**Project design document form**
**(Version 11.0)**

| BASIC INFORMATION | |
|---|---|
| **Title of the project activity** | 50.4 MW wind power project by EN Renewable Energy Pvt. Ltd[1] |
| **Scale of the project activity** | ☒ Large-scale<br>☐ Small-scale |
| **Version number of the PDD** | 07 |
| **Completion date of the PDD** | 11/09/2020 |
| **Project participants** | EN Renewable Energy Limited |
| **Host Party** | India |
| **Applied methodologies and standardized baselines** | **Methodology:** ACM0002 (Version 20.0[2])<br><br>**Standardized Baseline:** Not Applicable |
| **Sectoral scopes** | Energy industries (renewable/non-renewable sources) |
| **Estimated amount of annual average GHG emission reductions** | 104,878 $tCO_2e$ |

[1] https://cdm.unfccc.int/Projects/DB/RINA1295015997.94/view
[2] https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

## SECTION A. Description of project activity

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

EN Renewable Energy Limited ("ENRE") has developed 50.4 MW wind farm in the state of Karnataka in India. The project activity involved supply, erection, commissioning and operation of 63 machines of rated capacity 800 KW each. The machines are Enercon E-53 make. The project generates 111,347.31 MWh of electricity per year which is supplied to the Indian grid. The project activity assists the sustainable growth of the region by providing clean and green electricity to the state electricity grid.

The purpose of the project activity is to utilize renewable wind energy for generation of electricity. The project activity replaces anthropogenic emissions of greenhouse gases (GHG's) into the atmosphere, which is estimated to be approximately 105,239 $tCO_2e$ per year, by displacing the equivalent amount of electricity generation through the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansions connected to the grid. In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the Indian grid, which are/ will be predominantly based on fossil fuels. Whereas the operation of Wind Energy Convertors (WEC's) is emission free and no emissions occur during the lifetime of the project activity. As per the applicable methodology the baseline scenario for the project activity is the grid based electricity system, which is also the pre-project scenario.

The project activity has commissioned and the details of commissioning is provided below.

| Project Investor | Project type | Project Capacity | Date of Commissioning |
|---|---|---|---|
| EN Renewable Energy Limited | Wind | 24 MW | 16/02/2011 |
| | | 12 MW | 11/03/2011 |
| | | 3.2 MW | 31/03/2011 |
| | | 11.2 MW | 31/03/2011 |
| **Total Capacity (MW)** | | **50.4 MW** | |

### A.2. Location of project activity

**Country**: India
**Region/State/Province**: Southern Region/Karnataka State
**City/Town/Community**: The Project is spread across Sunahatti, Ganginahal, Kakti, Kanabargi, Baramanhatti, Nandi and Deshnur villages in Bailhongal and Belgaum Taluk of Belgaum District of Karnataka state in India. Nearest airport and railway station are at Belgaum.

### A.3. Technologies/measures

The project activity involves 63-wind energy converters (WECs) of Enercon make (800 kW E-53) with internal electrical lines connecting the project activity with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV. The project activity operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The average life time of the WEC is around 20 years as per the industry standards; the project activity has commissioned and the details are provided in section A.1 of the PDD. The other salient features of the state-of-art-technology are:

**E 53 Specifications**

| | |
|---|---|
| Turbine model | Enercon E- 53 |
| Rated power | 800 KW |
| Rotor diameter | 53 m |
| Hub height | 75 m |

| | |
|---|---|
| Turbine Type | Gearless horizontal axis wind turbine with variable rotor speed |
| Power regulation | Independent electromechanical pitch system for each blade. |
| Cut-in wind speed | 2.5 m/s |
| Rated wind speed | 12 m/s |
| Cut-out Wind speed | 28-34 m/s |
| Extreme Wind Speed | 59.5 m/s |
| Rated rotational speed | 32 rpm |
| Operating range rot. speed | 12-29 rpm |
| Orientation | Upwind |
| No of Blades | 3 |
| Blade Material | Glass Fibre reinforced Epoxy |
| Gear box type | Gear less |
| Generator type | Synchronous generator |
| Braking | Aerodynamic |
| Output Voltage | 400 V |
| Yaw System | Active yawing with 4 electric yaw drives with brake motor and friction bearing |
| Tower | 74 m concrete |

Enercon has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH, has established a manufacturing plant at Daman in India, where along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured. The Enercon annular generator is of primary importance in the gearless system design. Combined with the rotor hub it provides an almost frictionless flow of energy, while the gentle running of fewer moving components guarantees minimal material wear. Unlike conventional asynchronous generators, the Enercon annual generator is subjected to very little mechanical wear, which makes it ideal for particularly heavy demands and a long service life. Time consuming repair work and the associated turbine downtimes are also prevented.

The advantages of Enercon annular generator are:

- Yield optimized control
- High level of grid compatibility
- No gear
- Low wear due to slow machine rotation
- Low machine stress due to high level of speed variability

In the absence of the project activity, the equivalent amount of electricity would have been generated from the connected/ new power plants in the Indian grid, which are/ will be predominantly based on fossil fuels. Hence, baseline scenario of the project activity is the grid based electricity system, which is also the pre-project scenario. Since the project activity involves power generation from wind, it does not emit any emissions in the atmosphere.

The power generation from wind is a clean technology, as there are no GHG emissions associated with it. The power generation from wind turbines depends upon the wind speed and it does not require any fuel combustion for generating power, which is the major source of GHG emissions.

The power production through WEC's depends on several factors i.e. wind speed and grid availability. Grid availability as well as wind speed varies, based on different external factors. Enercon (India) Limited had conducted a study through Centre for Wind Energy Technology (C-WET) for estimating the PLF of the site. As per the report of 'site validation and generation estimation', the PLF of the site of the project activity comes out to be 26%. The same value of PLF has been used in the financial analysis in additionality demonstration.

### 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 Party) | EN Renewable Energy Limited (Private Entity) | 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.

The project activity has got loan assistance from Indian Renewable Energy Development Agency (IREDA) and does not involve any public funding and ODA component.

### A.6. History of project activity

The project activity was commissioned in a phase wise manner, wherein, the first machine got commissioned on 16/02/2011 and the last machine was commissioned on 31/03/2011. The registration date of the project activity under CDM mechanism is 21/03/2011. Currently, the project is applying for Renewal of 2nd Crediting Period.

The CDM 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). The CDM project activity is also not a project activity that has been deregistered. The CDM project activity was not a CPA that has been excluded from a registered CDM PoA.

### A.7. Debundling

According to Appendix C of simplified modalities and procedures for small scale CDM project activities, “de-bundling” is defined as the fragmentation of the large scale project activity into smaller parts. The proposed small scale project activity is not a “de-bundled” component of large scale project activity. If, there is no registered small scale CDM project activity or a request for registration by another small-scale project activity:

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

The proposed small-scale project activity is not a de-bundled component of a large project activity. Since, there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity by the project promoter, this project is not a debundled project.

## SECTION B. Application of methodologies and standardized baselines

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

**Title:** Grid-connected electricity generation from renewable sources
**Reference:** Approved consolidated baseline methodology ACM0002 (Version 20.0[3])

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

[3] https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

- Tool to calculate the emission factor for an electricity system[4] – Version 07 (EB 100, Annex 04)
- Tool for the demonstration and assessment of additionality[5] – Version 07.0.0

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

The project activity is wind based renewable energy source, zero emission power project connected to the Karnataka state grid, which forms part of the Indian electricity grid. The project activity will displace fossil fuel based electricity generation that would have otherwise been provided by the operation and expansion of the fossil fuel based power plants in Southern regional electricity grid. The approved consolidated baseline and monitoring methodology ACM0002 Version 20.0 is the choice of the baseline and monitoring methodology and it is applicable because:

| Para No. | Applicability Conditions as per ACM0002 | Applicability to this Project Activity |
|---|---|---|
| 1 | This methodology is applicable to grid-connected renewable power generation project activities that:<br>• install a Greenfield power plant;<br>• involve a capacity addition to (an) existing plant(s);<br>• involve a retrofit of (an) existing operating plants/units;<br>• involve a rehabilitation of (an) existing plant(s)/unit(s) or<br>• involve a replacement of (an) existing plant(s)/unit(s). | The project activity is grid connected renewable power generation from wind which falls under applicability criteria option 1 (a) i.e., "Install a Greenfield power plant". Hence the project activity meets the given applicability criterion. |
| 2 | 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 an installation of a new grid connected renewable energy wind power plant and hence this condition is met. |
| 3 | 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, 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 project activity does not involve any capacity additions, retrofits or replacements and therefore this condition is not applicable. |
| 4 | In case of hydro power plants, one of the following conditions shall apply:<br>a. The project activity is implemented in existing single or multiple reservoirs, with no | The project activity is a grid connected renewable wind energy project. This condition is applicable only for hydro power plants and not applicable for wind projects. Therefore, this condition is not applicable for project activity. |

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

| | | |
|---|---|---|
| | change in the volume of any of the reservoirs; or<br>b. The project activity is implemented in 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 $W/m^2$; or<br>c. The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 $W/m^2$.<br>d. The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 $W/m^2$, all of the following conditions shall apply:<br>i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 $W/m^2$;<br>ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 $W/m^2$ shall be;<br>a. Lower than or equal to 15 MW; and<br>b. Less than 10 per cent of the total installed capacity of integrated hydro power project. | |
| 5 | In the case of integrated hydro power projects, project participant shall:<br>i) 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>ii) 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 | The project activity is a grid connected renewable wind energy project. This condition is applicable only for hydro power plants and not applicable for wind projects.<br><br>Therefore this condition is not applicable for project activity. |

| | | |
|---|---|---|
| | 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 in different 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. | |
| 6 | In the case of integrated hydro power projects, project participant shall:<br>i) 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>ii) 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 in different 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 project activity is a grid connected renewable wind energy project. This condition is applicable only for hydro power plants and not applicable for wind projects.<br><br>Therefore this condition is not applicable for project activity. |
| 7 | Methodology is not applicable to the following:<br>a. Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, | The project activity is an installation of a new grid connected renewable energy project and does not involve switching from fossil fuel to renewable energy and hence this criterion is not relevant to the project activity. |

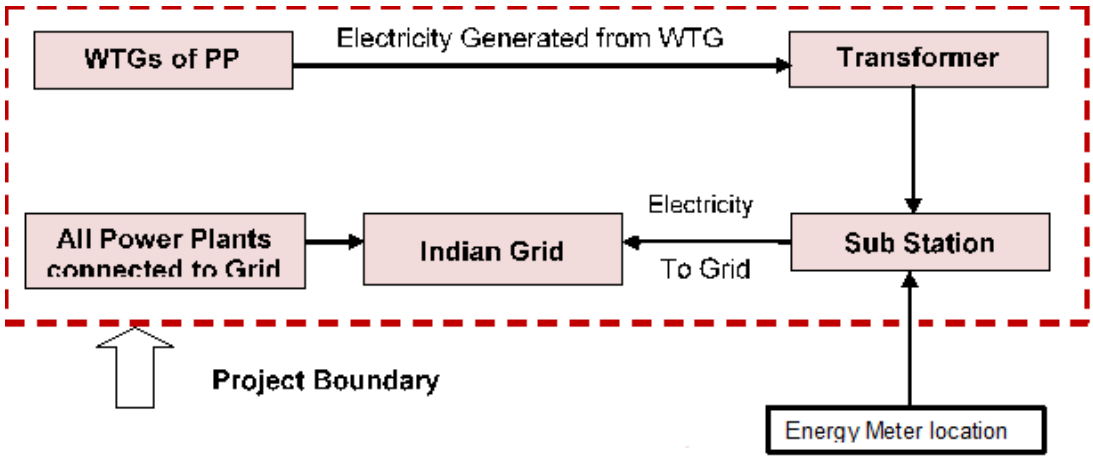
| | | |
|---|---|---|
| | since in this case the baseline may be the continued use of fossil fuels at the site;<br>b. Biomass fired power plants/units | |
| 8 | In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline 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 project activity is a new grid connected renewable wind energy plant and not a retrofits, replacement or capacity additions and therefore this criterion is not applicable to the project activity. |

The description provided in table above shows that the project activity satisfies the applicable conditions of the methodology, ACM0002.

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

According to the applicable methodology, spatial extent of this project activity includes the project site and all the power plants connected physically to the electricity system that the CDM power project is connected to. The project activity is connected to the network of state transmission utility which falls in Indian grid. Thus, the project boundary includes all the power plants physically connected to the Indian grid.

**Flow diagram of the project boundary:**




The baseline study of Indian grid shows that the main sources of GHG emissions in the baseline are $CO_2$ emissions from the conventional power generating systems, the other emissions are that of $CH_4$ and $N_2O$ but both emissions were conservative and are excluded for simplification of the project. The project activity is the emission free electricity generation from renewable sources and hence emits no gases in the atmosphere.

Following table indicates the sources and gases included in the project boundary:

| Source | | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Grid-connected electricity generation | $CO_2$ | Yes | In the baseline scenario the electricity would have been sourced from the Southern grid which in turn would be connected to fossil fuel fired power plants which emit $CO_2$. |

| | | | | |
|---|---|---|---|---|
| | | $CH_4$ | No | No methane generation is expected to be emitted. |
| | | $N_2O$ | No | No nitrous oxide generation is expected to be emitted. |
| **Project activity** | Greenfield wind energy conversion system | $CO_2$ | No | The project activity does not emit any emissions. |
| | | $CH_4$ | No | No methane generation is expected to be emitted. |
| | | $N_2O$ | No | No nitrous oxide generation is expected to be emitted. |

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

Updated baseline for the second crediting period in line with the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period." Version 03.0.1.

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 283 to 286 of Project Standard version 02.0.

The tool stipulates the following steps to be carried out.

**Step 1: Assess the validity of the current baseline for the next crediting period**

**Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies**

The baseline scenario remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies.

**Step 1.2: Assess the impact of circumstances**

The baseline scenario identified at the validation of the project activity was the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plants and by the addition of new generation sources into the grid. Thus this project activity was a voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period under CDM.

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 356,100.20 MW as on 31.03.2018, consisting of 226,279.34 MW Thermal, 77,641.63 MW Renew and 6,780 MW Nuclear. Sector-wise details of installed capacity are shown in Table 1. However, it is evident from Table 1[6] that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the $CO_2$ emissions in the country by increased use of renewable energy sources.

[6] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

Furthermore, project participant has considered the latest available $CO_2$ Baseline Database (CEA database, version 15) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission. As per below table, the fossil fuel based thermal power generation is dominant over the renewable based power generation, thus baseline scenario remains same as original.

Table 1: Sector- wise installed capacity (MW) as on 31/03/2019 (CEA Database version 15)

| Sector | Thermal | | | | Nuclear | Hydro | RES | Total |
|---|---|---|---|---|---|---|---|---|
| | Coal | Gas | Diesel | Total | | | | |
| State | 65366.50 | 7118.71 | 363.93 | 72849.14 | 0.00 | 29878.80 | 2347.93 | 105075.86 |
| Central | 58820.00 | 7237.91 | 0.00 | 66057.91 | 6780.00 | 12126.42 | 1632.30 | 86596.63 |
| Private | 76518.00 | 10580.60 | 273.70 | 87372.30 | 0.00 | 3394.00 | 73661.40 | 164427.70 |
| All India | 200704.50 | 24937.22 | 637.63 | 226279.34 | 6780.00 | 45399.22 | 77641.63 | 356100.19 |

Thus, current baseline remain same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period.

**Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested**

As explained in step 1.2, the baseline scenario was the electricity import/generation from the power plants connected to the electricity grid. The project activity in green field project and there is no any baseline equipment or investment involved in project activity. Therefore this condition is not applicable to the project activity.

**Step 1.4: Assessment of the validity of the data and parameters**

This step stipulates that “Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.”

In the context of the present project activity the emission factor has been updated along with the approach used to calculate the emission factor.

**Step 2: Update the current baseline and the data and parameters**

**Step 2.1: Update the current baseline**

As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version of CEA database available at the time of PDD submission for renewal.

In line with the project standard version 02.0, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

**Impact of the national and/or sectoral policies and circumstances upon the baseline scenario of the project activity**

The Government of India enacted the Electricity Act in the year 2003 to harmonize and rationalize the provisions in the existing laws. The Act consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. With the Enactment of the act, the then existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PDD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy[7] on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

In addition to the above policies, State Electricity Regulatory Commissions (SERCs) have announced preferential tariffs and Indian Renewable Energy Development Agency (IREDA) provides term loan assistance towards establishing wind power projects. All these fiscal and financial incentives were in force at the time of completion of the baseline study for the registered PDD of the project activity and still continue to exist.

The state electricity regulatory commission issues tariff order in respect of procurement of power generated wind generators and there is no mandatory national and/or sectoral policies have come into effect that would affect the compliance of the current baseline. Hence, it can be concluded the current baseline complies with all relevant mandatory national and/or sectoral policies that have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period.

However, in spite of the financial incentives given by the government to renewable power projects in India the generation from the low cost must run resources connected to the Southern Grid has not increased to such an extent that this would lead to more than 50% contribution from the low cost must run resources towards the total generation from the Southern Grid.

The approved consolidated baseline methodology, ACM0002 (Version 20.0), has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "*Tool to calculate the emission factor for an electricity system*" *(version 07.0)* has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

As per CEA database version 15, the fossil fuel dominated electricity is more than renewable sector and is continuing with same pattern. In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the Project Standard version 02.0, national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario. Hence the baseline scenario as applied for the present project activity remains justified.

As per the approved consolidated Methodology ACM0002 (Version 20.0) para 22: "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

[7] http://www.cercind.gov.in/Act-with-amendment.pdf

margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

The project activity involves setting up of wind project 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 Indian 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 Indian grid. Hence, the baseline for the project activity is the equivalent amount of power from the Indian grid.

**Step 2.2: Update the data and parameters**

As per the Step 1.4, in the context of the present project activity the emission factor has been updated along with the approach used to calculate the emission factor.

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 CEA database version 15 is the latest available data at the time of PD submission to DOE for validation, hence same is considered for emission factor calculations.

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

| Parameter | Value | Nomenclature | Source |
|---|---|---|---|
| $EF_{grid,CM,y}$ | 0.9419 $tCO_2/MWh$ | 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 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India |
| $EF_{grid,OM,y}$ | 0.9622 $tCO_2/MWh$ | Operating margin $CO_2$ emission factor for the project electricity system in year y | Calculated as the last 3 year (2016-17, 2017-18, 2018-19) generation-weighted average, sourced from Baseline $CO_2$ Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India |
| $EF_{grid,BM,y}$ | 0.8811 $tCO_2/MWh$ | Build margin $CO_2$ emission factor for the project electricity system in year y | Baseline $CO_2$ Emission Database, Version 15.0, May 2019 published by Central Electricity Authority (CEA), Government of India |

## B.5. Demonstration of additionality

The latest additionality tool i.e. Tool for the demonstration and assessment of additionality, version 07.0.0, approved by CDM Executive Board is used to demonstrate project additionality.

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

Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

**Sub-step 1a: Define alternatives to the project activity:**

1. Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity.

These alternatives are to include:

- The proposed project activity undertaken without being registered as a CDM project activity;
- Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g., cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;
- If applicable, continuation of the current situation (no project activity or other alternatives\ undertaken).

The baseline alternative for the project activity is pre-defined in ACM0002 as generation of equivalent amount of electricity by operation of grid-connected power plants and by addition of new generation sources. Accordingly, the realistic and credible alternatives to the project activity are:

(a) The Project is not undertaken as a CDM project activity.

As per this alternative the project participant would have gone ahead with the implementation of the project activity, generating renewable electricity and exporting the same to the grid under the power purchase agreement thereby displacing equivalent amount of electricity generated by the currently running power plants in the grid.

No emissions of greenhouse gases to atmosphere through this alternative. This alternative may be a part of the baseline. However, this alternative faces investment barrier as shown by the investment analysis conducted in the subsequent step 2.

(b) Setting up of comparable utility scale fossil fuel fired (gas or coal), wind power or hydro power projects that supply to the Indian grid under a PPA.

This alternative is to construct renewable power plants whose annual power supply is equivalent to the projects. However, those kinds of renewable power plants, such as photovoltaic, tidal/wave, hydro, geothermal and renewable wind project etc., are strongly dependent on climate and natural resources. There are not exploitable renewable (tidal/wave/hydro), and wind energy source at the project site since the project is located in dry land site. Further the solar photovoltaic power generation is not feasible because of its cost of electricity generation[8]. Therefore, this alternative is not a possible baseline scenario.

PDD do not consider coal or gas fired power plants as the viable alternative to the wind farm. As per the tool for additionality “a coal/gas -fired power station or hydropower may not be an alternative for an independent power producer investing in wind energy.

(c) Continuation of the current situation

The “no project option” where in the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions (which are mostly thermal) is the most plausible alternative as baseline option for the

[8] Cost of electricity generation from solar is about Rs. 15 per kWH
http://www.mnre.gov.in/pdf/guidelines_spg.pdf

project. Thus, suitable grid mix has been selected as baseline option and therefore for calculation of baseline emission. So, the baseline scenario of the project is Equivalent annual electricity supplied by Southern Grid, which is the continued operation of the existing power plants and the addition of new generation sources on the Southern regional grid to meet the electricity demand. The project involves constructing a wind farm by using wind resources for power generation. The emission reductions of the project are equal to the baseline emissions since the project emissions and leakage is zero respectively.

**Outcome of Step 1a:** Alternatives (a) and (c) above have been identified as realistic and credible alternative scenario(s) to the project activity

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

2. The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This Sub-step does not consider national and local policies that do not have legally binding status.)

3. If an alternative does not comply with all mandatory applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that non compliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration;

4. If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

Both above mentioned alternatives are in compliance with all mandatory applicable legal and regulatory requirements as shown below:

- The implementation of the project activity is a voluntary initiative and it is not mandatory or a legal requirement.
- The Indian Electricity Act, 2003 does not restrict or empower any authority to restrict the fuel choice for power generation.
- The applicable environmental regulations do not restrict the use of wind energy for power generation.
- There is no legal requirement on the choice of a particular technology for power generation.

**Outcome of Step 1b:** Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

**Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)**

**Step 2: 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, use the following Sub-steps:

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

1. Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (Sub-step 2b). If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III).

**Sub-step 2b: Option I. Apply simple cost analysis**

2. Document the costs associated with the CDM project activity and the alternatives identified in Step 1 and demonstrate that there is at least one alternative which is less costly than the project activity.

**"If it is concluded that the proposed CDM project activity is more costly than at least one alternative then proceed to Step 4 (Common practice analysis)".**

**Sub-step 2b: Option II. Apply investment comparison analysis**

1. Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context.

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

2. Identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context.

3. When applying Option II or Option III, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. Only in the particular case where the project activity can be implemented by the project participant, the specific financial/economic situation of the company undertaking the project activity can be considered.

4. Discount rates and benchmarks shall be derived from:

    a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;
    b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;
    c) A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by the same company used the same benchmark;
    d) Government/official approved benchmark where such benchmarks are used for investment decisions;
    e) Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified

Simple cost analysis is not applicable as the project activity sells electricity to the Utility and obtains economic benefits in the form of electricity tariffs.

The alternative to the project activity is continuation of current situation i.e. no project activity, in that case equivalent amount of electricity would have been produced by the grid electricity system. This option will not require capital investment. Hence investment comparison analysis (option II) cannot be applied.

The Project Proponent proposes to use **Option III – Benchmark Analysis** and the financial indicator that are identified as the post-tax equity IRR.

The guidance to investment analysis issued in EB 51, Annex 58 (paragraph 12) states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity (Cost of Equity) are appropriate benchmarks for equity IRR.

The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that in cases where the project has more than one potential developer, the benchmark shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Accordingly, the cost of equity applicable to the project type has been considered as the benchmark to be compared against equity IRR.

The benchmark Cost of equity for the project is **15.95%.**

**Calculation on Cost of Equity**

**Selection of Appropriate Benchmark:**

In choosing an appropriate benchmark we have based our approach on the principles of financing and investment decision making that are well found in theory and practice of corporate financing worldwide. We have derived from text book on “Corporate Finance Theory and Practice” by Dr. Aswath Damodaran of Stern School of Business, New York University. Dr. Damodaran is one of the foremost authorities in the world in the field of Investment Analysis.

The guidance to investment analysis issued in EB 51 states that in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR and cost of Equity is appropriate benchmark for equity IRR.

It is also worthwhile to note that the captioned project is a Greenfield wind power generation project that generates and supplies electricity to the state grid, therefore the project cannot have only one possible project developer. The tool for demonstration and assessment of additionality [para-5, sub step 2(b)] states that in such cases (where the project has more than one potential developer) the benchmark cannot be based on internal cost of equity or WACC and shall be based on parameters that are standard in the market, considering the specific characteristics of the project type. Hence, we have not used company or project specific parameters for the calculation of the benchmark.

**Risk free rate:**

The risk free rate is understood as the rate of return on an asset that is theoretically free of any risks, therefore the yeild rates are considered as risk free rates. Page 188 of text book on “Corporate Finance Theory and Practice” by Dr. Aswath Damodaran11, Stern School of Business, New York University, describes that the yield rates are suitable indicators of risk free rates when the time horizon for the investment is long term. Accordingly the risk free rate has been taken from yield rates available at the decision making date. This has been considered as it was in the year of investment (i.e in that year, the company had the alternative of this long term risk free investment). The data on yield rates is published by Reserve Bank of India. (RBI Web-link: http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/87456.pdf).

The applicable risk free rate is 7.53% (average of 6.17% to 8.88%).

**Risk Premium:**

The most common approach for estimating the risk premium is to base it on historical data, in the CAPM, the premium is estimated by looking at the difference between average return on stocks and risk free return. It is preferred to use long term premimums, i.e over a period of 25 years, since considering shorter time periods can lead to large standard errors because volatility in stock returns [page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran]. It is also preferred to calculate the risk premium based on geometric mean of the returns since arithmetic mean overstates the risk premium. Geometric mean is defined as the compounded annual return over the same period [page 191, Corporate Finance Theory and Practice, Dr. Aswath Damodaran].

Therefore, the risk premium has been calculated as the difference in compounded annual return between the BSE-Sensex and the yield rate since the year of inception of BSE Sensex. The detailed calculations are presented in the attached excel sheet.

The applicable risk premium is 10.64%.

**Beta:**

Beta (B) indicates the sensitivity of the company to market risk factors. Beta represents the market risk for an asset and is calculated as the statistical measure of volatility of a specific asset/investment relative to the movement of a market group. The conventional approach for estimating beta of an investment is a regression of returns on investment against returns on a market index. For companies that are not publicly listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is wind power generation; the approach therefore should be to base the beta for the project on the beta values of listed wind power generation companies in India. Therefore, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

Therefore, we have considered beta values of all electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. It is understood that risky businesses are likely to have higher cost of equity than safer businesses; projects in riskier businesses will have to cover these higher costs. Hence, investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks from significantly varying and unpredictable resource availability (e.g. wind), and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non conventional energy.

The applicable Beta value has been determined on the basis of the Beta values of major power generating companies in India which were listed on the stock exchange at the time of this investment. Beta values of individual companies have been sourced from Bloomberg. The table below summarises the beta values:

| **Company Name** | **Beta** |
|---|---|
| Cese Ltd | 1.20 |
| Gujarat industries | 0.93 |
| Tata Power | 1.17 |
| NTPC | 0.792 |
| Average | 1.02 |
| Minimum | 0.792 |
| Period: Five years from 1 Oct 2003 to 30 September 2008 | |

Source: Bloomberg

**Calculation of Benchmark Cost of Equity:**

Cost of Equity: The expected return on equity has been determined using the Capital Asset Pricing Model (CAPM)[9]. The CAPM economic model is used worldwide to determine the required/expected return on equity based on potential risk of an investment. The CAPM framework is the Nobel award winning work of financial economist Dr. William Sharpe.

$K_e = R_f + B \times (R_m - R_f)$

where:

$K_e$ = Rate of return on equity capital;

$R_f$ = Risk-free rate of return;

B = Beta;

$R_m – R_f$ = Market risk premium;

**Cost of Equity = Risk Free Rate + Beta x Market risk premium**
= 7.53% + 0.792 x 10.64%
= 15.95%

**Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):**

5. Calculate the suitable financial indicator for the proposed CDM project activity and, in the case of Option II above, for the other alternatives. Include all relevant costs (including, for example, the investment cost, the operations and maintenance costs), and revenues (excluding CER revenues, but possibly including inter alia subsidies/fiscal incentives, ODA, etc, where applicable), and, as appropriate, non-market cost and benefits in the case of public investors if this is standard practice for the selection of public investments in the host country.
6. Present the investment analysis in a transparent manner and provide all the relevant assumptions, preferably in the CDM-PDD, or in separate annexes to the CDM-PDD, so that a reader can reproduce the analysis and obtain the same results. Refer to all critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital). Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial/economic indicator, the project's risks can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents).
7. Assumptions and input data for the investment analysis shall not differ across the project activity and its alternatives, unless differences can be well substantiated.
8. Present in the CDM-PDD submitted for validation a clear comparison of the financial indicator for the proposed CDM activity and:

    a. The alternatives, if Option II (investment comparison analysis) is used. If one of the other alternatives has the best indicator (e.g. highest IRR), then the CDM project activity cannot be considered as the most financially attractive;
    b. The financial benchmark, if Option III (benchmark analysis) is used. If the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

The key assumptions used for calculating post-tax Equity IRR are set out below:

[9] The Capital Asset Pricing Model (CAPM) was published in 1964 by William Sharpe, for his work on CAPM Sharpe received the Nobel Prize in 1990. http://www.investopedia.com/articles/06/CAPM.asp

| | | | |
|---|---|---|---|
| Capacity of Machines in kW | 800 | | Enercon Offer |
| Number of Machines | 63 | | Enercon Offer |
| Project Capacity in MW | 50.40 | | Enercon Offer |
| Expected date of project Commissioning | 30-Sep-10 | | Detailed Project Report |
| Project Cost per MW (Rs. In Millions) | 52.1000 | | Enercon Offer |
| **Operations** | | | |
| Plant Load Factor Base Case | 26% | | Generation estimated by CWET |
| Transformation loss and Transmission Loss up to metering point | 3.0% | | Detailed Project Report |
| Effective PLF | 25.22% | | Calculated |
| Insurance Charges @ % of capital cost | 0.18% | | Detailed Project Report |
| Operation & Maintenance Cost base year @ % of capital cost | 1.25% | | Enercon's offer |
| % of escalation per annum on O & M Charges | 5.0% | | Enercon's offer |
| **Tariff** | | | |
| Base year Tariff for 10 years - Rs./Kwh | 3.40 | | KERC Order |
| Annual Escalation (Rs./kWh per Year) | 0.00 | | KERC Order |
| Tariff applicable after 10 years (Rs/kWh) | 2.80 | | Please refer for explanation for tariff beyond 10th year below. |
| **Project Cost** | **Rs Million** | | |
| Land and Infrastructure, Generator & Electrical Equipments, Mechanical Equipments, Civil Works, Instrumentation & Control, Other Project Cost, Pre operative Expenses, etc. | | | |
| **Total Project Cost** | **2,625.84 Cost/Machine (Rs Million)** | **Project Cost (Rs Million)** | Enercon Offer |
| WTG's | 29.5 | 1858.50 | Enercon Offer |
| Concrete Tower | 4.68 | 294.84 | Enercon Offer |
| Distribution Transformer | 2.7 | 170.10 | Enercon Offer |
| Civil works, foundation and electrical lines | 1.4 | 88.20 | Enercon Offer |
| Erection, commissioning, insurance and other works | 1.4 | 88.20 | Enercon Offer |
| Land and Transportation charges | 2 | 126.00 | Enercon Offer |
| | 41.68 | 2625.84 | |
| **Means of Finance** | | **Rs Million** | |
| Own Source | 30.00% | 787.75 | |
| Term Loan | 70.00% | 1,838.09 | |
| Total Source | | 2,625.84 | Enercon Offer |
| **Terms of Loan** | | | |

| | | | |
|---|---|---|---|
| Interest Rate | 13.25% | | PLR rate published by RBI (http://rbidocs.rbi.org.in/rdocs/Wss/PD Fs/wss250909_F.pd f) |
| Tenure | 10 | Years | Normative for power generation Sector in India |
| **Income Tax Depreciation Rate (Written Down Value basis)** | | | |
| on Wind Energy Generators | 80% | | Income Tax Act |
| Book Depreciation Rate (Straight Line Method basis) | | | |
| On all assets | 4.50% | | Straight line Method Adopted |
| **Income Tax** | | | |
| Income Tax rate | 33.99% | | Income Tax Act |
| Minimum Alternate Tax | 11.33% | | Income Tax Act |
| **Working capital** | | | |
| Receivables (no of days) | 30 | | Billing Cycle |
| O & m expenses (no of days) | 120 | | Enercon's Offer |

The post tax equity IRR for the Project without CDM revenues is 6.36% i.e. less than the benchmark.

**Tariff beyond 10th year (i.e. beyond the term of PPA)**

Karnataka state electricity commission has fixed the tariff for the period of 10 years. The tariff computed by the KERC order for the first year is INR 3.97 per unit and its decreases progressively to INR 2.80 per unit in the 10th year. According to KERC order dated 18 Jan 2005, the reduction in tariff year on year is on the account of repayment of debt and also there are no running cost other than O&M which increases only marginally.

Therefore from 11th year to the 20th year, the tariff number cannot contain the element of debt service (principal repayment and interest payment) and even with the increased operating costs, the overall tariff number is lower in the 11th year. In the public hearing held by KERC on 28-December-2004 to seek inputs on its "Consultation Paper on Back ground Issues on treatment of Renewable Energy Projects in the light of Electricity Act- 2003" under article (8-vii), common issues raised in the discussion paper on renewable energy projects: Tariff determination for old and new projects, KERC has ruled that the same tariff cannot be applied for projects that have completed 10 years of operational life since these projects has completed their loan repayment obligations. Therefore conservatively we have assumed tariff of INR 2.80 for substantiating additionality.

**Sub-step 2d: Sensitivity analysis (only applicable to Options II and III):**

9. Include a sensitivity analysis that shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 11a) or is unlikely to be financially/economically attractive (as per Step 2c para 11b).

**Sensitivity Analysis**

As per the investment guidelines only those parameters should be selected for the sensitivity analysis that constitute more than 20% of either total project costs or total project revenues. Capital cost, tariff and PLF are such parameters and hence these are selected for sensitivity analysis. However to show the robustness of the sensitivity analysis we have considered O&M cost and Debt-Equity ratio also as a sensitivity parameter along with the above mentioned parameters.

- Capital Cost
- Tariff
- Plant Load Factor

- Debt Equity Ratio
- O&M cost

**Capital Cost**

In accordance with the investment guidance, the additionality for the project activity is demonstrated at the time of decision making. We have indicated post tax equity IRR for the project activity with the variation of 10% over the base cost. The equity IRR is below the benchmark even with 10% decrease on capital cost.

| | 10% decrease in Capital Cost | Base Capital Cost | 10% Increase In Capital Cost |
|---|---|---|---|
| Post tax Equity IRR | 9.01% | 6.36% | 4.17% |

The equity IRR crosses the benchmark at capital cost variation of 28.6% which is not possible as such a huge deviation for a large capital intensive project after finalisation of Purchase Order is not realistic.

**Tariff**

Karnataka state electricity commission has fixed the tariff for the period of 10 years. The tariff computed by the KERC order for the first year is INR 3.97 per unit and its decreases progressively to INR 2.80 per unit in the 10th year. According to KERC order dated 18 Jan 2005, the reduction in tariff year on year is on the account of repayment of debt and also there are no running cost other than O&M which increases only marginally. Therefore conservatively we have assumed tariff of INR 2.80 for substantiating additionality.

Therefore from 11th year to the 20th year, the tariff number cannot contain the element of debt service (principal repayment and interest payment) and even with the increased operating costs, the overall tariff number is lower in the 11th year. In the public hearing held by KERC on 28-December-2004 to seek inputs on its “Consultation Paper on Back ground Issues on treatment of Renewable Energy Projects in the light of Electricity Act- 2003” under article (8-vii), common issues raised in the discussion paper on renewable energy projects: Tariff determination for old and new projects, KERC has ruled that the same tariff cannot be applied for projects that have completed 10 years of operational life since these projects has completed their loan repayment obligations.

Therefore we have conducted sensitivity assuming a variation of 10% over the tariff of Rs. 2.80 per unit for the period beyond the term of PPA. Further, we have included the tariff of Rs. 3.40 for the period from 11th to 20th year in the sensitivity analysis.

| Tariff beyond the term of PPA | 10% decrease over base tariff | Base tariff (Rs. 2.80 per unit beyond the term of PPA) | 10% Increase over base tariff | Tariff of Rs. 3.40 per Kwh for the period beyond 10th year |
|---|---|---|---|---|
| Post tax Equity IRR | 5.61% | 6.36% | 7.05% | 7.77% |

The project does not cross the benchmark even at the tariff of Rs. 5.00 per unit after 10th year which is not realistic.

**Plant Load Factor**

Plant Load Factor is the key variable encompassing variation in wind profile, variation in off-take (including grid availability) including machine downtime. We have conducted sensitivity at the variation of 10% from the base case.

Sensitivity is summarized in below table:

| | PLF @ 23.4 % (-10%) | PLF 26% (Base Case) | PLF @ 28.6% (+10%) |
|---|---|---|---|
| Post tax Equity IRR | 3.97% | 6.36% | 8.73% |

The sensitivity analysis clearly shows even with a higher PLF, the project is not able to generate sufficient returns. It can therefore be concluded that the project is financially not viable without CDM benefits. The project does not cross the benchmark even at PLF variation of 30% which is not realistic.

**Debt Equity Ratio**

The debt equity ratio envisaged for the project activity is 70:30. We have conducted sensitivity on debt equity ratio at the variation of +/-10%.

| | Debt equity [2.13] | Debt equity Ratio [2.33] | Debt equity [2.57] |
|---|---|---|---|
| Post tax Equity IRR | 6.31 % | 6.36% | 6.42% |

The project does not cross the benchmark even at 100% variation in debt equity ratio (i.e. 100% equity finance).

**O&M Cost**

The Sensitivity in O&M maintenance cost is conducted after taking to consideration +/-10% decrease in O&M Cost.

| | 10% decrease in O&M cost | Base O&M Cost | 10% Increase In O&M cost |
|---|---|---|---|
| Post tax Equity IRR | 6.70% | 6.36% | 6.02% |

The project does not cross the benchmark even at 100% variation in O&M cost.

**Outcome of Step 2:** If after the sensitivity analysis it is concluded that: (1) the proposed CDM project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 11a) or is unlikely to be financially/economically attractive (as per Step 2c para 11b), then proceed to Step 4 (Common practice analysis).

**Step 3: Barrier analysis**

Not Opted for.

**Step 4: Common practice analysis**

Unless the proposed project type has demonstrated to be first-of-its kind (according to Sub-step 3a), the above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. This test is a **credibility check** to complement the investment analysis (Step 2) or barrier analysis (Step 3). Identify and discuss the existing common practice through the following Sub-steps:

**Sub-step 4a: Analyze other activities similar to the proposed project activity:**

1. Provide an analysis of any other activities that are operational and that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take

place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

The additionality tool version 07.0.0 describes similar project activities are those that rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing etc.

The proposed project activity is in the state of Karnataka by EN Renewable Energy Limited. The tariff is determined by the state electricity regulatory commissions in their respective states and hence investment climate is different for each state. The proposed project activity is the wind based power generation project of 50.4 MW (large scale) by a single investor. In light of the above definition, all large scale wind projects, (greater than 15 MW) set up by a single investor in the state of Karnataka, have been analyzed. In India there 95[10] individual investors who have wind installations greater than 15 MW. Out of these there are 8[11] investors who have wind installations greater than 15 MW in the state of Karnataka. An analysis of these installations has been presented below.

| Sl. No | Name of Owner | Capacity in Karnataka (MW)[12] | CDM status |
|---|---|---|---|
| 1 | MSPL Limited | 92.15 | CDM project under 3 PDDs titled:<br>1) **"Emission free electricity generation at Harihar, Karnataka"** http://cdm.unfccc.int/UserManagement/FileStorage/Q7FCFG 27XNUZ6IB32EM7CTVC7KZG6R and<br>2) **"8.35 MW wind power project at Guddarangavana Halli, Chitradurga, Karnataka in India"** http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf.<br>3) **"125 MW Wind Power Project in Karnataka, India"** http://cdm.unfccc.int/UserManagement/FileStorage/6TU55O XGCAEHNZQV27694ATC31SOM3<br>All of MSPL's installations are under CDM or the voluntary carbon market as given in their website http://www.mspllimited.com/wind%20power.htm |
| 2 | Enercon Windfarms (Hindustan) P. Ltd. | 68.8 | CDM project under the PDD titled:<br>**" Enercon Wind Farm (Hindustan) Ltd in Karnataka"** http://cdm.unfccc.int/UserManagement/FileStorage/4N3W9XGUHAIZYL0CJDFQRV6S17K5ET |
| 3 | Vijayanand Roadlines Ltd | 42.5 | CDM project under the PDD titled:<br>**"42.5 MW Wind Power Project by VRL Logistics Ltd. In Karnataka State (India)"** http://cdm.unfccc.int/Projects/Validation/DB/5M0UJB3T8IVQ6OW8VMYEPCZ8WQBBGM/view.html |

[10] The list of wind power investors was analyzed using the Directory for Indian wind Power 2008

[11] The list of wind power investors was analysed using the Directory for Indian wind Power 2008 to identify the capacity of installations in each state for each investor.

[12] The capacity of each investor in Karnataka is taken from Directory for Indian Wind Power 2008

| | | | |
|---|---|---|---|
| 4 | Ramgad Minerals & Mining Pvt. Ltd. | 39.5 | CDM project under 2 PDDs titled:<br>1) **"125 MW Wind Power Project in Karnataka, India"** http://cdm.unfccc.int/UserManagement/FileStorage/6TU55O XGCAEHNZQV27694ATC31SOM3, and<br>2) **"8.35 MW wind power project at Guddarangavana Halli, Chitradurga, Karnataka in India"** http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/434/Revised%20Final%20CDM_4_Kar_PDD.pdf |
| 5 | Nuziveedu Seeds Ltd | 32.65 | The company website states that the company's wind installations are under CDM. http://www.nuziveeduseeds.co.in/wind.html; CDM project titled:<br>1) **"NSL 27.65 MW Wind Power Project in Karnataka, India"** http://cdm.unfccc.int/UserManagement/FileStorage/7 MKGRE0K2J0D6O1WKHV6XTW67UCAD6<br>2) **"33MW Wind Power Project at Linganahalli and Rangayyanadurga"** http://cdm.unfccc.int/UserManagement/FileStorage/S2I3TPZ8 NYWX5MH014UDJECF7Q9OGA |
| 6 | Enercon Wind Farms (Karnataka) Ltd. | 24.2 | CDM project under 2 PDDs titled:<br>1) **"Enercon Wind Farms in Karnataka Bundled Project - 73.60 MW"** http://cdm.unfccc.int/UserManagement/FileStorage/CE6EYN 7KWO13MRE0Q3FLKEAGANOXMS and<br>2) **"Enercon Wind Farms in Karnataka Bundled Project33 MW"** http://cdm.unfccc.int/UserManagement/FileStorage/QB4LN5D6YY0EZ9MDEUUCSB99HHER7R, |
| 7 | VSL Mining Company (P) Ltd | 19 | CDM project under the PDD titled:<br>**"VSL Wind Power project"**<br>http://cdm.unfccc.int/UserManagement/FileStorage/1V5DW5ZJNU9BGYUL8N04SIF0NERRP4 |
| 8 | Hindustan Zinc Limited | 18.4 | CDM project under the PDD titled:<br>**"Wind power project by HZL in Karnataka"**<br>http://cdm.unfccc.int/UserManagement/FileStorage/N9L0SY7CEOBTXFVGZQP5UH218WI6AJ |

It can be seen that, without exception, all private investors in the state of Karnataka with installations greater than 15 MW have developed these projects as CDM projects.

Out of the remaining investors with greater than 15 MW installations in the whole of India, even the investors with 10 to 15 MW of installations in Karnataka were also either CDM or VER projects (even though as they did not have over 15 MW capacity in Karnataka, they are not similar activities to the project activity).

It is clear from the above discussions and the overall trends that wind power project development in Karnataka is not common practice when compared to the power sector of Karnataka as a whole. In addition, all similar activities over 15 MW in size in the state of Karnataka are CDM projects.

**Sub-steps 4a is satisfied.**

**Sub-step 4b. Discuss any similar options that are occurring:**

Sub-step 4a shows that all similar activities i.e large scale wind investments by a single investor in the state of Karnataka are under CDM pipeline. This proves that similar activities are not widely observed or commonly carried out, and hence substep 4 (b) is not required.

**Sub-steps 4a is satisfied and 4b is not required as no similar activities are observed.**

The above additionality discussions shows that wind power development is not a common practice in the state of Karnataka and the project activity is not financially attractive; hence the project activity is additional.

## B.6. Estimation of emission reductions

### B.6.1. Explanation of methodological choices

As per the approved consolidated Methodology ACM0002, version 20.0:

Baseline emissions include only $CO_2$ 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:

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

Where:

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

$EG_{BL,y}$ = 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 methodology, combined grid emission factor as per the** "Tool to calculate the emission factor for an electricity system" version 07 is calculated as below.

$CO_2$ Baseline Database for the Indian Power Sector, Version 15, December 2019[13] published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per Methodological tool: Tool to calculate the emission factor for an electricity system (Version 07.0, EB 100, Annex 4), following six steps have been followed:

(a) **Step 1:** Identify the relevant electricity systems;

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

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

(d) **Step 4:** Calculate the operating margin emission factor according to the selected method;

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

[13] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

(f) **Step 6:** Calculate the combined margin (CM) emission factor.

**Step 1: Identify the relevant electricity systems**

As described in tool "For determining the electricity emission factors, identify the relevant project 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". Keeping this into consideration, the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids viz. Northern, Eastern, Western, North-eastern and Southern.

However since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this $CO_2$ Baseline Database. 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.

**Table: Geographical Scope of Indian Electricity 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 | Telangana |
| Punjab | Andaman & Nicobar | Maharashtra | Nagaland | Puducherry |
| Rajasthan | | Goa | Tripura | Lakshadweep |
| Uttar Pradesh | | | | |
| Uttarakhand | | | | |

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

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

**Option I:** Only grid power plants are included in the calculation.
**Option II:** Both grid power plants and off-grid power plants are included in the calculation.
The Project Participant has chosen only grid power plants in the calculation.

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

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

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

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for calculating operating margin emission factor depends on generation of electricity from low-cost/ must-run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

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

| | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 |
|---|---|---|---|---|---|
| India | 16.8% | 15.1% | 14.6% | 14.3% | 14.5% |

*Data Source: Central Electricity Authority (CEA) database Version 15, Dec 2019*[14]

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

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.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

(a) **Ex-ante option:** if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

**OR**

(b) **Ex-post option:** if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

PP has chosen ex-ante option for calculation of Simple OM emission factor using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PD to the DOE for validation.

OM determined at validation stage will be the same throughout the crediting period. There will be no requirement to monitor & recalculate the emission factor during the crediting period.

**Step 4: Calculate the operating margin emission factor ($EF_{grid,OMSimple,y}$) according to the selected method**

The operating margin emission factor has been calculated using a 3 year data vintage:

| Net Generation in Operating Margin (GWh) (incl. Imports) | | | |
|---|---|---|---|
| | 2016-17 | 2017-18 | 2018-19 |
| INDIAN Grid | 916,278 | 960,639 | 995,957 |

[14] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

| Simple Operating Margin ($tCO_2$/MWh) (incl. Imports) | | | |
|---|---|---|---|
| | **2016-17** | **2017-18** | **2018-19** |
| INDIAN Grid | 0.9636 | 0.9543 | 0.9685 |

| Weighted Generation Operating Margin | |
|---|---|
| INDIAN Grid | **0.9622** |

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

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 72:

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

(a) **Option 1 -** for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of PD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

(b) **Option 2 -** For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

| Build Margin ($tCO_2$/MWh) (not adjusted for imports) | |
|---|---|
| | **2018-19** |
| INDIAN Grid | **0.8811** |

**Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)**

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 81:

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin $CO_2$ emission factor in year y (t $CO_2$/MWh)
$EF_{grid,OM,y}$ = Operating margin $CO_2$ emission factor in year y (t $CO_2$/MWh)
$W_{OM}$ = Weighting of operating margin emissions factor (per cent)
$W_{BM}$ = Weighting of build margin emissions factor (per cent)

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

For wind project activities: $W_{OM}$ = 0.75 and $W_{BM}$ = 0.25 (owing to their intermittent and non-dispatchable nature) for the second crediting period and for subsequent crediting periods. Since project activity is of power generation by using wind, the above weightage has been considered for OM and BM.

Therefore, $EF_{grid,CM,y}$ = 0.9622 * 0.75 + 0.8811 * 0.25
= 0.9419 $tCO_2$/MWh

**Baseline emission factor ($EF_y$):**

The baseline emission factor is calculated using the combined margin approach as described in Step 6 above:

Therefore, $EF_y = EF_{grid,CM,y}$ = 0.9149 $tCO_2$/MWh.

$BE_y$= 111,347 x 0.9419 = 104,878 $tCO_2$ during a given year y.

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

| Data/Parameter | $EF_{grid, OM, ,y}$ |
|---|---|
| Data unit | $tCO_2e$/MWh |
| Description | Operating Margin $CO_2$ emission factor in year y |
| Source of data | Calculated from CEA database, Version 15, Dec 2019[15] |
| Value(s) applied | 0.9622 |
| Choice of data or measurement methods and procedures | Calculated as the last 3 year (2016-17, 2017-18, 2018-19) generation-weighted average, sourced from Baseline $CO_2$ Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India. |
| Purpose of data | For the calculation of the Baseline Emission |
| Additional comment | This parameter is fixed ex-ante for the entire crediting period. |

[15] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

| Data/Parameter | $EF_{grid, BM, y}$ |
|---|---|
| Data unit | $tCO_2e/MWh$ |
| Description | Build Margin $CO_2$ emission factor in year y |
| Source of data | Calculated from CEA database, Version 15, Dec 2019[16] |
| Value(s) applied | 0.8811 |
| Choice of data or measurement methods and procedures | Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for the most recent year 2017-18. The data is obtained from "$CO_2$ Baseline Database for Indian Power Sector" version 15, published by the Central Electricity Authority, Ministry of Power, Government of India. |
| Purpose of data | For the calculation of the Baseline Emission |
| Additional comment | This parameter is fixed ex-ante for the entire crediting period. |

| Data/Parameter | $EF_y$ or $EF_{grid, CM, y}$ |
|---|---|
| Data unit | $tCO_2e/MWh$ |
| Description | Combined Margin $CO_2$ emission factor in year y |
| Source of data | Calculated from CEA database, Version 15, Dec 2019[17] |
| Value(s) applied | 0.9419 |
| Choice of data or measurement methods and procedures | The combined margin emissions factor is calculated as follows:<br>$\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}}$<br>Where:<br>$EF_{grid,BM,y}$= Build margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)<br>$EF_{grid,OM,y}$= Operating margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)<br>$W_{OM}$ = Weighting of operating margin emissions factor (%) = 75%<br>$W_{BM}$= Weighting of build margin emissions factor (%) = 25% |
| Purpose of data | For the calculation of the Baseline Emission |
| Additional comment | This parameter is fixed ex-ante for the entire crediting period. |

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

Ex-ante calculation of emission reductions is equal to ex-ante calculation of baseline emissions as project emissions and leakage are nil.

Baseline emission factor (Combined Margin) ($EF_y$)
= 0.9419 $tCO_2e/MWh$

Annual electricity supplied to the grid by the Project ($EG_y$)
= 50.4 MW (Capacity) x 25.22% (PLF) x 8,760 (hours) MWh
= 111,347 MWh

Annual Baseline Emissions: $BE_y = EF_y * EG_y$
= 0.9419 $tCO_2e/MWh$ x 111,347MWh
= 104,878 $tCO_2e$

Project emissions = 0

Leakage = 0

Hence $BE_y = PE_y$

[16] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf
[17] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

The emission reductions per year are estimated to be 104,878 $tCO_2e$.

### 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 $CO_2e$) |
|---|---|---|---|---|
| 1st Year | 104,878 | 0 | 0 | 104,878 |
| 2nd Year | 104,878 | 0 | 0 | 104,878 |
| 3rd Year | 104,878 | 0 | 0 | 104,878 |
| 4th Year | 104,878 | 0 | 0 | 104,878 |
| 5th Year | 104,878 | 0 | 0 | 104,878 |
| 6th Year | 104,878 | 0 | 0 | 104,878 |
| 7th Year | 104,878 | 0 | 0 | 104,878 |
| **Total** | **734,146** | **0** | **0** | **734,146** |
| **Total number of crediting years** | **7** | | | |
| **Annual average over the crediting period** | **104,878** | **0** | **0** | **104,878** |

## B.7. Monitoring plan

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

| **Data/Parameter** | $EG_y$ |
|---|---|
| Data unit | MWh (Mega-watt hour) |
| Description | Net electricity supplied to the grid by the Project Activity |
| Source of data | Electricity supplied to the grid as per the joint meter report. |
| Value(s) applied | Annual electricity supplied to the grid by the Project.<br>= 50.4 MW (Capacity) x 25.22% (PLF) x 8,760 (hours) MWh<br>= 111,347 MWh |
| Measurement methods and procedures | Electricity supplied to grid for the project activity is calculated. Refer section B.7.3 of the PDD for an illustration of the provisions for measurement methods. |
| Monitoring frequency | Monthly |
| QA/QC procedures | QA/QC procedures are implemented by state utility and the PP. Refer section B.7.3 of the PDD for an illustration of the provisions for QA/QC procedures. |
| Purpose of data | To Determine baseline emissions |
| Additional comment | The data will be stored in hard formula and values will be taken from JMR |

| **Data/Parameter** | Gpe |
|---|---|
| Data unit | MWh (Mega-watt hour) |
| Description | Electricity Export recorded at the meter(s) connected 63 machines of the project activity. |
| Source of data | Electricity export to the grid as per the joint meter report. |
| Value(s) applied | This value is taken from the JMR (Form B) and is applied directly. |
| Measurement methods and procedures | Electricity export to the grid is recorded by the meter(s) connected to the 63 machines of the project activity feeding the pooling substation of Enercon. Refer section B.7.3 of the PDD for an illustration of the provisions for measurement methods. |
| Monitoring frequency | Monthly |
| QA/QC procedures | QA/QC procedures are implemented by state utility and the PP. Refer section B.7.3 of the PDD for an illustration of the provisions for QA/QC procedures. |
| Purpose of data | To Determine baseline emissions |
| Additional comment | The data will be stored in hard formula and values will be taken from JMR. |

| Data/Parameter | Gpi |
|---|---|
| Data unit | MWh (Mega-watt hour) |
| Description | Electricity Import recorded at the meter(s) connected 63 machines of the project activity. |
| Source of data | Electricity import from the grid as per the joint meter report. |
| Value(s) applied | This value is taken from the JMR (Form B) and is applied directly. |
| Measurement methods and procedures | Electricity import from the grid is recorded by the meter(s) connected to the 63 machines of the project activity feeding the pooling substation of Enercon. Refer section B.7.3 of the PDD for an illustration of the provisions for measurement methods. |
| Monitoring frequency | Monthly |
| QA/QC procedures | QA/QC procedures are implemented by state utility and the PP. Refer section B.7.3 of the PDD for an illustration of the provisions for QA/QC procedures. |
| Purpose of data | To Determine baseline emissions |
| Additional comment | The data will be stored in hard formula and values will be taken from JMR. |

| Data/Parameter | Li |
|---|---|
| Data unit | MWh (Mega-watt hour) |
| Description | Transmission loss between the metering point for the project activity feeding the pooling substation of Enercon and the metering point at EB Substation/Switching Station. |
| Source of data | Transmission Loss is directly applied from the joint meter report (Form B) for the project activity. |
| Value(s) applied | This value is certified by the State utility in the JMR (Form B). This value is directly applied from the JMR (Form B). |
| Measurement methods and procedures | Transmission loss between metering point feeding the pooling substation of Enercon and the metering point at the EB Substation/Switching Station is applied to the meter reading taken at the feeder connecting 63 turbines of the project activity and feeding the pooling substation of Enercon. Switching station/EB Substation is connected to the machines of the project activity and the machines commissioned by the other project developers. The project proponent does not have control over the data of the other project developers. Therefore, the project developer has to rely upon the transmission loss applied to the project activity by the state utility as reflected in the JMR (Form B). The JMR is signed by the representatives of Enercon and the state utility. Refer section B.7.3 of the PDD for an illustration of the provisions for measurement methods. |
| Monitoring frequency | Monthly |
| QA/QC procedures | QA/QC procedures are implemented by state utility and the PP. Refer section B.7.3 of the PDD for an illustration of the provisions for QA/QC procedures. |
| Purpose of data | To Determine baseline emissions |
| Additional comment | The data will be stored in hard formula and values will be taken from JMR. |

The data will be stored in hard format. Joint meter report is taken in the presence of the persons representing Enercon [Operation and Maintenance Contractor]. The copies of the joint meter report will be presented to the validator during the verification exercise. The archive will be kept for the period up to two years after the completion of the crediting period.

The continuous and daily records for parameters such as power generation, frequency and voltage of the individual machines are noted by the SCADA system. These records are maintained by Enercon India Limited (the O&M contractor) and the PP.

### B.7.2. Sampling plan

Not applicable

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

Approved monitoring methodology ACM0002 Version 20.0 Sectoral Scope: 1, “Large-scale Consolidated Methodology for Grid-connected electricity generation from renewable sources”, by CDM - Meth Panel is used to monitor the emission reductions.

This approved monitoring methodology requires monitoring of the following:

- Net Electricity generation from the project activity; and
- Operating margin emission factor and build margin emission factor of the grid, where ex post determination of grid emission factor has been chosen

Since the baseline methodology is based on ex ante determination of the baseline, the monitoring of operating margin emission factor and build margin emission factor is not required. Further, wind based electricity generation is not associated with any kind of leakages. Hence, the sole parameter for monitoring is the electricity generated by the project and supplied to the grid.

The reading are taken by the representatives of Enercon and the State utility at the meter(s) for the project activity connecting 63 turbines at the project site and feeding the pooling substation. This reading is recorded in the form of JMR (Form B) and is signed by the representatives of Enercon and State Utility. The electricity export and import are metered at this metering point. Transmission loss between metering point feeding the pooling substation and the metering point at the EB Substation/Switching Station is applied to the meter reading taken at the feeder connecting 63 turbines of the project activity and feeding the pooling substation.

Transmission loss given in the JMR is directly applied to the meter readings taken at the metering point of the project activity and feeding to pooling substation of Enercon. Net Electricity exported to the grid is calculated by applying transmission loss to the meter reading taken at the metering point of the project activity connecting 63 turbines and feeding to pooling substation of Enercon.

The Joint meter reading contains the following data:-

1. Electricity Export
2. Electricity Import
3. Transmission Loss (Between the metering point feeding the pooling substation and the EB/Switching substation)
4. Net Electricity exported to the Grid [Electricity Export-115%*Electricity Import-Transmission Loss]

Joint Meter reading is signed by the representatives of Enercon and the state utility. The meter readings (both export and import), transmission loss and net electricity exported to the grid are noted in the JMR. Hence, all these values are reproduced from the JMR at the time of verification.

**Metering:**

Electricity supplied to the grid is metered at the metering point connecting 63 machines of the project activity. The meter reading is taken in the presence of representatives of Enercon (O&M Contractor for the project activity) and KPTCL.

**Metering Equipment:**

Metering system for the project activity consists of main and check meter. Both the meters are two-way trivector meters capable of recording import and export of electricity. The metering equipment is calibrated annually.

**Meter Readings:**

The electricity supplied to the grid is recorded by taking a Joint Meter Reading (JMR) in the presence of Officials from the Utility and Enercon, O&M contractor, on behalf of project owner. The Joint meter reading contains the value of energy imported and exported. These certified readings are then used by the DISCOM officials to prepare the tariff invoices. Thus, the monitoring parameters for the project activity are the electricity import and electricity export to the grid as mentioned in the JMR. The readings are then adjusted for the transmission loss in the JMR, which can be crosschecked with the value mentioned in the invoices.

**Inspection of Energy Meters:**

All main and check energy meters (export and import) and all associated instruments, transformers installed at the project are of 0.2% accuracy class. Each meter is jointly inspected and sealed on behalf of the parties and is not to be interfered with by either party except in the presence of the other party or its accredited representatives.

**Meter Test Checking:**

There is a separate check and main meter. The Main and Check Meters are close to each other and are tested for accuracy, with a standard meter, by the KPTCL's testing Division. The KPTCL carry out the calibration, periodical testing, sealing and maintenance of meters. The KPTCL provides a copy of the test reports.

If during the meter test checking,

- the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then the meter reading will be as per the main meter as usual. The check meter shall, however, be calibrated immediately.

- the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible limit of error, then the meter reading for the month up to the date and time of such test shall be as per the check meter.

- If both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the meters shall be immediately calibrated and the correction will be applied to the reading registered by the main meter to arrive the correct reading of energy supplied to the grid for the period up to last test.

- If during any of the monthly meter readings, the variation between the main meter and the check meter is more than the permissible limit for meters of 0.2% accuracy class, all the meters shall be re-tested and calibrated immediately and the correction will be applied to the reading registered by the main meter to arrive the correct reading of energy supplied to the grid for the period up to last test.

- In case of the failures such as burning of the meter and the erratic display of the metered parameters and when the error found in testing the meters is beyond the permissible limit of error, the meter shall be calibrated immediately and the correction will be applied to the reading egistered by the main meter to arrive the correct reading of energy supplied to the grid for the period up to last test.

The continuous and daily records for parameters such as power generation, frequency and voltage of the individual machines are noted by the SCADA system. These records are maintained by Enercon India Limited (the O&M contractor) and the PP.

**Calculation of Data to be monitored:**

$EG_y = G_p – L_i$

$EG_y$: Net Electricity supplied to grid by the project activity

$G_p$: Generation of electricity by the project activity recorded at the feeder connected to 63 turbines of the project activity [export (Gpe) –115%* Import (Gpi)]

$L_i$: Transmission loss

**Transmission loss is certified by the state utility in JMR:**

L: $\sum j\ G_j - N$

$\sum j\ G_j$: Summation of electricity generation data measured at all the feeders connected to pooling substation (export – Import)

N: Electricity generation data measured at Switching station/Substation at Belgaum from the feeders emanating from the pooling substation

L: Total transmission loss

$L_i$: $G_p$ *$(L/\sum j\ G_j)$

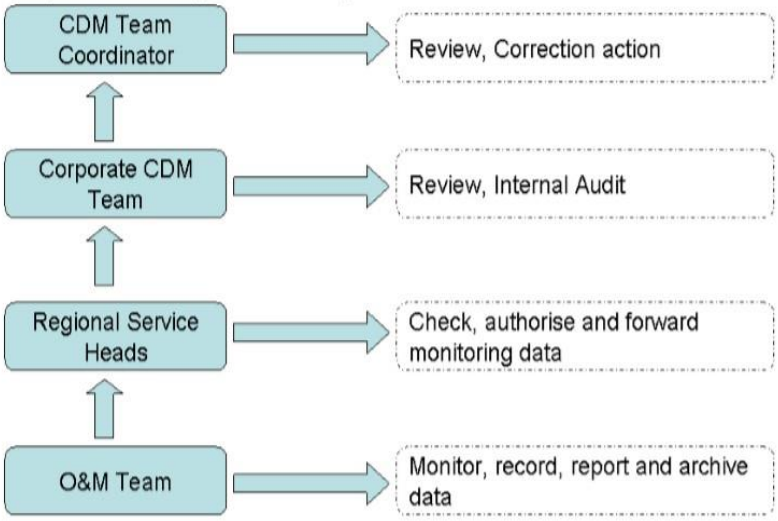
The Project is operated and managed by ENRE. The operational and maintenance contract for the project is with Enercon. Enercon is an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon follows the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project.

The accuracy of monitoring parameter is ensured by adhering to the calibration and testing procedure. The project will adhere to all the mandatory regulatory and statutory requirements at the state as well as national level. Enercon is Operation and Maintenance contractor for the project activity and provides the daily generation report to the project proponent. The project proponent also maintains the records of daily generation report and joint meter report.

**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 Wind Energy Converters (WECs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that Enercon's service staff 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. The Enercon Training Academy provides need-based training to meet the training requirements of Enercon projects. The training is contemporary, which results in imparting focused knowledge leading to value addition to the attitude and skills of all trainees. This ultimately leads to creativity in problem solving.

The operational and management structure implemented is as follows:




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

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

20/01/2009, being the date of placement of purchase order for the wind energy converters.

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

20 years 0 Months

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

#### C.3.1. Type of crediting period

The project proponent has selected the renewable crediting period for the project activity.

Currently, the project is requesting the Renewal of 2nd Crediting Period.

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

The project is applying for Renewal of 2nd Crediting Period. The start date of the new Crediting Period will be from 01/04/2018.

#### C.3.3. Duration of crediting period

7 Years 0 Months

## SECTION D. Environmental impacts

### D.1. Analysis of environmental impacts

As per the Schedule 1 of Ministry of Environment Forest and Climate Change (Government of India) notification dated January 27, 1994 and EIA Notification (S.O 1533) dated 14th September 2006, a list of activities that require to undertake environmental impact assessment studies10 has been provided. EIA is not a regulatory requirement in India for wind energy projects, since the project activity is the wind based renewable electricity generation it does not expect any adverse impacts on the environment. Thus, no detailed EIA study was conducted.

### D.2. Environmental impact assessment

The project activity does not have any significant adverse environmental impacts and also it does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment Forest and Climate Change, Government of India. Hence, EIA is not required by the host party.

## SECTION E. Local stakeholder consultation

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

The comments from local stakeholders were invited through a local stakeholder meeting conducted at Belgaum District in Karnataka on 6 October 2009. A local newspaper advertisement was placed in Vijay Karnataka on 21 September 2009 inviting the local stakeholders for the meeting. The meeting was presided over by Mr. Navin Kumar, (EIL-Asst. Manager), C.B. Poonacha (EIL), Saujanya Kumar (EIL-CDM), Mr. Sreedhar Kumar , and R.P. Chavate (KPTCL).

Mr. Navin Kumar welcomed the gathering and introduced the company and its initiative to the stakeholders. He further briefed the gathering about the environmental hazards faced by the society in the present scenario and highlighted the importance of CDM and clean energy. He also explained how wind energy can be instrumental in promoting clean and pollution free environment. He invited Mr. C.B. Poonacha to explain the project activity and discuss the benefits of upcoming wind farm project. Mr. Saujanya Kumar further stressed on the need for climate change mitigation and presented the global warming scenario across the world for better understanding of the need for the proposed CDM project activity. Mr. R.P. Chavate explained the importance of KPTCL's role in WPPs. Mr. Sreedhar Kumar then delivered the vote of thanks and appreciated the villagers for their active participation.

The meeting was very cordial and ended on a positive note. No adverse comments were received. The following queries were raised by the stakeholders:

I. Whether there would be any effect on rain due to wind power projects? II.
II. Whether the project is useful to the villagers? III.
III. Whether there is any use for farmers? IV.
IV. Whether there is any effect on the cattle grazing near wind farms?

### E.2. Summary of comments received

The clarifications that were addressed by the representatives of Enercon (Enercon is authorized by the PP to execute all the activities in relation to CDM i.e. project registration and verification including local stakeholder consultation) are listed in the table below:

| S.No | Villager Name | Question | Reply by Enercon representatives |
|---|---|---|---|
| 1 | Prashant Patil | Whether there would be any effect on rain due to wind power projects? | The height of machines are much lower than the clouds and it has been proven scientifically that WTGs does not impact the rainfall pattern. |
| 2 | Virag Harakuni | Whether the project is useful to the villagers? | The project will help in local jobs being created during implementation phase and security staff jobs during operational phase of the project. |
| 3 | Vikram Patil | Whether there is any use for farmers? | The project will help the farmers indirectly as the project will help in reducing the demand supply gap and may help in longer hours of power supply in the local areas. |

| | | | |
|---|---|---|---|
| 4 | Laxman Kangrali | Whether there is any effect on the cattle grazing near wind farms? | There is no effect and no reduction on the flora and fauna due to the project activity. |

## E.3. Consideration of comments received

No negative comments were received from the villagers.

## E.4. Approval and authorization

The project obtained Host country Approval from Indian DNA i.e. Ministry of Environment Forest and Climate Change vide letter no. 4/5/2010-CCC dated 06/08/2010.

# Appendix 1. Contact information of project participants

| | |
|---|---|
| **Organization name** | EN Renewable Energy Limited |
| **Country** | India |
| **Address** | 7th Floor, Tower No. 3, Suit No. 702, Equinox business park, Kurla West-Mumbai-Suburban, Maharashtra-400070, India |
| **Telephone** | +91 7338856105 |
| **Fax** | - |
| **E-mail** | nbeleri@brookfieldrenewable.in |
| **Website** | - |
| **Contact person** | Mr. Nagaraj I. Beleri |

# Appendix 2. Affirmation regarding public funding

The project activity does not involve any public funding from parties included in Annex 1.

# Appendix 3. Applicability of methodologies and standardized baselines

Please refer section B.2 of the PDD.

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

Please refer section B.6.3 of the PDD.

# Appendix 5. Further background information on monitoring plan

Please refer section B.7.3 of the PDD.

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

Please refer section E.2 of the PDD.

# Appendix 7. Summary of post-registration changes

Not Applicable.

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## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 11.0 | 31 May 2019 | Revision to:<br>• Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN);<br>• Make editorial improvements. |
| 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