*(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;*
*(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;*
*(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;*

[8] http://www.mperc.nic.in/26032013-Wind-tariff-order.pdf

[9] http://www.mperc.nic.in/310316-Wind-tariff-SMP-74-15.pdf

*(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.*

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

The capacity of the project activity is 60MW and hence the output range as per the guideline is selected to be 25MW to 75MW

**Step (2):** Identification of the similar projects (CDM and non-CDM) is carried out as per sub-steps of Step (2) as follows:

a) As the project is located in India, therefore, the applicable geographical area is India and projects in the host country India have been chosen for analysis.
b) The projects applying same measure (i.e, only renewable energy through wind) are selected as the proposed project activity is wind power project.
Therefore, all projects applying same measure (b) as the proposed project activity are candidates for similar projects..
c) The energy source used by the project activity is wind. Hence, only wind energy projects have been considered for analysis.
d) The project activity produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.
e) The capacity range of the projects is within the applicable capacity range from 25 MW to 75 MW.
f) The start date of the project activity is 24/01/2016. As Kyoto Protocol was ratified by India on 26-Aug-2002[10], therefore projects which had started commercial operation between 26-Aug-2002 to project's start date, have been identified.

Numbers of Similar projects identified, which fulfil above-mentioned conditions are
**$N_{wind}$ = 61**

The projects considered for analysis are sourced from "Directory - Indian Wind Power published by CECL".

**Step (3):** *within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number $N_{all}$.*

CDM project activities, which have got registered, submitted for registration or are under validation have been excluded in this step. The list of the power plants identified is provided to the DOE. After excluding the registered, submitted for registration and under validation projects the total number of projects,

**$N_{all}$** = **9**

**Step (4):** *within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number $N_{diff}$.*

From the projects identified above, those projects which employ "**different technologies**" have been excluded and the number of such projects has been identified as $N_{diff}$.

The policies/tariff for each state is regulated by the State Electricity Regulatory Commission of the respective states. The project activity is located in the state of Madhya Pradesh of India and the policy applicable for the wind projects is regulated by Madhya Pradesh Electricity Regulatory

[10] http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php

Commission. Therefore, it can be assumed that the policies and tariff are different in different states and hence projects installed in other states have been considered in $N_{diff}$. The identified projects in $N_{all}$ (step 3) located in states other than Madhya Pradesh and are regulated by the respective State Electricity Regulatory Commissions (SERCs). Therefore, these projects come under different investment climate and have been considered under $N_{diff}$.

**$N_{diff}$ = 9**

**Step (5):** *calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.*

*Calculate* **$F = 1-N_{diff}/N_{all}$**
**F** = 1-(9/9) = **0.0**
**$N_{all} - N_{diff}$** = 9 - 9 = **0**

**Outcome of Step 5:**

**As,**
- **i. F = 0; is less than 0.2**
- **ii. $N_{all}-N_{diff}$ = 0; is not more than 3**

***The proposed project activity is not a "common practice" within a sector in the applicable geographical area.***

**Chronology:** The below table represents the chronology of the project activity:

| Events related to project implementation | GS relevant events | Dates |
|---|---|---|
| Completion of DPR | - | Dec 2015 |
| Board decision for investing in Project and securing carbon credits | Investment decision | 18.01.2016 |
| Placement of the Purchase Orders | Start date of the project activity | 24.01.2016 |
| Loan Sanction by Banks | - | 31.01.2016 |
| Signing of PPA | - | 10.02.2017 |
| Commissioning of Project | - | 05.05.2016 |
| GS Compliance | Appointment of the Carbon Credits consultant | 07.07.2015 |
| GS Compliance | Notices and Publication about Stakeholder' Feedback round Meeting | 11 to 19.02.2016 |
| GS Compliance | Stakeholder' Feedback round Meeting | 23.02.2016 |

## B.6. Estimation of emission reductions

### B.6.1. Explanation of methodological choices

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**Project Emissions:**

As per the approved consolidated Methodology ACM0002 (Version 17.0, EB 89, Annex 1) para 36:

*"For most renewable energy power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:*

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$ *Equation (1)*

| *Where:* | | |
|---|---|---|
| $PE_y$ | = | *Project emissions in year y (t CO2e/yr)* |
| $PE_{FF,y}$ | = | *Project emissions from fossil fuel consumption in year y (t CO2/yr)* |
| $PE_{GP,y}$ | = | *Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (t CO2e/yr)* |
| $PE_{HP,y}$ | = | *Project emissions from water reservoirs of hydro power plants in year y (t CO2e/yr)"* |

As the project activity is the installation of a new grid-connected Wind power plant/ unit and does not involve any project emissions from fossil fuel, operation of dry, flash steam or binary geothermal power plants, and from water reservoirs of hydro power plants. Therefore $PE_{FF,y}$, $PE_{GP,y}$, $PE_{HP,y}$ are equal to zero and thus, $PE_y = 0$.

**Baseline Emissions:**

The baseline emission is calculated in line with para 44 of ACM0002, Version 17, using equation below

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

Where,

$BE_y$ = Baseline emissions in year y (t $CO_2$/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" (t $CO_2$/MWh)

AS per para 46 of ACM0002, version 17, when the project activity is installation of Greenfield power plant, then:

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

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

The methodology follows the latest version of "tool to calculate the emission factor of an electricity system" provides following approaches for emission factor calculations:
(a) Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology "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.

**Option (a) has been considered to calculate the grid emission factor as per the** 'Tool to calculate the emission factor for an electricity system' since data is available from an official source.
$CO_2$ Baseline Database for the Indian Power Sector, Version 11, April 2016, published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per the "Tool to calculate the emission factor for an electricity system" Version 6.0, EB 97, Annex 7, the following steps have been followed.

STEP 1: Identify the relevant electricity systems;

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

STEP 3: Select a method to determine the operating margin (OM);
STEP 4: Calculate the operating margin emission factor according to the selected method;
STEP 5: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emission factor.

**STEP 1: Identify the relevant electricity power systems**
The tool defines that “for determining the electricity emission factors, identify the relevant electricity system. Similarly, identify any connected electricity systems”. It also states that, “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”. In previous years, the Indian electricity system was divided into two grids, the NEWNE and Southern Grid. These are now integrated as a single Indian Grid covering all the states.

As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

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

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

Project participants have the option of choosing between the following two options to calculate the operating margin and build margin emission factor:

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

Option I corresponds to the procedure contained in earlier versions of this tool. Option II allows the inclusion of off-grid power generation in the grid emission factor. Option II aims to reflect that in some countries off-grid power generation is significant and can partially be displaced by CDM project activities, e.g. if off-grid power plants are operated due to an unreliable and unstable electricity grid. Option II requires collecting data on off-grid power generation and can only be used if the conditions outlined therein are met. Option II may be chosen only for the operating margin emission factor or for both the build margin and the operating margin emission factor but not only

for the build margin emission factor. If Option II is chosen, off-grid power plants should be classified in different classes of off-grid power plants. Each off-grid power plant class should be considered as one power plant *j, k, m or n*, as applicable. In case of the project Option I is chosen with only grid power plants included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

PP has chosen Option (a) i.e. simple OM, to determine the operating margin. Other available options in the tool were ruled out considering the fact that data required to calculate simple adjusted OM or dispatch data analysis is not available publically. As per the tool, low cost/must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Data for the same, as published by Central Electricity Authority, has been presented below which illustrates that low cost/must run resources constitute less than 50% of total Indian grid generation, hence, the average OM method could not have been used.

**Share of Must-Run (Hydro/Nuclear) (% of Net Generation)**

| | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| India | 18.4% | 19.6% | 16.9% | 18.6% | 16.8% |

Data Source: Central Electricity Authority (CEA) database Version-11

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of three most recent years) for the INDIAN grid is less than 50 % of the total generation. Thus the average emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

The “Simple operating margin” has been calculated as per the weighted average emissions (in $tCO_2/MWh$) of all generating sources serving the system, excluding hydro, geo-thermal, wind, low-cost biomass, nuclear and solar generation;

As per tool to calculate emission factor for an electricity system (Version 06.0), 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. Since the low cost/must run resources constitute less than 50% of total grid generation as seen from the average of five most recent years, the Simple OM method can be used to calculate the Operating Margin Emission factor.

PP has chosen ex ante option, thus, no monitoring and recalculation of the emissions factor during the crediting period is required. PP has considered a data vintage of 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

**STEP 4: 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:

Option A: Based on the net electricity generation and a CO2 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.

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The $CO_2$ Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the "Tool to calculate the emission factor for an electricity system, Version 06.0". We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

As per „Tool to calculate the emission factor for an electricity system", Option A ("Based on the net electricity generation and a $CO_2$ emission factor of each power unit") is used to calculate simple OM emission factor. Where Option A is used, the simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = (\Sigma_m EG_{m,y} \times EF_{EL,m,y}) / \Sigma_m EG_{m,y}$$

Where:

$EF_{grid,OMsimple,y}$ Simple operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$)

$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$)

m All power units serving the grid in year y except low-cost / must-run power units

y the relevant year as per the data vintage chosen in STEP 3

As per the CEA database (Version 11.0), weighted average operating margin is as below:

$\mathbf{EF_{OM,y}}$ = 0.9941 $tCO_2/MWh$

**Step 5: Calculate the build margin (BM) emission factor, $EF'_{grid',BM,y}$**

The project participants have chosen Option I, i.e. fixing 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.

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

$$\mathbf{EFgrid_{BM,y} = \Sigma(EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin $CO_2$ emission factor in year *y* (t $CO_2$ e/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* (t $CO_2$ e/MWh)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

The $CO_2$ emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 4 (a) for the simple OM, using options A1B1 using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

The build margin emission factor ($EF_{grid,BM,y}$) for the year 2014-15 (most recent year) for Indian grid is 0.9285 $tCO_2$/MWh.

CEA's "CO2 Baseline Database for the Indian Power Sector" Version 11.0,.

| Build Margin (tCO2/MWh) (not adjusted for imports) | |
|---|---|
| | 2014-2015 |
| Indian Grid | 0.9285 |

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

The combined margin is the weighted average of the simple operating Margin and the build margin. In particular, for intermittent and non-dispatchable generation types such as wind and solar photovoltaic, the 'Tool to calculate the emission factor for an electricity system (Version 05.0.0)', allows to weigh the operating margin and Build margin at 75% and 25%, respectively

$$EF_{Indian,grid,y} = ( EF_{Indian,OM,y} \times w_{OM} ) + ( EF_{Indian,BM,y} \times w_{BM} )$$

$$= ( EF_{Indian,OM,y} \times 75\% ) + ( EF_{Indian,BM,y} \times 25\%)$$

Electronic spreadsheet showing calculation of all these parameters is being submitted separately and the final values are presented below:

| Parameter | Value | Units |
|---|---|---|
| Operating Margin : $EF_{OM,y}$ | 0.9941 | $tCO_2e$/MWh |
| Build Margin : $EF_{BM,y}$ | 0.9285 | |
| Combined Margin : $EF_{Indian,grid,y}$ | =0.9941*75%+0.9285*25% | |
| Combined Margin : $EF_{Indian,grid,y}$ | 0.9777 | |

**Project Emissions:**

As per applied methodology only emission associated with the fossil fuel combustion, emission from operation of geo-thermal power plants due to release of non-condensable gases, emission from water reservoir of Hydro should be accounted for the project emission. Since the project activity is a wind power project, hence $PE_y$= 0.

**Leakage Emissions:**

As per applied methodology no source of leakage emissions identified under proposed project activity.
Hence, $LE_y$= 0

**Emission reduction ($ER_y$):**

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plant by renewable electricity. The emission reduction $ER_y$ by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission. The emission reduction is calculated in line with para 58 of AC0002, Version 17, using equation below:

$ER_y = BE_y - PE_y - LE_y$

Where,

$ER_y$ = Emission Reduction in $tCO_2$/year
$BE_y$ = Baseline emission in $tCO_2$/year
$PE_y$ = Project emissions in $tCO_2$/year
$LE_y$ = Leakage Emissions in $tCO_2$/year

### B.6.2. Data and parameters fixed ex ante

| Data / Parameter | $EF_{OM, y}$ |
|---|---|
| Unit | $tCO_2$/MWh |
| Description | Operating Margin $CO_2$ emission factor for the Indian Grid in year y |
| Source of data | CEA's "*Baseline Carbon Dioxide Emission Database Version 11.0* " |
| Value(s) applied | 0.9941 |
| Choice of data or Measurement methods and procedures | Calculated in line with "*Tool to calculate the emission factor for an electricity system (Version 06.0.0)*" using data from Central Electricity Authority of India's (CEA) "*Baseline Carbon Dioxide Emission Database Version 11.0*".<br><br>The value used is calculated ex-ante as generation based weighted average of last three years of the operating margin provided in the CEA database.<br>Weighted average<br>= $\sum_{i=1 \text{ to } n}$ (Net generation in operating margin in year i * Simple operating margin in year i)/$\sum_{i= 1 \text{ to } n}$ (Net generation in operating margin of year i) |
| Purpose of data | *Calculation of baseline emissions* |
| Additional comment | The value is fixed ex-ante |

| Data / Parameter | $EF_{BM, y}$ |
|---|---|
| Unit | $tCO_2$/MWh |
| Description | Build Margin $CO_2$ emission factor for the Indian Grid in year y |
| Source of data | CEA's "*Baseline Carbon Dioxide Emission Database Version 11.0* " |
| Value(s) applied | 0.9285 |
| Choice of data or Measurement methods and procedures | Calculated in line with "*Tool to calculate the emission factor for an electricity system (Version 06.0.0)*" using data from Central Electricity Authority of India's (CEA) "*Baseline Carbon Dioxide Emission Database Version 11.0*".<br><br>The value is calculated ex-ante as most recent build margin provided by the CEA. |
| Purpose of data | *Calculation of baseline emissions* |
| Additional comment | The value is fixed ex-ante |

| Data / Parameter | $EF_{grid,CM, y}$ |
|---|---|
| Unit | $tCO_2$/MWh |
| Description | Combined Margin $CO_2$ emission factor for the Indian Grid in year y |
| Source of data | Central Electricity Authority(CEA) of India Database *Version 11.0* |
| Value(s) applied | 0.9777 |
| Choice of data or Measurement methods and procedures | This has been calculated based on Operating Margin (OM) and Build Margin (BM) published by Central Electricity Authority (CEA) of India. Please refer section B.6.1 for details. |

| | |
|---|---|
| **Purpose of data** | *Calculation of baseline emissions* |
| **Additional comment** | The value is fixed ex-ante |

### B.6.3. Ex ante calculation of emission reductions

>>

This is a renewable power generation project, the entire power generated from the project activity will be sold to Indian grid. This form of energy generation has no associated GHG emissions. So, the emission reductions will just depend on the quantity of electricity being supplied to the grid, which would have been otherwise generated from the grid.

**Baseline emissions:**

Baseline emission is calculated as per equation (1) in section B.6.1

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

Here, $EG_{PJ,y}$ *is* $EG_{facility,y}$ *as the project activity is a Green field power plant.*

$EG_{PJ,y}$*:* 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)

$EG_{facility,y}$ =50 MW*25%*365days*24 hours = 109,500 MWh

PLF has been taken from the DPR, prepared by third party.

Here,

$EF_{grid,CM,y}$ =*0.9777 $tCO_2$/MWh*

Hence,

BEy =**107,058 $tCO_2e$/year** (rounded down)

**Project emissions:**

Not applicable as this is a wind energy based power generation project.

$PE_y = 0$

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

| Year | Baseline emissions ($tCO_2e$) | Project emissions ($tCO_2e$) | Leakage ($tCO_2e$) | Emission reductions ($tCO_2e$) |
|---|---|---|---|---|
| Year 1 | 107,058 | 0 | 0 | 107,058 |
| Year 2 | 107,058 | 0 | 0 | 107,058 |
| Year 3 | 107,058 | 0 | 0 | 107,058 |
| Year 4 | 107,058 | 0 | 0 | 107,058 |
| Year 5 | 107,058 | 0 | 0 | 107,058 |
| Year 6 | 107,058 | 0 | 0 | 107,058 |
| Year 7 | 107,058 | 0 | 0 | 107,058 |
| **Total** | 749,406 | 0 | 0 | 749,406 |

| | | | | |
|---|---|---|---|---|
| **Total number of crediting years** | 7 years | | | |
| **Annual average over the crediting period** | 107,058 | 0 | 0 | 107,058 |

## B.7. Monitoring plan

### B.7.1. Data and parameters to be monitored

| **Data/Parameter** | **EG** $_{facility,y}$[11] |
|---|---|
| Data unit | MWh/year |
| Description | Quantity of net electricity supplied to the grid during the year y. |
| Source of data | Monthly energy generation statement issued by State Electricity Board. These are called JMR (Joint Meter Reading) |
| Value(s) applied | 109,500 |
| Measurement methods and procedures | Net electricity supplied will be calculated based on the difference between values of "export" and "import" on the energy meter at the Government sub station (evacuation point).<br>(Net Electricity = Export – Import)<br>The net electricity will be calculated by State electricity board and provided in the monthly generation statement/JMR/B-form. Hence, the net electricity reading will be directly sourced from the monthly generation statement/JMR/B-form. |
| Monitoring frequency | Measurement: Continuous<br>Recording: Monthly<br>Monitoring Method: recording in JMR (Join Meter Reading)<br>The JMR includes, monthly recording of electricity export & import. Energy meters of accuracy class 0.2 or 0.2s. |
| QA/QC procedures | Net electricity supplied to the grid by the project activity will be cross checked with invoices submitted to EB. The meter(s) shall be calibrated and maintained by the state utility as per their schedule, and this frequency of meter calibration is not within the control of the Project Proponent. However, the project proponent shall ensure that calibration of electricity meters is carried out in-line with the Nation standard[12] which recommends at least once in 5 year calibration or whenever abnormal difference/inconsistency is observed between main meter and check meter. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | - |

### B.7.2. Sampling plan

>>
Not Applicable

### B.7.3. Other elements of monitoring plan

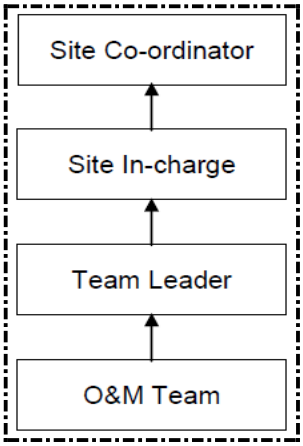
>>

[11] If the project activity is the installation of a Greenfield power plant, then: $EGPJ,y = EGfacility,y$

[12] (Page number 12 of ) http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

The project proponent has entered into an agreement with the WTG Suppliers (Gamesa) for the operation and maintenance of WTGs. The WTG supplier has dedicated and technically well-equipped O&M team for day to day Operation and maintenance of each WTG. O&M contractor will provide a monthly report, which includes generation data, major breakdown events and machine availability. Project manager is responsible for recording of monthly meter readings of export and import. Monthly power export and import data will be sent regularly to site in charge.

The data for the project is compiled by the O&M Contractor and subsequently stored by the PP, the reporting and data flows as per the below mentioned flow chart starting from Site O&M team which monitors day to day operational data and monthly recording. The roles and responsibilities for the project are described as below;



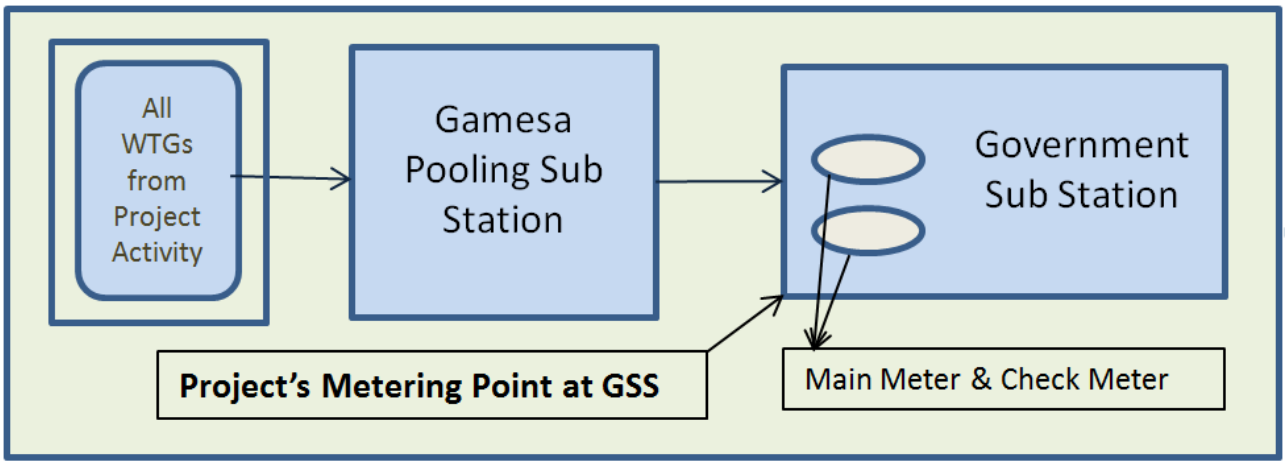

**Personal Training:**
The training for operating and maintaining the plant will be provided to the O&M team whenever there would be necessity or any technological up gradation

**Monitoring Process at project site**
Joint monthly meter reading shall be taken from substation meter by representative of DISCOM and O&M team/service provider (on behalf of the project proponent). It must be noted here that the meter readings as mentioned above shall be calculated as the product of meter multiplication factor and the difference of the current and previous meter readings

Based on the above procedure, the Monthly Wind Energy Certificates shall be provided to the project proponent. This is to be noted that the detail procedure of monitoring is illustrated here for the sake of understanding; for the preparation of monitoring report during periodic verifications, only the net electricity generation value calculated from energy certificates shall be used for emission reduction calculation. No other parameters as explained above shall be used and presented in the monitoring report.

**Emergency preparedness:**
In case Main meter or Check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the Check meter will be used for readings

The project's metering arrangement representation:




## SECTION C. Start date, crediting period type and duration

### C.1. Start date of project activity

>>
24/01/2016 (date of issue of first purchase order)

### C.2. Expected operational lifetime of project activity

>>
25 years 0 months[13]

### C.3. Crediting period of project activity

### C.3.1. Type of crediting period

>>
Renewable crediting period

### C.3.2. Start date of crediting period

>>

Retroactive start date required from 05/05/2016 (project commissioning date) or upon registration of the project activity with Gold Standard; as decided by the GSF.

### C.3.3. Duration of crediting period

>>
7 years

## SECTION D. Environmental impacts

### D.1. Analysis of environmental impacts

>>
In the applicable EIA notification i.e. S.O. 3067[14], dated 01/12/2009, Ministry of Environment & Forests (MoEF), Govt. of India, the wind projects are not included in the list of projects that has to

[13] General characteristic manual from Gamesa for WTG G97-IIIA

[14] http://moef.nic.in/downloads/rules-and-regulations/3067.pdf

get Prior Environmental Clearance (EC) either from State or Central Govt. authorities and hence no EIA study was conducted. The project does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. However due weightage has been given to environmental aspects.
However, the PP has conducted details ESIA (Environmental & Social Impact Assessment) study for the project activity and some of the significant impacts taken into consideration during the construction and operation of the wind farm are as follows:

1. Land Use: Due consideration has been taken in order to ensure that the land available for the setting up of the wind farm has no alternative use. Furthermore, no forest land was used for the purpose. Stringent measures were followed in order to prevent any soil erosion during the construction phase.
2. Noise Pollution: Typically, the wind farms are located in isolated areas and thereby the noise impacts on the neighbouring population are reduced. Also during the construction phase, suitable noise prevention and reduction measures were employed in order to reduce the ill-effects of noise pollution on the construction labourers.
3. Water Pollution: The nearest large water body present is the Arabian Sea. However, no significant impacts are envisaged due to the project activity.
4. Air Pollution: The implementation of the project activity will reduce the dependence on fossil fuel generated power and thereby lead to the improvement in air quality during the operational phase.
5. Visual Impact: As gathered in the stakeholder analysis, the wind mills do not have a negative impact on the surrounding villagers in terms of visual intrusion/impact.
6. Local Flora and Fauna: The land used for the purpose of setting up the wind farm was fallow land and therefore did not require any destruction of local flora. The only vegetation in the vicinity was shrubs and weeds.

Hence it can be concluded that the proposed project activity does not have any major negative impacts.

Further, as per the prevailing Ministry of Environment and Forest laws, the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated 14 September (2006), 38 activities are required to undertake environmental impact assessment studies. Environmental Impact Assessment study is not required for wind mill project as there is no negative environmental impact due to the project activity and wind energy is one of the cleanest sources of energy.

### D.2. Environmental impact assessment

>>
Not Applicable

## SECTION E. Local stakeholder consultation

### E.1. Modalities for local stakeholder consultation

>>
The project is a retroactive GS project as the stakeholder consultation was conducted after the start date of the project activity. The complete details of physical meeting conducted for stakeholders feedback (SFR) are explained in the section E.2 of the Passport. Summary of comments received

### E.2. Summary of comments received

>>
All the comments are mere clarification requests. All those comments were clarified by PP and consultant. No negative comments were received. Details of comments as well provided under the section E.2 of the project's GS passport.

### E.3. Consideration of comments received

>>

Refer above.

## SECTION F. Approval and authorization

>>
Not Applicable

# Appendix 1. Contact information of project participants

| | |
|---|---|
| **Organization name** | Orange Bercha Wind Power Private Limited |
| **Country** | India |
| **Address** | 301B, 3rd Floor, D-21 Corporate Park, Sector 21, Dwaraka, New Delhi- 110077 |
| **Telephone** | 011- 30501110 |
| **Fax** | 011- 30501114 |
| **E-mail** | pavangupta@orangerenewable.net |
| **Website** | www.orangerenewable.net |
| **Contact person** | Pavan Kumar Gupta |

# Appendix 2. Affirmation regarding public funding

No public funding for this project activity was received from annex 1 parties.

# Appendix 3. Applicability of methodologies and standardized baselines

Please refer section B.1 & B.2 of the PDD for the same.

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

From CO2 database of CEA, Version 11 published by Government of India, Ministry of Power Central Electricity Authority, Government of India.

| **CENTRAL ELECTRICITY AUTHORITY: $CO_2$ BASELINE DATABASE** | | | |
|---|---|---|---|
| VERSION | | | 11 |
| DATE | | | April 2016 |
| BASELINE METHODOLOGY | ACM0002 / Ver 16.0 and "Tool to Calculate the Emission Factor for an Electricity System" | | |
| | | | |
| **Net Generation in Operating Margin (GWh) (incl. Imports)** | | | |
| | **2012-13** | **2013-14** | **2014-15** |
| Indian Grid | 697,187 | 721,632 | 808,417 |
| | | | |
| **Simple Operating Margin ($tCO_2$/MWh) (incl. Imports) (1) (2)** | | | |
| | **2012-13** | **2013-14** | **2014-15** |
| Indian Grid | 0.9922 | 1.0002 | 0.9903 |
| | | | |
| **Weighted Generation Operating Margin** | | | |
| Indian Grid | | | 0.9941 |
| | | | |

| Build Margin ($tCO_2$/MWh) (not adjusted for imports) | | | |
|---|---|---|---|
| | **2012-13** | **2013-14** | **2014-15** |
| Indian Grid | 0.9692 | 0.9550 | 0.9285 |
| | | | |
| **Combined Margin Emission Factor** | | | |
| Indian Grid | | | **0.9777** |

## Appendix 5. Further background information on monitoring plan

Please refer section B.7.2 & B.7.3 for information on monitoring

## Appendix 6. Summary report of comments received from local stakeholders

The detailed stakeholders' consultation process and comments are described in the GS Passport.

## Appendix 7. Summary of post-registration changes

Not Applicable

- - - - -

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 10.1 | 28 June 2017 | Revision to make editorial improvement. |
| 10.0 | 7 June 2017 | Revision to:<br>• Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms;<br>• Make editorial improvement. |
| 09.0 | 24 May 2017 | Revision to:<br>• Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0);<br>• Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM);<br>• Make editorial improvement. |
| 08.0 | 22 July 2016 | EB 90, Annex 1<br>Revision to include provisions related to automatically additional project activities. |
| 07.0 | 15 April 2016 | Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0). |
| 06.0 | 9 March 2015 | Revision to:<br>• Include provisions related to statement on erroneous inclusion of a CPA;<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to local stakeholder consultation;<br>• Provisions related to the Host Party;<br>• Make editorial improvement. |
| 05.0 | 25 June 2014 | Revision to:<br>• 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));<br>• Include provisions related to standardized baselines;<br>• 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;<br>• Change the reference number from F-CDM-PDD to CDM-PDD-FORM;<br>• Make 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). |

| *Version* | *Date* | *Description* |
|---|---|---|
| 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<br>Initial adoption. |

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