



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

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

BASIC INFORMATION

Title of the project activity	100 MW Wind Power Project at Anantapur, Andhra Pradesh
Scale of the project activity	<input checked="" type="checkbox"/> Large-scale <input type="checkbox"/> Small-scale
Version number of the PDD	4.0
Completion date of the PDD	26/01/2018
Project participants	Orange Anantapur Wind Power Private Limited
Host Party	India
Applied methodologies and standardized baselines	ACM0002 "Grid-connected electricity generation from renewable sources" (Version 17.0, EB 891)
Sectoral scopes linked to the applied methodologies	Sectoral Scope 1: Energy Industries(renewable – /non renewable sources)
Estimated amount of annual average GHG emission reductions	209,833 tCO ₂

¹<https://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L>

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Orange Anantapur Wind Power Private Limited (OAWPPL) is setting up wind power project in the villages of Nimbagallu, Amidyala, Mopidi, Indravathi and Renumakulapalli in Uravakonda Mandal, Anantapur District, Andhra Pradesh with capacity of 100 MW (50 X 2 MW).

The purpose of the project activity is to generate electrical power using wind energy through operation of Wind Electric Generators (WEG's). The total installed capacity of the project activity is 100 MW comprising of 50 nos of Gamesa G 97 turbines of 2 MW each. OAWPPL is installing WTGs at Anantapur district of Andhra Pradesh State in India.

The project has been already commissioned and all the WTGs are operational.

How the proposed activity reduces GHG emissions

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

Scenario existing prior to the implementation of project activity:

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

Baseline Scenario:

As the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following as per applied methodology: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" – version 5.0, EB 87, Annex 9. Hence, pre-project scenario and baseline scenario are the same.

The estimation of GHG reductions by this project is limited to carbon dioxide (CO₂) only. Thus the project activity leads to an emission reduction of 1,468,831 tCO₂ for the chosen crediting period of 7 years renewable with the annual average emission reduction of 209,833 tCO_{2e}

Project Contribution to Sustainable development:

Ministry of Environment and Forests, Govt. of India has stipulated the following indicators for sustainable development² in the interim approval guidelines.

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

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

²http://envfor.nic.in/divisions/ccd/cdm_iac.html

Economic well-being:

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

Social well-being:

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

Environmental well-being:

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

Technological well-being:

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

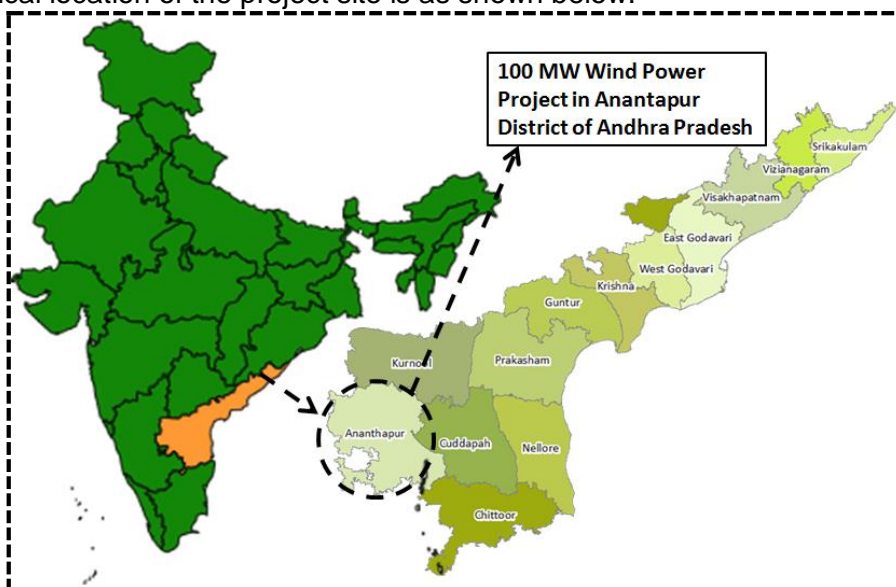
The successful implementation and operation of the project would serve as demonstration for harnessing wind potential and encourage setting up of similar projects in future.

A.2. Location of project activity

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NImbagallu, Amidyala, mopidi, Renumakulapalli, Indravathi villages of Uravakonda Mandal, Anantapur Disytrict, Andhra Pradesh, India

The geographical location of the project site is as shown below:



The below table provides the location of individual WTGs:

S. No	WTG No	Latitude	Longitude	Village	Mandal	District
1	G1-07	16.4197	73.5719	Amidyala	Uravakonda	Anantapur
2	G1-08	16.4225	73.5617	Amidyala	Uravakonda	Anantapur
3	G1-09	16.4257	73.5547	Amidyala	Uravakonda	Anantapur
4	G1-11	16.4324	73.5301	Amidyala	Uravakonda	Anantapur
5	G1-12	16.4349	73.5268	Amidyala	Uravakonda	Anantapur
6	G1-14	16.4397	73.5108	Amidyala	Uravakonda	Anantapur
7	G1-15	16.4231	73.7548	Amidyala	Uravakonda	Anantapur
8	G1-16	16.4256	73.7483	Amidyala	Uravakonda	Anantapur
9	G1-17	16.4284	73.7456	Amidyala	Uravakonda	Anantapur
10	G1-18	16.4309	73.7265	Amidyala	Uravakonda	Anantapur
11	G1-19	16.4341	73.7241	Amidyala	Uravakonda	Anantapur
12	G1-20	16.4202	73.7557	Amidyala	Uravakonda	Anantapur
13	G1-21	16.4257	73.5547	Indravathi	Uravakonda	Anantapur
14	G1-23	16.4509	73.7016	Amidyala	Uravakonda	Anantapur
15	G1-24	16.4349	73.5268	Renimakulapalli	Uravakonda	Anantapur
16	G1-25	16.4962	73.9643	Renimakulapalli	Uravakonda	Anantapur
17	G1-26	16.4901	74.0145	Renimakulapalli	Uravakonda	Anantapur
18	G1-27	16.4749	74.0365	Indravathi	Uravakonda	Anantapur
19	G1-28	16.4344	73.925	Amidyala	Uravakonda	Anantapur
20	G1-29	16.4385	73.9344	Amidyala	Uravakonda	Anantapur
21	G1-30	16.4406	73.9235	Amidyala	Uravakonda	Anantapur
22	G1-31	16.4431	73.9161	Amidyala	Uravakonda	Anantapur
23	G1-32	16.4454	73.9048	Amidyala	Uravakonda	Anantapur
24	G1-33	16.4291	74.0404	Amidyala	Uravakonda	Anantapur
25	G1-34	16.4493	73.8834	Nimbagallu	Uravakonda	Anantapur
26	G1-35	16.4517	73.8782	Nimbagallu	Uravakonda	Anantapur
27	G1-36	16.4542	73.8764	Nimbagallu	Uravakonda	Anantapur
28	G1-37	16.4372	73.725	Nimbagallu	Uravakonda	Anantapur
29	G1-38	16.4397	73.7282	Nimbagallu	Uravakonda	Anantapur
30	G1-39	16.4437	73.7203	Nimbagallu	Uravakonda	Anantapur
31	G1-40	16.4460	73.703	Nimbagallu	Uravakonda	Anantapur
32	G1-41	16.4484	73.7063	Nimbagallu	Uravakonda	Anantapur
33	G1-42	16.4509	73.7016	Nimbagallu	Uravakonda	Anantapur
34	G1-43	16.4346	74.0551	Amidyala	Uravakonda	Anantapur
35	G1-44	16.4370	74.0438	Amidyala	Uravakonda	Anantapur
36	G1-45	16.4404	74.1268	Amidyala	Uravakonda	Anantapur
37	G1-46	16.4430	74.1301	Amidyala	Uravakonda	Anantapur
38	G1-47	16.4455	74.1329	Amidyala	Uravakonda	Anantapur
39	G1-48	16.4484	74.1097	Mopidi	Uravakonda	Anantapur
40	G1-49	16.4509	74.108	Mopidi	Uravakonda	Anantapur
41	G1-50	16.4532	74.0995	Mopidi	Uravakonda	Anantapur
42	G1-51	16.4557	74.0918	Mopidi	Uravakonda	Anantapur
43	G1-52	16.4581	74.0885	Mopidi	Uravakonda	Anantapur
44	G1-53	16.4606	74.0833	Mopidi	Uravakonda	Anantapur
45	G1-54	16.4773	74.0302	Indravathi	Uravakonda	Anantapur
46	G1-55	16.4798	74.0254	Mopidi	Uravakonda	Anantapur
47	G1-56	16.4828	74.0343	Mopidi	Uravakonda	Anantapur
48	G1-57	16.4854	74.0305	Mopidi	Uravakonda	Anantapur
49	G1-58	16.4236	74.0439	Amidyala	Uravakonda	Anantapur
50	G1-59	16.4189	74.0189	Amidyala	Uravakonda	Anantapur

A.3. Technologies/measures

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The technology employed, converts wind energy to electrical energy. In wind power generation, energy of wind is converted into mechanical energy and subsequently into electrical energy. The

project activity is the installation of an environmentally safe and sound technology since there are no GHG emissions associated with the electricity generation.

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

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

The average lifetime of the WTGs under project activity is around 25 years as per the equipment supplier specifications. The plant load factor assessed by third party for WTGs at project site is 24.5%.

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

Project specifications include a safety system with instrumentation for tracking individual functions of the wind electric generator. The project activity is to convert wind energy into electricity and is a GHG emission free form of energy generation. The technology and the project do not pose any adverse threat to the environment and contribute positively in reducing GHG emissions by displacing energy generation from fossil fuel powered projects. The proposed project activity is environmentally safe to implement and operate.

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)	Orange Anantapur Wind Power Private Limited	No

A.5. Public funding of project activity

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

A.6. History of project activity

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The project proponent confirms that

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

A.7. Debundling

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Not Applicable

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

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Title: Grid-connected electricity generation from renewable sources

References: Approved consolidated baseline methodology ACM0002 "Grid-connected electricity generation from renewable sources" (Version 17.0³)

ACM0002 draws upon the latest versions of the following tools; some of which have been used in the PDD:

"Tool to Calculate the Emission Factor for an Electricity System" – version 5.0, EB 87, Annex 9⁴.

³<https://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L>

“Tool for the demonstration and assessment of Additionality” – version 07, EB 70, Annex 8⁵.

“Combined tool to identify the baseline scenario and demonstrate additionality”

“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”

“Tool to determine the remaining lifetime of equipment”

B.2. Applicability of methodologies and standardized baselines

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

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

Applicability Criteria	Applicability status
<p>This methodology is applicable to grid-connected renewable power generation project activities that:</p> <p>(a) install Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s); (c) involve a retrofit of (an) existing plant(s)/unit(s); (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (d) involve a replacement of (an) existing plant(s)/unit(s)</p>	<p>The proposed project activity is a Green field, Indian grid connected renewable power plant.</p> <p>Therefore, it confirms to the said criteria</p>
<p>The methodology is applicable under the following conditions: 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</p>	<p>The project activity is the installation of a new grid connected renewable wind power project. Thus, it meets the first applicability condition</p>
<p>In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity</p>	<p>The proposed project activity is the installation of a new wind power plant/unit. Therefore, the said criteria is not applicable</p>
<p>In case of hydro power plants, one of the following conditions shall apply:</p> <p>(a) The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or</p> <p>(b) The project activity is implemented in an</p>	<p>The proposed project activity is the installation of a wind power plant/unit. Therefore, the said criteria is not applicable</p>

⁴<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf>

⁵http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf/history_view

<p>existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3) is greater than 4 W/m²; or</p> <p>(c) The project activity results in new single or multiple reservoirs and the power density calculate equation (3), is greater than 4 W/m².</p> <p>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density of any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m², all of the following conditions shall apply.</p> <p>(i) The power density calculated using the total installed capacity of the integrated project, as per equation (4) is greater than 4W/m²;</p> <p>(ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</p> <p>(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m²shall be:</p> <p>(a) Lower than or equal to 15 MW; and</p> <p>(b) Less than 10% of the total installed capacity of integrated hydro power project</p>	
<p>In the case of integrated hydro power projects, project proponent shall:</p> <p>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</p> <p>Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability indifferent seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.</p>	<p>The proposed project activity is the installation of a wind power plant/unit. Therefore, the said criterion is not applicable</p>
<p>The methodology is not applicable to:</p> <p>(a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</p>	<p>The proposed project activity is the installation of a wind power plant/unit. Therefore, the said criteria is not applicable</p>

(b) Biomass fired power plants;	
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	The proposed project activity is the installation of a green field wind power plant. Therefore, the said criterion is not applicable.
In addition, the above applicability conditions the applicability conditions of tool referred in the methodology ACM0002, version 17 has been referred here under:	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid(e.g. demand-side energy efficiency projects).	This condition is applicable. OM, BM and CM are estimated using the tool under section B.6.1 for calculating baseline emissions.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in “Appendix 2: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, anon-Annex I country. Therefore, this criterion is not applicable for the project activity
Under this tool, the value applied to the CO ₂ emission factor of bio fuels is zero	The project activity is a grid connected wind power project and therefore, this criterion is not applicable for the project activity

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

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Source		GHGs	Included?	Justification/Explanation
Baseline	Grid-connected Electricity Generation	CO ₂	Yes	Major emission sources
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.
Project	Green Field Wind Energy Power Project	CO ₂	No	The project activity does not emit any emissions
		CH ₄	No	No methane generation is expected to be emitted.
		N ₂ O	No	No nitrous oxide generation is expected to be emitted.

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

The proposed project activity evacuates the power to the Indian grid. Therefore, all the power plants contributing electricity to the Integrated grid have been considered in the project boundary for the purpose of baseline estimation. The project activity targets reduction of CO₂e as main GHG greenhouse gas in baseline, there are no GHG emission associated with project activity.

B.4. Establishment and description of baseline scenario

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The project activity involved setting up of WTGs to harness the power of wind to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied to the electricity grid by the operation of grid-connected power plants (mainly by fossil fuel fired plants) and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

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

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

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

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.9777 tCO ₂ /MWh	Combined margin CO ₂ emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline CO ₂ Emission Database, Version 11.0 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9941 tCO ₂ /MWh	Operating margin CO ₂ emission factor for the project electricity system in year y	Calculated as the last 3 year (2012-14, 2013-14 & 2014-15) generation-weighted average, sourced from Baseline CO ₂ Emission Database, Version 11.0, published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.9285 tCO ₂ /MWh	Build margin CO ₂ emission factor for	Baseline CO ₂ Emission Database, Version 11.0, published by Central

		the project electricity system in year y	Electricity Authority (CEA), Government of India
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B.5. Demonstration of additionality

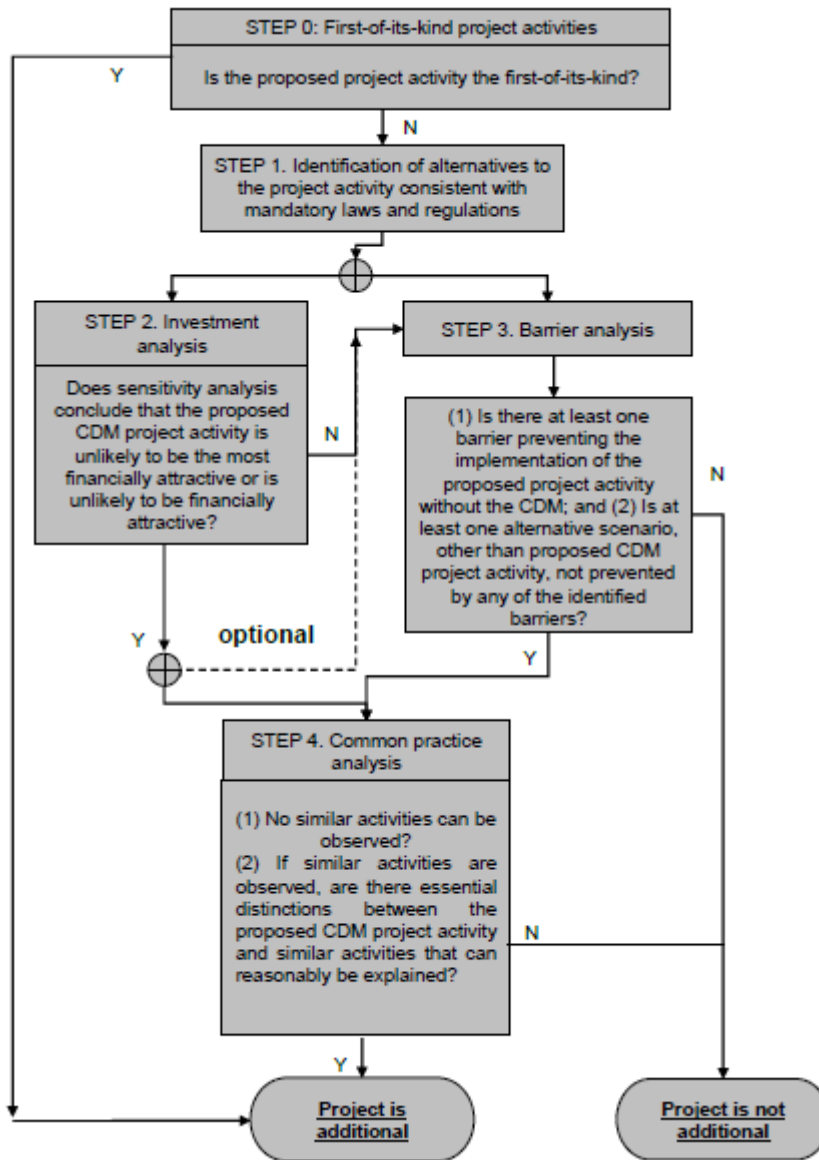
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The latest revision in the PDD format has included information about automatically additional projects, as defined by the applied approved methodology or standardized baseline.

Specify the methodology or standardized baseline that establish automatic additionality for the proposed project activity (including the version number and the specific paragraph, if applicable).	NA
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology or standardized baselines.	NA

The applicable methodology under section 5.3.1 details a Simplified procedure to demonstrate additionality. The defined auto additionality is not applicable to the project activity as total wind projects installation in India are beyond the set limit of 2% of total installed capacity.

As per the applied methodology requirement, Additionality of the project activity is demonstrated using the Methodological tool “Tool for the Demonstration and assessment of additionality” Version 07.0.0. The step-wise approach is presented in the flow-chart:



The tool defines the following steps:

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

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

Since the proposed project activity is not the first-of-its-kind, this step is being skipped.

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

As per the applied ACM0002 version 17.0; Para 24, *if the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plant and by the addition of new generation sources.*

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

Step 2: Investment Analysis

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

To conduct the investment analysis, Methodological tool: Investment analysis, version 7.0 (EB 92 annex 5) has been referred.

Sub-step 2a: Determine appropriate analysis method

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

Option I: Simple Cost Analysis

Option II: Investment Comparison Analysis

Option III: Benchmark Analysis

The project will generate revenues from sale of electricity, therefore Option I is not applicable as per para 32 of the “Tool for the demonstration and assessment of additionality” (version 07.0.0). Since, identified baseline for the proposed project activity is continuation of current practice (i.e. equivalent amount of energy would be generated by grid electricity system through its currently operating power plants and by new capacity addition) and which is outside the direct control of the project participant, hence benchmark analysis (option III) is selected as the most appropriate method for the proposed project activity’s financial analysis. Option III has been elaborated further as it is a benchmark analysis approach, where the returns on investment in the project activity are compared to benchmark returns.

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

To analyze the financial viability of the project, as explained above in step 2a, project Internal Rate of Return (IRR) has been chosen as the financial indicator.

As per the guidance in “Demonstration and assessment of additionality” IRR analysis is an appropriate financial indicator in cases where a benchmark analysis has been applied.

There are two types of IRR analysis referred in “Guidelines on the Assessment of Investment Analysis”, project IRR and equity IRR.

Since the project activity is funded with both debt & equity, project IRR is considered to be the appropriate financial indicator for investment analysis. Hence, in order to analyse the financial viability of the project activity, the prime financial indicator that has been used is the post-tax project IRR of the project activity.

Selection of Appropriate Benchmark

As per ‘Guidelines on the Assessment of Investment Analysis’ **para 16**, *“The applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR.”*

“,

Above referred guidance provides the project proponent with freedom to choose a proper benchmark against project IRR. Project proponent has chosen PLR of Banks available at the time of decision making. The source of PLR is actual prevailing BPLR of leading National Banks in India, which works out to be 14.15% which is considered to be the benchmark of the project activity.

The Project proponent has chosen step 2b Option III for demonstration of Additoinality.

Chronology:

The below table represents the chronology of the project activity:

Events related to project implementation	GS relevant events	Dates
Completion of DPR	-	25/08/2015
GS Compliance	Stakeholders’ Invitations for	17/08/2015 to

	LSC Meeting	25/08/2015
GS Compliance	LSC Meeting	01/09/2015
Board decision for investing in Project and securing carbon credits	Investment decision	01/09/2015
Placement of the Purchase Orders	Start date of the project activity	14/09/2015
Loan Sanction		24/09/2015
Placement of O&M Contract w		23/12/2015
PPA		28/03/2016
Commissioning of Project		28/03/2016
GS Readiness	Appointment of the Gold Standard consultant	10/08/2015
GS Compliance	Appointment of DOE	16/06/2016
GS Compliance	Notices about Stakeholder' Feedback round Meeting	10/08/2017 to 15/08/2017
GS Compliance	Stakeholder' Feedback round Meeting	22/08/2017

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

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

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

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

Details of data/ information and assumptions used by the project proponent in the financial analysis and the results of financial analysis for both the projects are presented below:

Particulars	Value	Units	Ref Details
Energy Generation			
No. of generating units	50	Nos.	SBICAPS (Detailed Project Report) DPR
Capacity of each generating unit	2000	kW	SBICAPS DPR
Total generating Capacity	100000	kW	Calculated Value
Plant Load Factor	24.50%	%	SBICAPS DPR
Technical			
Tariff Rate	4.83	Rs./ kWh	SBICAPS DPR
O & M Expenses 1st Year/WTG	0.00	Rs. Lakh	SBICAPS DPR
O & M Expenses 2nd Year/WTG	20	Rs. Lakh/WTG	SBICAPS DPR
O & M Expenses	1100	Rs. Lakh	SBICAPS DPR
Annual Escalation	5.00%	%	SBICAPS DPR
Insurance	0.50%	% of project Cost	SBICAPS DPR
Working Capital Requirement			
Interest on Working Capital	13.50%	%	SBICAPS DPR
O & M	1	Month	CERC
Receivables Equivalent to 2 months of energy charges for sale of electricity	2	Month	CERC
Working Capital Loan	75%	%	SBICAPS DPR
Working Capital Margin	25%	%	SBICAPS DPR
Financial			

Total project cost	75901.00	Rs. Lakh	SBICAPS DPR
Cost per MW	759.01	Rs. Lakh	Calculated Value
Debt	75%	%	SBICAPS DPR
Equity	25%	%	SBICAPS DPR
Term Loan	56925.75	Rs. Lakh	Calculated Value
Promoter's contribution	18975.25	Rs. Lakh	Calculated Value
Interest Rate on Term Loan	12.50%	%	SBICAPS DPR
Repayment Period	54	Months	SBICAPS DPR
Moratorium	6	Months	SBICAPS DPR
Minimum Tax Rate	18.50%	%	For the year 2014-15
Plant & Machinery	15.00%	%	For the year 2014-15
CERs			
Gross Energy generated	2146.200	Lakh Units	Calculated Value
Net generation after deducting losses	2146.200	Lakh Units	Calculated Value
Grid Emission Factor	0.9777	tCO ₂ /MWh	CEA Version 11
No. of CERs	209833	tCO ₂	Calculated Value

The input values used in the investment analysis are valid and applicable as per the investment decision making by the project participant. This is in-line with the *"Investment Analysis, paragraph 11, Annex 05, EB 92"*.

Considering the above mentioned assumptions and working out the project profitability, the Project IRR works out to **7.20%** as against the benchmark value of **14.15%**. Hence it is clearly evident that the project is not a business as usual scenario and this needs additional revenue stream to make to strengthen the project returns.

1. Result of Financial Assessment

Sl. No	Project Proponent	Benchmark (%)	IRR (%)
1	Project	14.15%	7.20%

Sub-step 2d: Sensitivity Analysis

The robustness of the conclusion drawn above, namely that the project is not financially attractive, has been tested by subjecting critical assumptions to reasonable variation. As required by Annex 05 of EB 92, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. PPs have identified the total revenue from the project activity is dependent on the Plant Load Factor and Project Cost, O&M Costs constitute more than 20% of the project costs. These factors have been subjected to a 10% variation on either side and the results of the sensitivity analysis so conducted are given in the following tables.

Variation in Parameter	-10%	0%	10%	Variation required to Benchmark Breach	Value required to reach benchmark
Project cost	8.90%	7.20%	5.70%	-34.45%	49753.11
PLF	5.35%	7.20%	8.92%	46.50%	35.89%
Tariff Rate	5.35%	7.20%	8.92%	46.50%	7.08
O&M	7.42%	7.20%	6.96%	NA	--

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

- Tariff: The Tariff rate of electricity used for investment analysis i.e. 4.83 INR/kWh is sourced from the offered tariff applicable at the time of investment decision. Furthermore, the project will breach the benchmark value at a tariff variation of over 46.5%. However, the electricity tariffs are fixed for the lifetime of the project activity;

hence this is not a likely scenario. The project has already entered a PPA with DISCOM at the same tariff of 4.83 INR/kWh.

- b) PLF: The PLF value considered is based on Third Party PLF report reflected in DPR i.e. 24.5% for and the IRR will breach the benchmark value at a PLF variation of more than 46.5%. The increase in PLF value to breach the benchmark is highly unlikely as the normative PLF reflected in the tariff order applicable for the state of Andhra Pradesh is only 23.5% and project IRR at normative PLF values are less than the benchmark value and given the analysis above its highly unlikely that PLF will increase above breaching value.
- c) Project Cost: The project cost considered for investment analysis i.e. 7590.1 Million INR. A variation of -34.45% is required for IRR to breach benchmark which is highly unlikely as the project is already commissioned with the actual project cost incurred being 7369.3 Million INR. The actual projects cost is a mere -2.91% variation from the estimated project cost and hence falls within the applied sensitivity analysis.
- d) O&M Costs: The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation/inflation, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.

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

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

Step 3: Barrier analysis

Barrier analysis has not been used.

Step 4: Common practice analysis

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

Unless the proposed project type has demonstrated to be first-of-its kind (according to Sub-step 3a), and for measures different from those listed in paragraph 6 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.

The project activity is not first-of-its kind and also not a measure listed in paragraph 6 of the tool. Therefore, the common practice analysis is carried out as mentioned below:

The project activity is a power generation based on renewable energy, which falls under measures listed in definition section of "Tool for the demonstration and assessment of additionality". Hence, substep 4a is been followed and latest version of tool: Common Practice Version 03.1.

Sub-step 4a: Analyze other activities 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. Therefore, activities similar to the proposed project activity have been selected based on the following assumption:

For Common practice analysis, Version 03.1 of the tool "COMMON PRACTICE" has been used. As per the guideline the following steps have been suggested:

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

The proposed project activity is of 100 MW capacity. Considering +/- 50% of the project activity capacity the output range to be considered for the common practice analysis is 50 MW to 150 MW.

Step 2: identify similar projects (both Carbon Credit and non-Carbon Credit) which fulfil all of the following conditions:

- a) *The projects are located in the applicable geographical area*
- b) *The projects are located in the applicable geographical area.*
- c) *The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity*
- d) *The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant*
- e) *The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1*
- f) *The projects started commercial operation before the project design document is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity*

- a) The host country's state of Andhra Pradesh has been chosen as the applicable geographical area. Hence, projects in the Andhra Pradesh state have been chosen for analysis.

The Electricity Act 2003, which came into effect from 10/06/2003, replaced all the acts governing the Indian power sector. Since this Act is applicable to the project activity, all projects commissioned before 2003 have not been considered for the common practice analysis.

Every state in India has its own State Electricity Regulatory Commission. The policy / regulations for each SERC are unique and different from the other. For example parameters like tariff, regulatory frameworks and investment climate varies from state to state. Hence only the projects located in Andhra Pradesh can be compared with the project. The proposed project activity is governed by the policy /regulations of Madhya Pradesh Electricity Regulatory Commission. Wind projects in other states will follow their respective policy / regulations and will be different from that of the proposed project activity. In line with the aforesaid guidelines, the investment climate in the state of Andhra Pradesh is different from that of other state in India. Therefore, the applicable geographical area for common practice analysis has been limited to the state of Andhra Pradesh alone and for projects commissioned after 2003.

- b) The proposed project is a wind power project supplying electricity to the grid. Hence, similar projects in the capacity range which use the same source of energy and apply the same measure have been selected.
- c) The energy source used by the project activity is wind. Hence, only wind energy projects have been considered for analysis.
- d) The plants which produce goods or services with comparable quality, properties and applications have been considered.
- e) The projects within the applicable capacity range have been considered.

- f) The projects which started commercial operations before the start date of the project activity have been considered as the project start date is before the date of global stakeholder consultation.

Thus, all power plants which supply electricity to the grid in the applicable capacity range and commissioned before the project start date have been considered. From Indian wind energy directory these projects were found to satisfy these conditions i.e. between 50 MW – 150 MW grid connected wind power projects installed in the Andhra Pradesh state before project start date.

Wind projects by individual investors in Andhra Pradesh where the installed capacity is in the range identifies and were commissioned before the start date of the project activity are presented in the table below:

S. No	Project Proponent	Capacity	GS/CDM/VCS	Reference or Comment
1	Vaayu (India) Power Corporation Private Limited	50	CDM	cdm.unfccc.int/Projects/DB/DNV-CUK1302613748.83/view
2	Tadas Wind Energy Limited	50.4	CDM	http://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1355495522.4/view
3	Rayala Wind Power Company Private Limited	100.8	CDM	http://cdm.unfccc.int/Projects/DB/DNV-CUK1351859167.83/view
4	Axis Wind Farms (Borampalle) Private Limited	150	CDM	http://cdm.unfccc.int/Projects/Validation/DB/YDALPTQO0JTE0RDDV9MAA40L7APR1O/view.html
5	Axis Wind Farms (Payalakuntla) Private Limited	50	CDM	http://cdm.unfccc.int/Projects/Validation/DB/2WXP0NZA HIT9QTGD DDCRG1D ZISY8TKP/view.html
6	Mytrah Vayu (Pennar) Private Limited	63	CDM	http://cdm.unfccc.int/Projects/DB/SGS-UKL1369989385.4/view
7	Hetero Wind Power Limited	54	CDM	http://cdm.unfccc.int/Projects/Validation/DB/50NLH6P1TUCUT2WUWM0HMNFYDDZ084/view.html
8	Rajasthan Gum Pvt Ltd	53.7	CDM	http://cdm.unfccc.int/Projects/Validation/DB/5BU0X71NHOOR84M81JZDLX4UV516MV/view.html

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

The project activity identified in Step 2 is already registered/under validation of Carbon Credit mechanisms.

Therefore $N_{all} = 0$

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

As per paragraph 12 of common practice tool, “Different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed clean development mechanism (CDM) project activity and applicable geographical area):

- a) Energy source/fuel.

- b) Feed stock.
- c) Size of installation (power capacity)/energy savings.
- d) Investment climate on the date of the investment decision,
- e) Nature of the investment

Since no projects have been identified under N_{all} , N_{diff} is found to be zero.
Hence, $N_{diff} = 0$

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

$$F = 1 - (0/0)$$

Thus $F = 1$

And, $N_{all} - N_{diff} = 0$

As per paragraph 18 of common practice tool, the proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

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

Since the $N_{all} - N_{diff}$ is less than 3, the project activity cannot be considered as a common practice within the applicable geographical area.

This proves that similar activities are not widely observed or commonly carried out. Therefore the project activity is not a common practice.

Conclusion:

The implementation of the project activity would result in anthropogenic GHG emission reductions. However, the PP is dependent on the projected revenues to be accrued from the sale of carbon credits as it would provide the necessary cover to overcome or alleviate the risks or the barriers faced. Registering the project activity as a GS project, would provide additional revenue to the project activity improving the project's profitability and economic viability. Thus in accordance with the above analysis, the project activity is deemed to be **additional**.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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The baseline emission is calculated in line with para 44 of AC0002, Version 17, using equation below

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

Where,

BE_y = Baseline emissions in year y (t CO₂/yr)

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

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

The methodology follows the latest version of "tool to calculate the emission factor of an electricity system" provides following approaches for emission factor calculations:

- (a) Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology "Tool to calculate the emission factor for an electricity system". OR
- (b) The weighted average emissions (in t CO₂/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' since data is available from an official source. CO₂ Baseline Database for the Indian Power Sector, Version 11, April 2016, published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per the "Tool to calculate the emission factor for an electricity system" Version 05.0, EB 87, Annex 9, the following steps have been followed.

- STEP 1: Identify the relevant electricity systems;
- STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional);
- STEP 3: Select a method to determine the operating margin (OM);
- STEP 4: Calculate the operating margin emission factor according to the selected method;
- STEP 5: Calculate the build margin (BM) emission factor;
- STEP 6: Calculate the combined margin (CM) emission factor.

STEP 1: Identify the relevant electricity power systems

The tool defines that "for determining the electricity emission factors, identify the relevant electricity system. Similarly, identify any connected electricity systems". It also states that, "If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used". In previous years, the Indian electricity system was divided into two grids, the NEWNE and Southern Grid (SR). These are now integrated as a single Indian Grid covering all the states.

As of 31/12/2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

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

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

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

Option I: Only grid power plants are included in the calculation.

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

Option I corresponds to the procedure contained in earlier versions of this tool. Option II allows the inclusion of off-grid power generation in the grid emission factor. Option II aims to reflect that in some countries off-grid power generation is significant and can partially be displaced by CDM project activities, e.g. if off-grid power plants are operated due to an unreliable and unstable electricity grid. Option II requires collecting data on off-grid power generation and can only be used if the conditions outlined therein are met. Option II may be chosen only for the operating margin emission factor or for both the build margin and the operating margin emission factor but not only for the build margin emission factor. If Option II is chosen, off-grid power plants should be classified in different classes of off-grid power plants. Each off-grid power plant class should be considered as one power plant *j*, *k*, *m* or *n*, as applicable. In case of the project Option I is chosen with only grid power plants included in the calculation.

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

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

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

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

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

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

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

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

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

As per tool to calculate emission factor for an electricity system (Version 05.0.0), The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Since the low cost/must run resources constitute less than 50% of total grid generation as seen from the average of five most recent years, the Simple OM method can be used to calculate the Operating Margin Emission factor.

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

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

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

The simple OM may be calculated:

Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit; or

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

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO₂ Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the “Tool to calculate the emission factor for an electricity system, Version 05.0.0”. We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

As per „Tool to calculate the emission factor for an electricity system”, Option A (“Based on the net electricity generation and a CO₂ emission factor of each power unit”) is used to calculate simple OM emission factor. Where Option A is used, the simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

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

Where:

$EF_{grid,OMsimple,y}$ Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

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

$EF_{EL,m,y}$ CO₂ emission factor of power unit m in year y (tCO₂/MWh)

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

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

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

$$EF_{OM,y} = 0.9941 \text{ tCO}_2/\text{MWh}$$

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

The project participants have chosen Option I, i.e. fixing build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM PDD submission to the DOE for validation.

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

$$EF_{grid, BM, y} = \frac{\sum(EG_{m, y} \times EF_{EL, m, y})}{\sum EG_{m, y}}$$

Where:

- $EF_{grid, BM, y}$ = Build margin CO₂ emission factor in year y (t CO₂ e/MWh)
- $EG_{m, y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- $EF_{EL, m, y}$ = CO₂ emission factor of power unit m in year y (t CO₂ e/MWh)
- m = Power units included in the build margin
- y = Most recent historical year for which power generation data is available

The CO₂ emission factor of each power unit m ($EF_{EL, m, y}$) is determined as per the procedures given in step 4 (a) for the simple OM, using options A1B1 using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

The build margin emission factor ($EF_{grid, BM, y}$) for the year 2014-15 (most recent year) for Indian grid is 0.9285 tCO₂/MWh.

CEA’s “CO2 Baseline Database for the Indian Power Sector” Version 11.0,.

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

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

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

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

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

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

Parameter	Value	Units
Operating Margin : $EF_{OM, y}$	0.9941	tCO ₂ e/MWh
Build Margin : $EF_{BM, y}$	0.9285	
Combined Margin : $EF_{Indian, grid, y}$	=0.9941*75%+0.9285*25%	
Combined Margin : $EF_{Indian, grid, y}$	0.9777	

Project Emissions:

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

Leakage Emissions:

As per applied methodology no source of leakage emissions identified under proposed project activity.

Hence, $LE_y = 0$

Emission reduction (ER_y):

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

$$ER_y = BE_y - PE_y - LE_y$$

Where,

ER_y = Emission Reduction in tCO₂/year

BE_y = Baseline emission in tCO₂/year

PE_y = Project emissions in tCO₂/year

LE_y = Leakage Emissions in tCO₂/year

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data or parameter.)

Data/Parameter	EF _{OM,y}
Data unit	tCO ₂ /MWh
Description	Operating Margin CO ₂ emission factor for the Indian Grid in year y
Source of data	CEA's "Baseline Carbon Dioxide Emission Database Version 11.0"
Value(s) applied	0.9941
Choice of data or measurement methods and procedures	<p>Calculated in line with "Tool to calculate the emission factor for an electricity system (Version 05.0.0)" using data from Central Electricity Authority of India's (CEA) "Baseline Carbon Dioxide Emission Database Version 11.0".</p> <p>The value used is calculated ex-ante as generation based weighted average of last three years of the operating margin provided in the CEA database.</p> <p>Weighted average $= \frac{\sum_{i=1 \text{ to } n} (\text{Net generation in operating margin in year } i * \text{Simple operating margin in year } i)}{\sum_{i=1 \text{ to } n} (\text{Net generation in operating margin of year } i)}$</p>
Purpose of data	Calculation of baseline emissions
Additional comment	The value is fixed ex-ante

Data/Parameter	EF_{BM, y}
Data unit	tCO ₂ /MWh
Description	Build Margin CO ₂ emission factor for the Indian Grid in year y
Source of data	CEA's "Baseline Carbon Dioxide Emission Database Version 11.0"
Value(s) applied	0.9285
Choice of data or measurement methods and procedures	Calculated in line with "Tool to calculate the emission factor for an electricity system (Version 05.0.0)" using data from Central Electricity Authority of India's (CEA) "Baseline Carbon Dioxide Emission Database Version 11.0". The value is calculated ex-ante as most recent build margin provided by the CEA.
Purpose of data	Calculation of baseline emissions
Additional comment	The value is fixed ex-ante

Data/Parameter	EF_{grid, CM, y}
Data unit	tCO ₂ /MWh
Description	Combined Margin CO ₂ emission factor for the Indian Grid in year y
Source of data	Central Electricity Authority(CEA) of India Database Version 11.0
Value(s) applied	0.9777
Choice of data or measurement methods and procedures	This has been calculated based on Operating Margin (OM) and Build Margin (BM) published by Central Electricity Authority (CEA) of India. Please refer section B.6.1 for details.
Purpose of data	Calculation of baseline emissions
Additional comment	The value is fixed ex-ante

B.6.3. Ex ante calculation of emission reductions

>>

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

Baseline emissions:

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

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

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

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

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

$$EG_{facility,y} = 100 \text{ MW} * 24.5\% * 365 \text{ days} * 24 \text{ hours} = 214,620 \text{ MWh}$$

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

Here,

$$EF_{grid,CM,y} = 0.9777 \text{ tCO}_2/\text{MWh}$$

Hence,

$$BE_y = 209,833 \text{ tCO}_2/\text{year} \text{ (rounded down)}$$

Project emissions:

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

$$PE_y = 0$$

Leakage emissions:

No leakage emissions occur due to this project activity.

$$LE_y = 0$$

Emission reductions:

$$ER_y = BE_y - PE_y$$

or

$$ER_y = BE_y \text{ as } PE_y = 0$$

$$ER_y = 209,833 \text{ tCO}_2/\text{annum}$$

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

Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
Year 1	209,833	0	0	209,833
Year 2	209,833	0	0	209,833
Year 3	209,833	0	0	209,833
Year 4	209,833	0	0	209,833
Year 5	209,833	0	0	209,833
Year 6	209,833	0	0	209,833
Year 7	209,833	0	0	209,833
Total	1,468,831	0	0	1,468,831
Total number of crediting years	7 Years			
Annual average over the crediting period	209,833	0	0	209,833

B.7. Monitoring plan**B.7.1. Data and parameters to be monitored**

(Copy this table for each piece of data or parameter.)

Data/Parameter	EG_{facility,y}⁶
Data unit	MWh/year
Description	Quantity of net electricity supplied to the grid during the year y.
Source of data	Monthly energy generation statement issued by State Electricity Board. These are called JMR (Joint Meter Reading)
Value(s) applied	214,620
Measurement methods and procedures	<p>Net electricity supplied will be calculated based on the difference between values of “export” and “import” on the EB energy meter at the Government sub-station (evacuation point). (Net Electricity = Export – Import – Transmission Losses)</p> <p>The net electricity will be calculated by State electricity board and provided in the monthly generation statement/JMR/B-form. Hence, the net electricity reading will be directly sourced from the monthly generation statement/JMR/B-form.</p> <p>Transmission Losses: This will be arrived at by the way of apportioning.</p>
Monitoring frequency	<p>Measurement: Continuous</p> <p>Recording: Monthly</p> <p>Monitoring Method: recording in JMR (Join Meter Reading)</p> <p>The JMR includes, monthly recording of electricity export, import & transmission loss. Energy meters of accuracy class 0.5 or better.</p>
QA/QC procedures	Net electricity supplied to the grid by the project activity will be cross checked with invoices submitted to EB. The meter(s) shall be calibrated and maintained by the state utility as per their schedule, and this frequency of meter calibration is not within the control of the Project Proponent. However, the project proponent shall ensure that calibration of electricity meters is carried out in-line with the Nation standard ⁷ which recommends at least once in 5 year calibration or whenever abnormal difference/inconsistency is observed between main meter and check meter.
Purpose of data	EG_{facility,y}⁸
Additional comment	MWh/year

B.7.2. Sampling plan

>>

Not Applicable

B.7.3. Other elements of monitoring plan

>>

The project proponent has enter into agreement with the WTG Suppliers (Gamesa) for the operation and maintenance of WTGs. The WTG supplier has dedicated and technically well-equipped O&M team for day to day Operation and maintenance of each WTG. O&M contractor will provide a monthly report, which includes generation data, major breakdown events and machine

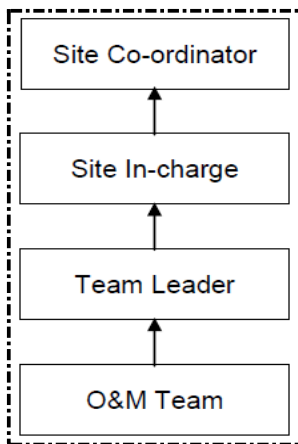
⁶ If the project activity is the installation of a Greenfield power plant, then: $EGPJ,y = EG_{facility,y}$

⁷ (Page number 12 of) http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

⁸ If the project activity is the installation of a Greenfield power plant, then: $EGPJ,y = EG_{facility,y}$

availability. Project manager is responsible for recording of monthly meter readings of export and import. Monthly power export and import data will be sent regularly to siren in charge of each project separately.

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



Personal Training:

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

Monitoring Process at project site

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

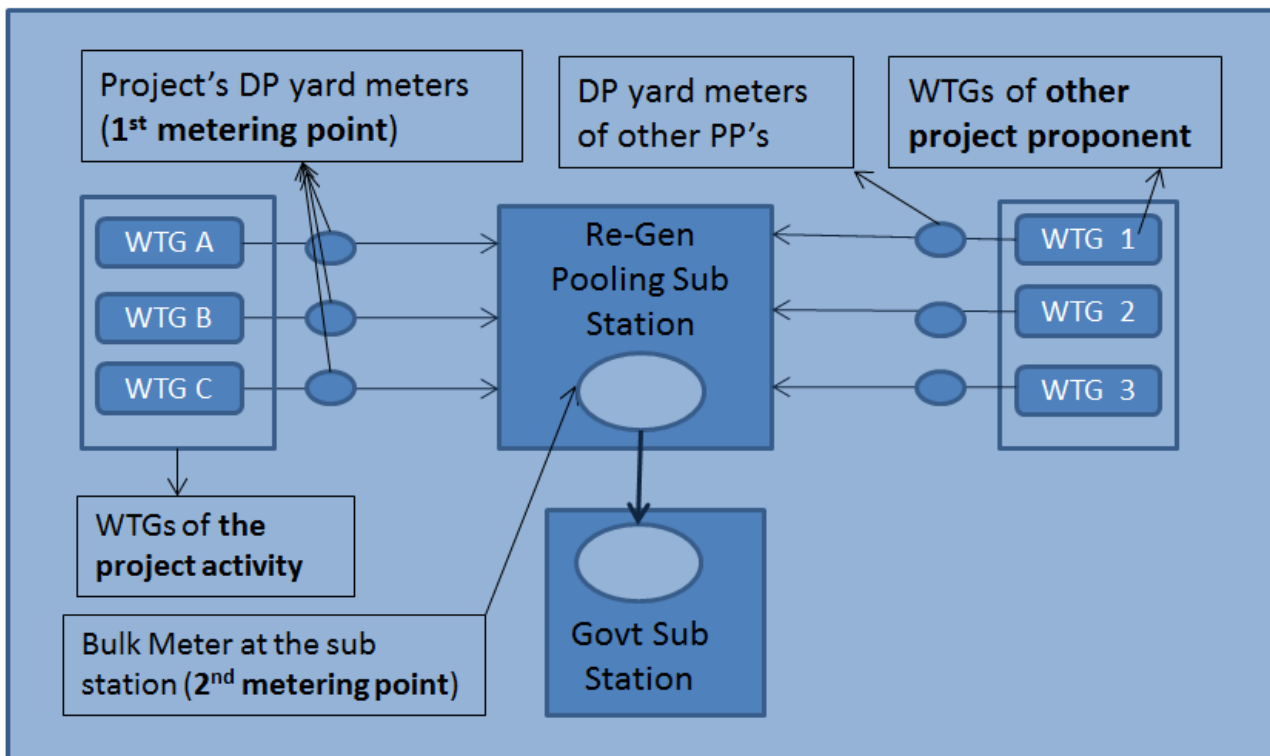
Based on the above procedure, the Monthly Wind Energy Certificates shall be provided to the project proponent. This is to be noted that the detail procedure of monitoring is illustrated here for the sake of understanding; for the preparation of monitoring report during periodic verifications, only the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

Emergency preparedness:

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

Metering

The below diagram represents the metering at site:



The project activity metering is done at the WTG end and at the Pooling substation (PSS). The line losses are calculated as below:

$$\text{Line Loss (Z)} = \frac{(\text{Generation at WTGA} + \text{WTG B} + \text{WTG C} + \text{WTG 1} + \text{WTG 2} + \text{WTG 3} \dots) - Y}{(\text{Generation at WTGA} + \text{WTG B} + \text{WTG C} + \text{WTG 1} + \text{WTG 2} + \text{WTG 3} \dots)}$$

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>
14/09/2015 (date of issue of first purchase order)

C.2. Expected operational lifetime of project activity

>>
25 years 0 months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Renewable crediting period

C.3.2. Start date of crediting period

>>
Retroactive start date required from 28/03/2016 (date of Commissioning) or upon registration with Gold Standard; as decided by the GSF.

C.3.3. Duration of crediting period

>>
7 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

In the applicable EIA notification i.e. S.O. 30679, dated 01/12/2009, Ministry of Environment & Forests (MoEF), Govt. of India, the wind projects are not included in the list of projects that has to get Prior Environmental Clearance (EC) either from State or Central Govt. authorities and hence no EIA study was conducted. The project does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. However due weightage has been given to environmental aspects.

However, some of the significant impacts taken into consideration during the construction and operation of the wind farm are as follows:

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

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

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

D.2. Environmental impact assessment

>>

Not Applicable

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

The project has conducted local stakeholders' meeting as per the requirement of GS. Hence, the LSC report is separately available. The stakeholders' feedback round (SFR) as well has been conducted during the validation site visit.

E.2. Summary of comments received

>>

⁹ <http://moef.nic.in/downloads/rules-and-regulations/3067.pdf>

Provided in LSC report

E.3. Consideration of comments received

>>

Provided in LSC report

SECTION F. Approval and authorization

>>

Not Applicable

Appendix 1. Contact information of project participants

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

Appendix 2. Affirmation regarding public funding**Appendix 3. Applicability of methodologies and standardized baselines****Appendix 4. Further background information on ex ante calculation of emission reductions****Appendix 5. Further background information on monitoring plan****Appendix 6. Summary report of comments received from local stakeholders****Appendix 7. Summary of post-registration changes**

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 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: <ul style="list-style-type: none"> • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • 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).

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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