BUNDLED RENEWABLE ENERGY PROJECT IN GUJARAT AND KARNATKA, INDIA

Document Prepared By (PA Research & Consultants Pvt. Ltd.)

Project Title	Bundled renewable energy project in Gujarat and Karnataka, India
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The proposed project activity is a bundled project activity involving installation and operation of 2 Wind Turbine Generators (WTGs) having individual capacities 1x2000 kW (G114) and 1x850 kW (G58) manufactured and supplied by Siemens Gamesa Renewable Power Pvt. Ltd. and 3.5 MW solar PV modules manufactured and supplied by Diwakar Soltek Pvt. Ltd. with aggregated capacity of 6.35 MW in Indian states of Karnataka and Gujarat. The proposed project activity is promoted by Sai Pet Preforms Limited with a view to align itself with sustainable development policies of India has undertaken this project to produce green power using wind and solar as an energy source.

The 2 MW wind power project site in Karnataka is located in Bableshwar Wind Park at Malaghan village at Basavana Bagewadi Taluka at Vijayapura district and 0.85 MW wind power project in Gujarat is located at Village Juna kataria, Khodasar of Bhachhau Taluka falling under Kutch district. On the other hand, the 3.5 MW solar PV power generation project site is located at Upparhalli village Hospet taluka within Bellari district of Karnataka. The generated electricity from this project activity is exported to the Indian grid. Electricity generated from 2 MW wind power plant in Karnataka is supplied to the local electricity distribution licensee Hubli Electricity Supply Company Limited (HESCOM), electricity generated from 0.85 MW wind power plant in Gujarat is supplied to Gujarat Urja Vikas Nigam Limited (GUVNL) while the 3.5 MW solar PV power plant supplies electricity to Gulbarga Electricity Supply Company Limited (GESCOM).

The project activity helps in Greenhouse gas (GHG) emission reduction by using renewable resources (wind/solar energy) for generating power which otherwise would have been generated using grid mix power plants, which is dominated by fossil fuel based thermal power plants. The project activity is a Greenfield project aimed at utilizing wind and solar energy sources to generate electricity. In the pre-project scenario, the equivalent amount of electricity would have been generated by grid mix power plants connected Indian grid, which is dominated by fossil fuel based thermal power plant. The project activity will thus reduce the anthropogenic emissions of Green House Gases (GHGs) in to the atmosphere associated with the equivalent amount of electricity generation from the fossil fuel-based grid connected power plant. Since the project activity will generate electricity through wind energy, a clean renewable energy source it will not cause any negative impact on the environment and thereby contributes to climate change mitigation efforts as well as sustainable development.

The estimated annual average and the total CO_2e emission reduction by the project activity over the first renewable crediting period of 10 years are expected to be **11,842** tCO_2e and **118,420** tCO_2e respectively.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:

Sectoral scope-01, Energy Industries (Renewable -/non renewable sources)

Project Type-I Renewable Energy Project

The project activity is not a grouped project.

1.3 Project Proponent

Organization name	Sai Pet Preforms
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1.4 Other Entities Involved in the Project

NA

1.5 Project Start Date

The start date of the project activity is 08/03/2018 which is the earliest date of commissioning of the WTG.

1.6 Project Crediting Period

The PP has chosen renewable crediting period of 10 years, crediting period start from 8th March 2018 (The date of commissioning) to 7th March 2028 (including both days). The crediting period can be renewed as 2x10 years.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	✓
Large project	---

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	11842
Year 2	11842
Year 3	11842
Year 4	11842
Year 5	11842
Year 7	11842
Year 8	11842
Year 9	11842
Year 10	11842
Total estimated ERs	**118420**
Total number of crediting years	10
Average annual ERs	11842

1.8 Description of the Project Activity

The proposed project activity is installation and operation of 2 Wind Turbine Generators (WTGs) having individual capacities 1*2000 kW and 1*850 kW in the states Karnataka and Gujarat respectively and solar PV modules with capacity 3500 kW in Karnataka. WTGs are manufactured and supplied by Siemens Gamesa Renewable Power Pvt. Ltd. while solar PV modules are manufactured and supplied by Diwakar Soltek Pvt. Ltd. The total power generating installed capacity in the proposed project activity is 6.35 MW.

The bundled project activity is a new facility (Greenfield) and the electricity generated by the project will be 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. The Project Proponents plan to avail the VCS benefits for the Project.

In the Pre- project scenario the entire electricity, delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected power plants which is mainly dominated by fossil fuels.

The salient features of the WTGs are

Turbine Model	G 114
Rated Power	2000 kW
Rotor Diameter	114 m
Hub Height	106 m

Power Regulation	Independent pitch system for each blade
Cut-in wind speed	2.5m/s
Rated wind speed	10.0 m/s
Cut-out wind speed	25.0 m/s
Survival Wind Speed	60.0 m/s
Swept area	10,207.0 m2
No. of blades	3
Blade material	GFK
Gear box type	spur/planetary
Generator type	Double Fed Asyn
Output Voltage	690.0 V

WTG2

Turbine Model	G 58
Rated Power	850 kW
Rotor Diameter	58 m
Hub Height	65 m
Power Regulation	Independent pitch system for each blade
Cut-in wind speed	3.0 m/s
Rated wind speed	12.0 m/s
Cut-out wind speed	20.0 m/s
Survival Wind Speed	60.0 m/s
Swept area	2642.0 m2
No. of blades	3
Blade material	Fiber Glass Epoxy

Gear box type	3 stages (spur/planetary)
Generator type	Asynchronus
Output Voltage	690.0 V

3.5MW Solar PV

The instant project activity involves installation of 3.5MW$_{AC}$ solar power project based on polycrystalline technology. The major components of the solar project are the solar modules, module mounting structures, transformer etc. The solar modules are mounted on the module mounting structures. The solar module is a packaged, connected assembly of solar cells which uses the incident photons from the sun light and converts it into electricity. The solar module generates DC power, which is converted to AC power with the help of inverters. The instant project encompasses the following:

Particulars	**Details**
Nominal Power	4.50 MWdc
AC Power	3.5MW$_{AC}$
Module make	Waaree
Mounting	Ground mount
Inverter	Enphase Micro Inverter

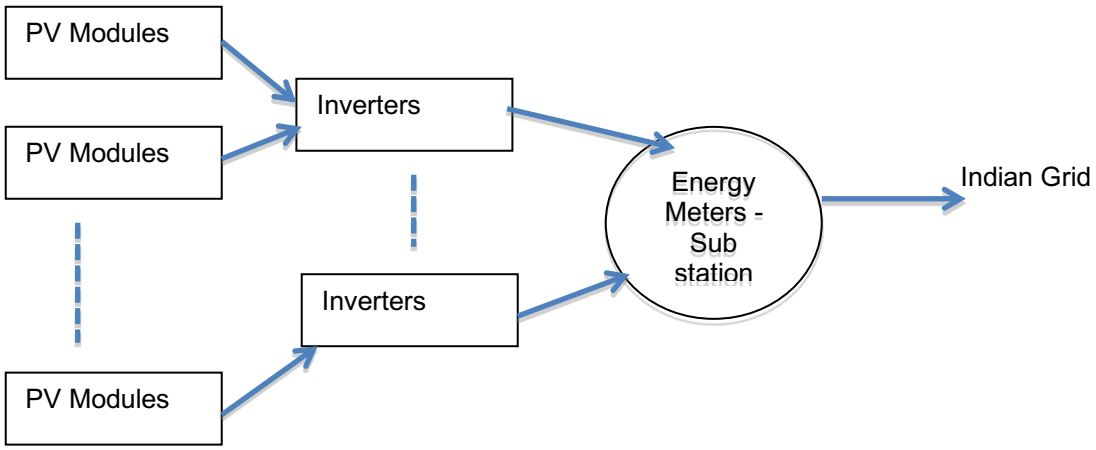

Fig 1: Schematic arrangements of systems and monitoring equipment

The average lifetime of the modules/WTG under project activity are around 20 years as per the equipment supplier specifications. The third party estimation on electricity generation is considered for emission reduction calculation.

In the absence of the project activity the equivalent amount of electricity would have been imported

from the Indian grid, which is predominantly based on fossil fuels[1], hence baseline scenario of the project activity is the grid-based electricity system, which is also the pre-project scenario.

The solar/wind project converts the incident sunlight/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.

1.9 Project Location

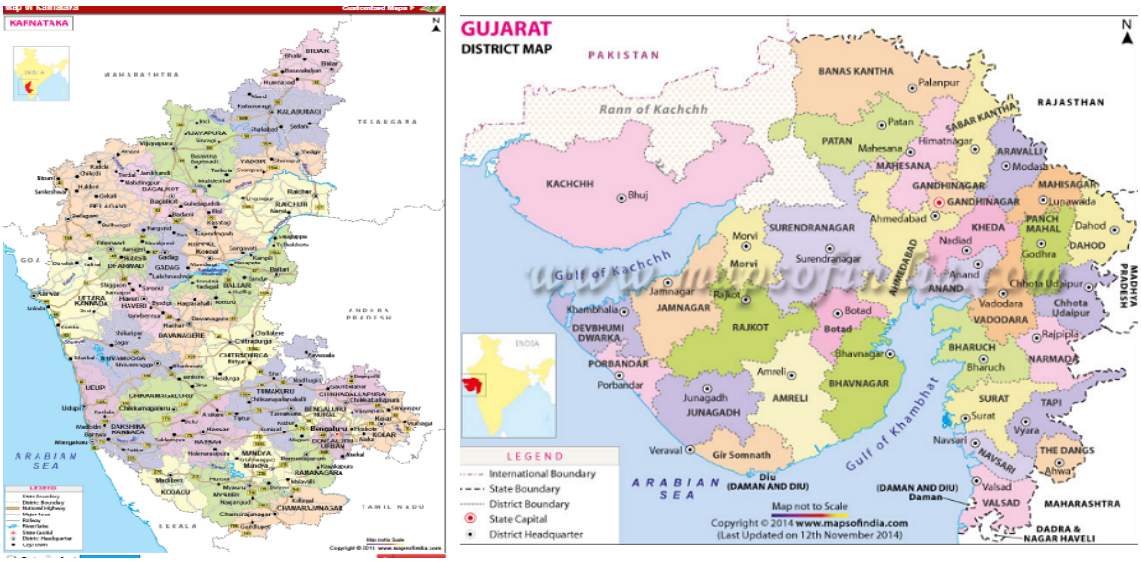

Fig: Project Sites

The Project sites are connected by roads to the nearest town. The physical address and geographic co-ordinate of project site is provided below.

Type	Capacity	Location	Geo-coordinates
Wind Power Project	2.0 MW	Malaghan village at Basavana Bagewadi Taluka of Vijaypura District, Karnataka	16.56^0 N, 75.97^0 E
Wind Power Project	0.85 MW	Juna Katiar village at Bhachhau taluka of Kutch district, Gujarat	23.29^0 N, 70.33^0 E
Solar PV Power Project	3.5 MW	Upparhalli village at Hospet taluka of Ballari district, Karnataka	15.26^0 N, 76.39^0 E

[1] http://www.cea.nic.in/executive_summary.html

1.10 Conditions Prior to Project Initiation

The proposed project activity is a greenfield activity that is the installation of new 6.35MW (1*2000KW and 1*850 kW WTGs and 1*3500 kW solar PV plant) renewable energy based power generation for generating electricity. In the absence of the project activity, the equivalent quantity of electricity would have been generated by grid mix power plant connected to INDIAN grid. Therein, the main emission sources in the pre-project scenario are the grid connected power plants and the primary GHG involved is CO_2. For this project activity, the baseline scenario is the same as conditions existing prior to project initiation.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The relevant national laws and regulation pertaining to generation of energy are:

- Electricity Act 2003
- National Electricity Policy 2005

Power generation using wind/solar energy is not a legal requirement or a mandatory option. There are state and sectoral policies, framed primarily to encourage hydro power projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments. As per environmental act the proposed project activity does not require to carry out environmental impact assessment. The PP has secured all necessary regulatory and statutory clearances to establish and operate the project under discussion. The Indian Electricity Act, 2003 (May 2007 Amendment) does not influence the choice of fuel used for power generation. There is no legal requirement on the choice of a particular technology for power generation.

The project activity conforms to all the applicable laws and regulations in India. As per Central Pollution Control Board (Ministry of Environment & Forests, Govt. of India), final document on revised classification of Industrial Sectors under Red, Orange, Green and White Categories (February 29, 2016)[2], the project falls under white category with no requirement for EIA and the project has secured all the nodal agency approval.

1.11.1 Project Ownership

The Project is owned by Sai Pet Preforms hence it possesses right of use of ER credits. The Ownership is demonstrated through the following documents provide evidence of project ownership, in accordance with the VCS specifications on project ownership.

1. Commissioning Certificates
2. Purchase Orders
3. Power Purchase Agreements between DISCOM and PP

1.11.2 Emissions Trading Programs and Other Binding Limits

This project activity is voluntary initiative and it is not to meet any local laws or regulatory compliances. An undertaking has been submitted that PP shall not claim for GHG emission

[2] http://www.ppcb.gov.in/Attachments/Categorisation%20of%20Industries/category29.9.2016.pdf

reduction credits for the given crediting period under any other emission-trading program or GHG binding limits.

1.11.3 Other Forms of Environmental Credit

The Project Participant declares that emission reductions generated from the project activity will not be double-counted (i.e. issuance of other form of environmental credit like under CDM) for the particular crediting period, which is being claimed under VCS mechanism. PP has submitted an undertaking to the VVB that they shall not claim for GHG emission reduction credits for the given period under any other emission-trading program.

1.11.4 Participation under Other GHG Programs

The project activity has not been registered or currently seeking registration under any other GHG programs. The project has not participated under any other GHG programme.

1.11.5 Projects Rejected by Other GHG Programs

The Project Participant hereby declares that any other GHG program has not rejected the project activity; an undertaking for the same has been submitted by the Project Participant.

1.12 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project activity. Thus, this section is not applicable for this project.

Leakage Management

Not applicable to the project activity.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

Ministry of Environment, Forests and Climate Change of Government of India, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

- Social well-being: The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.

- Economic well-being: The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the region and eventually in national level. As the project activity generates employment opportunities in the local area. Hence, the project contributes to the economic sustainability, which is promotion of decentralization of economic power.

- Environmental well-being: The project utilizes wind and solar energy for generating electricity which otherwise would have been generated through alternate fuels based power plants; thus the project activity contributes in reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. Being renewable resources, using wind or solar energy to generate electricity contributes to resource conservation of natural resources besides avoiding emissions of harmful effluents. Thus, the project causes no negative impact on the surrounding environment contributing to environmental well-being.

- Technological well-being: The project makes use of efficient environmentally safe technology for power generation. The project activity employs state of art technology i.e. 2.0MW and 0.85 MW WTGs which has high power generation potential with optimised utilization of land and solar PV modules of combined capacity 3.5 MW with high power conversion efficiency. Hence, the project leads to technological well-being. Successful operation of project activity would lead to promotion of solar based power generation and would encourage many other entrepreneurs to participate in similar projects. The generation of electricity from the project also leads to strengthening of the grid, increasing the energy availability thereby meeting the energy demand to a certain extent leading to technological well being.

Further Information

NA

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied;
Title: Type-I, Renewable Energy Project
Methodology: I.D. Grid connected renewable electricity generation

Version: 18, valid from 28/11/2014. Scope: 01, EB 81 Annex-14
Reference:
http://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

The tools referenced in this methodology used for the proposed project includes:

- Tool to calculate the emission factor for an electricity system Version 07.0.0, Annex 4 of EB 100
- "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" Version 03, Annex 4, EB96.
- Tool to Demonstrate Additionality of Small-Scale Project Activities (Version 12.0);
- Investment Analysis Version-09, Annex-11 of EB101

- **Guidelines:**

- General guidelines for SSC CDM methodologies, Version 23, EB 104, Annex 5. (https://cdm.unfccc.int/filestorage/e/x/t/extfile-20190916153418116-MethSSC_guid25.pdf/MethSSC_guid25.pdf?t=TlN8cTBhajZufDC2VEpoiNPTlmK-9s8qCAG8)

2.2 Applicability of Methodology

The project activity involves generation of grid connected electricity from renewable energy sources – wind and solar energy. The project activity has a proposed aggregated capacity of 6.35 MW including 2.85 MW wind and 3.5 MW solar photovoltaic based power generation facilities which will qualify for a small scale CDM project activity under Type-I of the small scale methodologies. The project status corresponding to the methodology AMS I.D version 18.0 and applicability of methodology are discussed below.

<table>
<tr><th>Applicability</th><th>Project Cause</th></tr>
<tr><td>1. This methodology comprises renewable energy generation units such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass
a) Supplying electricity to a national or a regional grid
b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.</td><td>The project activity involves 2.85 MW wind and 3.5 MW solar based power generation project with aggregated installed capacity 6.35 MW the net electricity generated will be supplied to identified customer facilities via Indian grid.</td></tr>
<tr><td>2. Illustration of respective situations under which each of the methodology (i.e. “AMS I. D.: Grid connected renewable electricity generation”, “AMS-I.F.: Renewable electricity generation for captive use and mini-grid” and “AMS-I.A.: Electricity generation by the user) applies is included in the appendix.
<table>
<tr><th></th><th>Project Type</th><th>AMS-I. A</th><th>AMS-I.D</th><th>AMS-I.F</th></tr>
<tr><td>1</td><td>Project supplies electricity to a national/regional grid</td><td></td><td>√</td><td></td></tr>
<tr><td>2.</td><td>Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to the grid)</td><td></td><td></td><td>√</td></tr>
<tr><td>3</td><td>Project supplies electricity to an identified</td><td></td><td>√</td><td></td></tr>
</table>
</td><td>The 3rd option of Table of AMS-I.D Version 18 , EB 81 is applicable</td></tr>
</table>

	consumer facility via national/regional grid (through a contractual agreement such as wheeling)				
4	Project supplies electricity to a mini-grid system where in the baseline all generators use exclusively fuel oil and/or fossil fuel			√	
5	Project supplies electricity to household users (included in the project boundary) located in the off-grid areas	√			
3. This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s)					The project is installation of new power generation plant based on wind and solar energy sources (not addition/retrofit/replacement). Option (a) is applicable.
4. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.					The project activity is wind and solar based power generation; hence not applicable
5. If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small- scale CDM project activity applies only to the renewable component. If the new unit co fires fossil fuel, the					The project activity is only 6.35MW Wind and Solar based renewable electricity generation project. It does not include any non-renewable unit and co-firing system.

capacity of the entire unit shall not exceed the limit of 15MW.	
6.Combined heat and power (co-generation) systems are not eligible under this category.	The project activity does not involve combined heat and power generation system as it involves hydro energy based power generation.
7.In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct5 from the existing units.	It is a Greenfield project and not the extension of an existing renewable energy facility.
8.In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The project activity is not the retrofitting or replacement of an existing facility for renewable energy generation. Hence this criteria in not applicable.
9.In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	The proposed project activity is a hydroelectric power project, hence criterion not applicable.
10.In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	The proposed project activity is a hydroelectric power project, hence criterion not applicable.

The project activity is installation of 6.35MW wind/solar power project for captive consumption, where electricity is supplied through Indian Grid. The project installed capacity of plant is less than 15MW. Hence the choice of project Type I and category is justified.

2.3 Project Boundary

As per Para 18 of applied baseline and monitoring methodology AMS I.D, Version-18, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the VCS project power plant is connected to. This includes the turbine, generator and sub-stations.

The proposed project activity will use generated power for captive consumption by evacuating the power to the grid. Therefore, all the power plants contributing electricity to the Indian Grid have been considered in the project boundary for the purpose of baseline estimation. The project activity targets reduction of CO_2e as main GHG greenhouse gas in baseline, there are no GHG emission associated with project activity.

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity from grid	CO_2	Yes	Main Emission source.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project activity	Electricity from hydro project via grid	CO_2	No	No emission
		CH_4	No	
		N_2O	No	

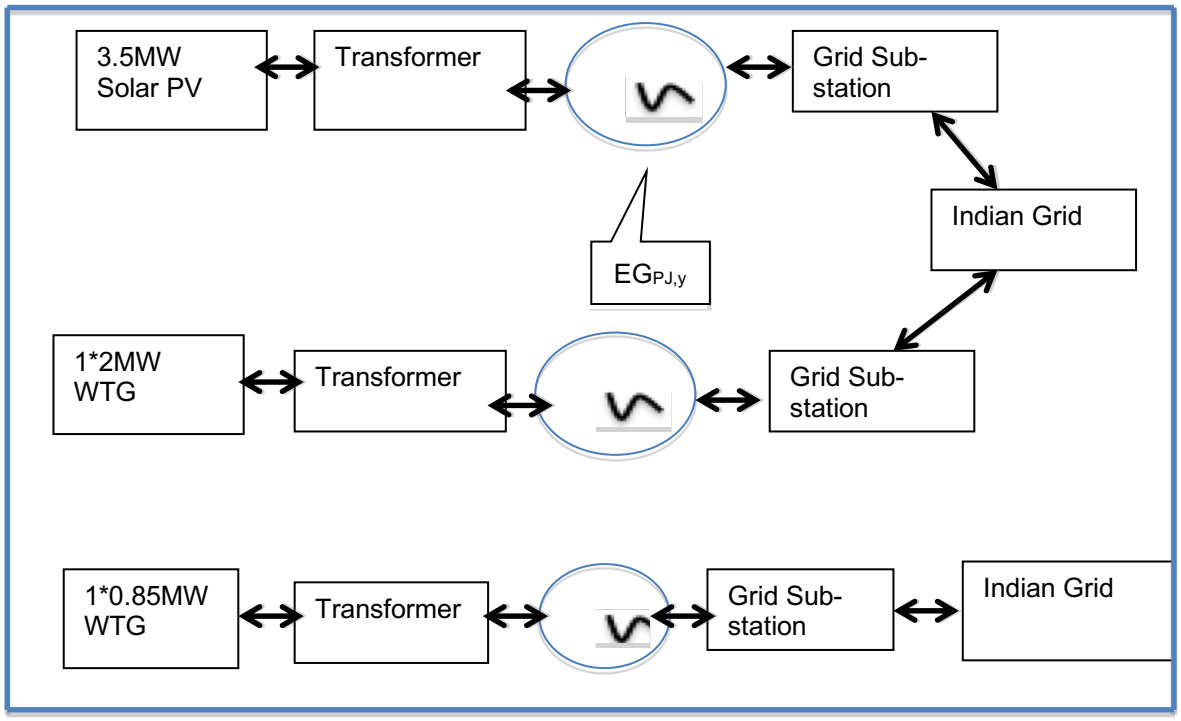

Fig: Project Boundary

2.4 Baseline Scenario

The project activity involves installation of 6.35MW Wind/Solar power project. The generated power will be supplied for captive consumption through Indian grid, which otherwise would have been imported from grid, which possesses a mix of generation types with fossil fuel fired power plants.

As per para 19 of AMS-I.D. (Version 18) "The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid. In the absence of the project activity same amount electricity would have been generated from grid, in which the

electricity is generated by the fossil fuel intensive power plant. Thus, baseline is in line with para 19 of AMS-I.D. (Version 18).

Para 22 of AMS-I.D. (Version 18) calculates baseline emissions as:

$BE_y = EG_{PJ,y} \times EF_{grid,y}$ ……..(A)

Where,

BE_y = Baseline Emissions in year y; t CO_2

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

$EF_{grid,y}$ = 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)

Accordingly, the emission factor of the grid will be used to estimate emission reductions. As per para 23 of AMS-I.D. (Version 18), PP has chosen option (a) and used the combined margin (CM) approach to calculate emission factor, as official data is available for operating margin (OM) and build margin (BM) values, whereas no such data exists in the public domain to support choice of option (b). Hence,

$EF_{grid,y} = EF_{grid,CM,y}$ *.....(B)*

DATA USED

Parameter	Description	Source
$EF_{OM,Y}$	Operating margin CO_2 emission factor for the project electricity system in year *y*	**Calculated as per "Tool to calculate the emission factor for an electricity system (Version 07.0.0)" using CEA CO2 database version-14**
$EF_{BM,Y}$	Build margin CO_2 emission factor for the project electricity system in year *y*	
$EF_{CM,Y}$	Combined margin CO_2 emission factor for the project electricity system in year *y*	
$EG_{PJ,Y}$	Quantity of net electricity supplied by the candidate project activity to the grid in year *y*	Estimated generation based on rated capacity of the project activity and the applicable PLF. During the crediting period, records of actual net electricity supply to the grid will be used.
PLF_{Solar}	21%	KERC
PLF_{2MWWTG}	25%	KERC
$PLF_{0.85MW\ WTG}$	24.5%	GERC

2.5 Additionality

The project activity meets the eligibility criteria to use the simplified baseline and monitoring methodology listed in annexure B of simplified modalities and procedure for small-scale CDM project activities. In accordance with "demonstration of additionality of small scale project activity" Version-12.0, PP shall provide an explanation to show that the project activity would not have occurred due to at least one of the following barrier

- Investment barrier:
- Technological barrier:
- Barrier due to prevailing practice:
- Other barriers

The project proponent identified "investment barrier" as the most relevant barrier faced by the project activity.

The revised investment decision for proposed project activity was taken on 8th February 2017 for WTGs and project activity commissioned on 8th March 2018. The solar PV project is commissioned in August 2019.

The investment analysis method recommends three analysis methods: simple cost analysis, investment comparison analysis and benchmark analysis. The proposed project produces economic benefits through the use/sale of electricity other than VCS related income; therefore, the simple cost analysis cannot be taken. The investment comparison analysis is not applicable to the proposed project because the alternative of the proposed project is "Equivalent electricity service provided by the grid", is outside the direct control of the PP.

As per tool Investment Analysis, the benchmark approach is suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest. In the project activity the baseline scenario is the generation of equivalent amount of electricity from the grid connected power plants.

The baseline scenario is outside the direct control of the PP. Hence, the benchmark analysis is chosen and the Equity IRR is used as the financial indicator to assess the financial viability of the WTGs under the project activity. However the 3.5MW solar PV project comes under positive list of technology and is auto additional the same is explained after sensitivity analysis section of WTGs investment analysis.

Benchmark:

As per the "Investment Analysis" tool, Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Hence the benchmark for the sub projects is based upon weighted average of the cost of debt and equity component as determined for the project activity. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate". Since in

this project activity, equity IRR has been considered as financial indicator, hence as per tool EB101 Annex11, Required/expected returns on equity are considered as appropriate benchmarks and benchmark supplied by relevant national authorities has been used.

Since the choice of benchmark is based upon parameters that are standard in the market, hence as per tool EB 101 Annex 11, "the cost of equity should be determined either by: (a) selecting the values provided in the Appendix; or by (b) calculating the cost of equity using CAPM". Hence as per option (a), the default value for India is being considered as per the value provided in Appendix of EB 101 Annex 11. The benchmark thus selected complies as per the relevant guidelines on Investment Analysis.

Further as per tool EB 101 Annex 11, "In situations where an investment analysis is carried out in nominal terms and the available IRR benchmarks are in real terms, project participants shall convert the real term values of benchmarks to nominal values by adding the inflation rate. The inflation rate shall be obtained from the inflation forecast of the central bank of the host country for the duration of the crediting period". Following the above guidance, the default value is being converted to nominal values by adding inflation rate for 10 years, as per the inflation forecast rate provided by Reserve Bank of India.

As the proposed project activity generates power utilizing wind energy, Group 1 as per Appendix- Default values for cost of equity (return on equity) of EB101, Annex 11 has been identified as a suitable category.

The investment analysis has been carried out in Nominal terms. Accordingly, Default value as given in Appendix- Default values for cost of equity (return on equity), Annex 11, EB 101 has been adjusted by adding suitable forecasted inflation rate taken from RBI (Central Bank, India). In case of inflation data from RBI, Benchmark has been calculated based on WPI median inflation rate. As per Para 16 of EB 101, Annex 11, the inflation forecast should be for the duration of the crediting period. However, since RBI provides forecast inflation only for 5 & 10 years, the project investor has calculated benchmark using 10 Years forecast and the most conservative value is considered as Benchmark for the project activity.

The benchmark has been computed in the following manner:

Nominal Benchmark[3] *= {(1+Real Benchmark) * (1+Inflation rate)}-1*

Where,

Real Benchmark = 9.79% (as per Appendix of Annex 11, EB 101)

The Reserve bank of India (RBI) provides the bimonthly forecast (for the next 5 years and 10 years) for the inflation. Results of the Survey of Professional Forecasters on Macroeconomic Indicators – (published dated 08/02/2017 and 06/04/2017), RBI forecasted values for the next ten years for WPI

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

inflation has been used to adjust the default value of ROE, which is given in real terms as per below for the project activity.

Long term WPI for 10 years forecast applicable to project activity is 4.1%[4] and 4.1%[5] applicable for the proposed project activity as the same was available to PP at the time of investment decision date i.e. 09/02/2017 for WTGs and 13/07/2018 for Solar PV project respectively.

Therefore,

Return on equity$_{Nominal}$ WTGs =(1+ 9.79%)*(1+4.1%) – 1=14.29%

Calculation and comparison of financial indicators

The period considered for Post Tax Equity IRR calculations is 20 years, which corresponds to the operational lifetime of the project activity. Depreciation, and other non-cash items related to the project activity, which have been deducted in estimating gross profits on which tax is calculated, is added back to net profits for the purpose of calculating the financial indicator.

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

1*2MW WTG MP (Gamesa)		
Capacity of Machines in kW	2000	Offer Letter from Gamesa dated 17/01/2017
Number of Machines	1	Offer Letter from Gamesa dated 17/01/2017
Project Capacity in MW	2	Offer Letter from Gamesa dated 17/01/2017
Project Cost (INR. In Millions)	150	Offer Letter from Gamesa dated 17/01/2017
Plant Load Factor Base Case	25%	KERC https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf
Net Electricity Generation per year(MWh)	4380	Calculated
Operation & Maintenance Cost (INR Million)	2.71	Offer Letter from Gamesa dated 17/01/2017
% of escalation per annum on O & M Charges every year after 4th Year	5.0%	Offer Letter from Gamesa dated 17/01/2017
Tariff Rate of Electricity(INR/kWh)	4.5	https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf

[4] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=17398

[5] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=17458

Equity	30%	https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf
Debt	70%	https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf
Interest Rate	14.55%	Calculated as average of BPLR of five major bank
Loan Tenure (years) including 1 year moratorium period	8	https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf
Rate of Depreciation (As per Books) on Plant and Machinery	4.75%	Company's act, Shcedule XIV, http://www.aadisol.in/aca/images/bullentins/bt_23.pdf
Book depreciation	90%	CERC order dated 26/04/2010 http://www.cercind.gov.in/2010/ORDER/April10/Final_RE_Tariff_Order_FY2010-11(53-2010_Suo-motu).pdf
Residual Value (%)	10%	CERC order dated 26/04/2010 http://www.cercind.gov.in/2010/ORDER/April10/Final_RE_Tariff_Order_FY2010-11(53-2010_Suo-motu).pdf
Rate of Depreciation (As per Income Tax) (15%+ 20% additional)	35%	Income tax Act
MAT Rate	21.34%	http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html
Corporate Tax	34.61%	http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html
Lifetime of the project activity (years)	25	https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf

1*0.85 MW WTGs		
Capacity of Machines in kW	850	Offer Letter from Gamesa dated 12/01/2017
Number of Machines	1	Offer Letter from Gamesa dated 12/01/2017
Project Capacity in MW	0.85	Offer Letter from Gamesa dated 12/01/2017
Project Cost (INR. In Millions)	51.7	Offer Letter from Gamesa dated 12/01/2017
Plant Load Factor Base Case	24.5%	As per GERC order 2016, Pg 25
Net Electricity Generation per year(MWh)	1820	Calculated
Operation & Maintenance Cost (INR Million)	0.88	Offer Letter from Gamesa dated 12/01/2017
% of escalation per annum on O & M Charges every year after 4th Year	5.0%	Offer Letter from Gamesa dated 12/01/2017
Tariff Rate of Electricity (INR/kWh)	4.19	As per GERC order 2016, Pg 26
Equity	30%	https://www.gercin.org/wp-content/uploads/2019/08/Tariff-Regulations.pdf

Debt	70%	https://www.gercin.org/wp-content/uploads/2019/08/Tariff-Regulations.pdf
Interest Rate	14.55%	Calculated as average of BPLR of five major bank
Loan Tenure (years) including 1 year moratorium period	8	https://www.gercin.org/wp-content/uploads/2019/08/Tariff-Regulations.pdf
Rate of Depreciation (As per Books) on Plant and Machinery	4.75%	Company's act, Shcedule XIV, http://www.aadisol.in/aca/images/bullentins/bt_23.pdf
Book depreciation	90%	CERC order dated 26/04/2010 http://www.cercind.gov.in/2010/ORDER/April10/Final_RE_Tariff_Order_FY2010-11(53-2010_Suo-motu).pdf
Residual Value (%)	10%	CERC order dated 26/04/2010 http://www.cercind.gov.in/2010/ORDER/April10/Final_RE_Tariff_Order_FY2010-11(53-2010_Suo-motu).pdf
Rate of Depreciation (As per Income Tax) (15%+ 20% additional)	35%	Income tax Act
MAT Rate	21.34%	http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html
Corporate Tax	34.61%	http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html
Lifetime of the project activity (years)	25	https://www.gercin.org/wp-content/uploads/2019/08/Tariff-Regulations.pdf

Post Tax Equity IRR for the WTGs based power project under proposed project activity is given in table below against the benchmark values. Thus, it is evident that the project is not financially attractive.

WTGs	Investment Decision Date	IRR	Benchmark
1*0.85MW WTG	09/02/2017	7.08%	14.29%
1*2.0MW WTG	09/02/2017	6.34%	14.29%

Sensitivity Analysis

To check the robustness of the project's financial return calculation it has been tested by subjecting critical parameters to reasonable variations as required by Annex 11 EB 101.

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 11 EB 101, 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 and Interest rate 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.

1*2MW Gamesa

FACTOR	VARIATION			Breaching value
	-10%	0%	+10%	
Project Cost	8.49%	6.34%	4.34%	-28.76%
O&M Cost	6.64%	6.34%	5.99%	-340.4%
PLF	3.95%	6.34%	8.56%	36.0%
Tariff	3.95%	6.34%	8.56%	36.0%
Interest Rate	*6.98%*	6.34%	*5.60%*	*-95.7%*
Benchmark	***14.29%***			

1*0.85MW Gamesa

FACTOR	VARIATION			Breaching value
	-10%	0%	+10%	
Project Cost	9.28%	7.08%	5.31%	-26.62%
O&M Cost	7.42%	7.08%	6.82%	-285.4%
PLF	4.69%	7.08%	9.35%	32.12%
Tariff	4.69%	7.08%	9.35%	32.12%
Interest Rate	7.73%	7.08%	6.52%	-88.28%
Benchmark	**14.29%**			

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.

An analysis has been done to identify the percentage variation at which the financial indicator will equal/breach the benchmark and the probability of its occurrence. The occurrence of these events is unlikely for the following reasons:

a) Project Cost: The project cost considered for investment analysis for respective WTGs are sourced from offer letter, the actual project cost incurred by the PP is well within 10% sensitivity range of the investment cost considered at the time of investment analysis. As the project cost has already been incurred by the PP, further reduction in the same is not possible.

b) O&M Costs: The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.

c) PLF: The PLF value considered is based on CWET assessment sourced by respective State i.e. 24.5% and 25% for 1*0.85MW Gamesa and 1*2MW Gamesa and the PLF will breach the benchmark value at PLF variation of 31.12% and 36% respectively. The increase in PLF value to breach the benchmark is highly unlikely.

d) Tariff: The Tariff rate of electricity used for investment analysis i.e. 4.19 INR/kWh (Gujarat), and 4.5 INR/kWh (Karnataka) are sourced from the tariff orders by respective states, the same has been also confirmed from tariff orders of respective states applicable to project activity at the time of investment decision. Furthermore, these tariffs will be fixed for lifetime of the project activity, hence this is not a likely scenario.

e) Interest rate: The interest rate of long-term loan i.e. 14.43% is considered for investment analysis, which is calculated as five major banks average available to PP prior to decision making date for individual projects. The sensitivity analysis reveals that a variation in interest rate by -88.28% and -95.70% for 0.85MW WTG, 2 MW WTG will breach the benchmark value, which is much lower than actual value of interest rate.

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

3.5MW Solar PV:

Further, referring to EB 99 Annex 3 "Demonstration of additionality of small-scale Project activities" (Version 12) [6] Para 11, a positive list of grid-connected renewable electricity generation technologies that are automatically defined as additional, without further documentation of barriers, (e.g. installed capacity up to 15 MW) consists of the following renewable electricity generation technologies:

(a) The following grid-connected and off-grid renewable electricity generation technologies:

(i) Solar technologies (photovoltaic and solar thermal electricity generation);
(ii) Off-shore wind technologies;
(iii) Marine technologies (wave, tidal);
(iv) Building-integrated wind turbines or household rooftop wind turbines of a size up to 100 kW;
(v) Biomass internal gasification combined cycle (BIGCC);

(b) The following off-grid electricity generation technologies where the individual units do not exceed the thresholds indicated in parentheses with the aggregate project installed capacity not exceeding the 15 MW threshold:

(i) Micro/pico-hydro (with power plant size up to 100 kW);
(ii) Micro/pico-wind turbine (up to 100 kW);
(iii) PV-wind hybrid (up to 100 kW);
(iv) Geothermal (up to 200 kW);
(v) Biomass gasification/biogas (up to 100 kW);

As the subject project is the installation of a new small scale Solar photovoltaic power plant with aggregated installed capacity 3.5 MW, which is below 15 MW and would contribute in reducing GHG emissions below that would have occurred in the absence of the instant project activity, therefore the same may be considered to be additional.

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.

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v12.pdf

2.6 Methodology Deviations

There is no deviation from applied methodology.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

As per para 22 of AMS-I.D. (Version 18), baseline emissions are calculated as follows:

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

Where:
BE_y = Baseline Emissions in year y; t CO_2

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

$EF_{grid,y}$= 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)

Calculation of $EG_{PJ,y}$

As proposed project activity is a greenfield project, in accordance with para 26 of applied methodology

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

Where,

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

Calculation of BE_y

Calculation of baseline emissions i.e. BE_y, requires calculation of grid emission factor ($EF_{grid,y}$), which is being presented below.
As per para 23 of the applied methodology, the emission factor can be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system"; or

(b) The weighted average emissions (in t CO2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The PP has chosen option a i.e. combined margin (CM) consisting of combination OM and BM. Tool to calculate the emission factor for an electricity system (Version 07.0.0), has been used to

determine the CO2 emission factor for displacement of electricity generated by power plants in an electricity system, by calculating the combined margin emission factor (CM) of that electricity system.

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 14, December 2018, 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 07.0, EB 100, Annex 4, 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". 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 CO2 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.

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.
The Project Participant has chosen only grid power plants 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 publicly. 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)

	2013-14	2014-15	2015-16	2016-17	2017-18
India	18.6 %	16.8 %	15.1 %	14.6 %	14.3 %

Data Source: Central Electricity Authority (CEA) database Version-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 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 tCO2/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 07.0.0), 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 07.0.0”. 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:

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

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

The CO2 emission factor ($EF_{EL,m,y}$) data for simple OM, available under the CEA database (Version 14.0) for the last three years is as follows.

Net generation in operating margin GWh including import			
	2015-16	2016-17	2017-18
Indian Grid	871753	916278	960693
Simple operating margin(tCO2/MWh) (Incl Import)			
	2015-16	2016-17	2017-18
Indian Grid	0.97	0.96	0.95

Weighted Avg. Operating Margin Indian Grid is
= (871753*0.97+916278*0.96+960693*0.95)/ (871753+916278+960693)
= 0.9610 tCO2/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 GS 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:

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

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 2017-18 (most recent year) for Indian grid is 0.8644 tCO2/MWh.

CEA's "CO2 Baseline Database for the Indian Power Sector" Version 14.0,.

Build Margin (tCO2/MWh) (not adjusted for imports)	
Year	2017-2018
Indian Grid	0.8644

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. As per the 'Tool to calculate the emission factor for an electricity system (Version 07.0.0)', allows to weigh the operating margin and Build margin at 75% and 25%, respectively

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

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

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

Combined margin = 0.9368 tCO_2e/MWh

3.2 Project Emissions

As per the approved methodology AMS-I.D. version 18, para 39, For most renewable energy project activities, project emissions i.e. PE y = 0.

As the proposed project activity is installation of new wind and solar energy based power plants, it does not involve any project emissions. Hence $PE_y = 0$.

3.3 Leakage

No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

Leakage Emissions $LE_y = 0$

3.4 Net GHG Emission Reductions and Removals

Net GHG Emission Reductions are calculated as

$ER_y = BE_y - PE_y - LE_y$

ER_y = Emissions Reductions in year y (tCO_2)

BE_y = Baseline Emissions in year y (tCO_2)

PE_y = Project Emissions in year y (tCO_2)

LE_y = Leakage Emissions in year y (tCO_2)

As mentioned in earlier section PE_y and LE_y are considered zero.

Hence,

$ER_y = BE_y$

Where,

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

$EF_{grid,y}$ =0.9368 tCO_2e/MWh

$EG_{PJ,y} = EG_{PJ,0.85MW} + EG_{PJ,2MW} + EG_{PJ,3.5MW}$

The electricity generation for each site is calculated based on PLF estimates by third party as below

$EG_{PJ,y}$= (0.85MW x 0.245 + 2MW x 0.25 + 3.5MW x 0.21) x 24 hours x 365 days

$EG_{PJ,y}$= (1824 + 4380 + 6438) MWh

$EG_{PJ,y}$=12642 MWh

Hence baseline emission is

BE_y=12642 x 0.9368 =11,842 tCO_2e/year

BE_y=11,842 tCO_2e/year

*The crediting period starts from date of commissioning i.e. 08/03/2018.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1*	11842	0	0	11842
Year 2	11842	0	0	11842
Year 3	11842	0	0	11842
Year 4	11842	0	0	11842
Year 5	11842	0	0	11842
Year 6	11842	0	0	11842
Year 7	11842	0	0	11842
Year 8	11842	0	0	11842

Year 9	11842	0	0	11842
Year 10	11842	0	0	11842
Total	**118420**	**0**	**0**	**118420**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	**$EF_{grid,OM,y}$**
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 14.0*" http://www.cea.nic.in/tpeandce.html
Value applied	0.9610
Justification of choice of data or description of measurement methods and procedures applied	Calculated in line with "*Tool to calculate the emission factor for an electricity system (Version 07.0.0)*" using data from Central Electricity Authority of India's (CEA) "*Baseline Carbon Dioxide Emission Database Version 14.0*". 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. Weighted average = $\sum_{i=1 \text{ to } n}$ (Net generation in operating margin in year i * Simple operating margin in year i)/$\sum_{i= 1 \text{ to } n}$ (Net generation in operating margin of year i)
Purpose of Data	Calculation of baseline emissions
Comments	This parameter is fixed ex-ante for the entire crediting period

Data / Parameter	**$EF_{grid,BM,y}$**
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor for the India Grid in year y
Source of data	CEA's "*Baseline Carbon Dioxide Emission Database Version 14.0* http://www.cea.nic.in/tpeandce.html
Value applied	0.8644
Justification of choice of data or description of measurement methods and procedures applied	Calculated in line with "*Tool to calculate the emission factor for an electricity system (Version 07.0.0)*" using data from Central Electricity Authority of India's (CEA) "*Baseline Carbon Dioxide Emission Database Version 14.0*". The value is calculated ex-ante as most recent build margin provided by the CEA.
Purpose of Data	Calculation of combined margin emissions
Comments	This parameter is fixed ex-ante for the entire crediting period

Data / Parameter	**EF** $_{grid, CM, y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor for the India Grid in year y
Source of data	Central Electricity Authority(CEA) of India Database*Version 14.0* http://www.cea.nic.in/tpeandce.html
Value applied	0.9368
Justification of choice of data or description of measurement methods and procedures applied	This has been calculated based on Operating Margin (OM) and Build Margin (BM) published by Central Electricity Authority (CEA) of India.
Purpose of Data	Calculation of baseline emissions
Comments	This parameter is fixed ex-ante for the entire crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,y\_WTG0.85MW}$
Data unit	MWh/y
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y in MWh
Source of data	Joint meter reading reports or Share certificate issued by GUVNL
Description of measurement methods and procedures to be applied	These values are monitored through the main meter readings at two outgoing feeders or from check meters as per emergency preparedness procedure. This parameter accounts for the project imports and export, hence showing the net (export – import) electricity supplied to the grid. The difference of final value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations
Frequency of monitoring/recording	Continuous measurement and monthly recording
Value applied	1824
Monitoring equipment	Energy meters with accuracy class 0.2s
QA/QC procedures to be applied	The energy meters will be of 0.2S accuracy class and Calibration of the meter will be done at least once in 3 years. The main meter readings can be cross checked with the check meter readings to ensure correctness. The main and check meters shall be calibrated and maintained by GEDA/GETCO as per their own schedule and this frequency of meter calibration is not within the control of the Project Proponent. The electricity supplied to grid can also be cross-checked from invoice raised by PP.

Purpose of data	For the calculation of Baseline Emissions
Calculation method	NA.
Comments	Data will be kept for crediting period + 2 Years

Data / Parameter	EG_{PJ,y_WTG2MW}
Data unit	MWh/y
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y in MWh
Source of data	Joint meter reading reports or Certificate from Karnataka Power Transmission Corporation Limited (KPTCL)
Description of measurement methods and procedures to be applied	These values are monitored through the main meter readings at two outgoing feeders or from check meters as per emergency preparedness procedure. This parameter accounts for the project imports and export, hence showing the net (export – import) electricity supplied to the grid. The difference of final value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations
Frequency of monitoring/recording	Continuous measurement and monthly recording
Value applied	4380
Monitoring equipment	Energy meters with accuracy class 0.2s
QA/QC procedures to be applied	The energy meters will be of 0.2S accuracy class and Calibration of the meter will be done at least once in 3 years. The main meter readings can be cross checked with the check meter readings to ensure correctness. The main and check meters shall be calibrated and maintained by BESCOM as per their own schedule and this frequency of meter calibration is not within the control of the Project Proponent. The electricity supplied to grid can also be cross-checked from invoice raised by PP.
Purpose of data	For the calculation of Baseline Emissions
Calculation method	NA.
Comments	Data will be kept for crediting period + 2 Years

Data / Parameter	$EG_{PJ,y\_3.5MWSolar}$
Data unit	MWh/y
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y in MWh

Source of data	Joint meter reading reports or Certificate from Karnataka Power Transmission Corporation Limited (KPTCL)
Description of measurement methods and procedures to be applied	These values are monitored through the main meter readings at two outgoing feeders or from check meters as per emergency preparedness procedure. This parameter accounts for the project imports and export, hence showing the net (export – import) electricity supplied to the grid. The difference of final value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations
Frequency of monitoring/recording	Continuous measurement and monthly recording
Value applied	6438
Monitoring equipment	Energy meters with accuracy class 0.2s
QA/QC procedures to be applied	The energy meters will be of 0.2S accuracy class and Calibration of the meter will be done at least once in 3 years. The main meter readings can be cross checked with the check meter readings to ensure correctness. The main and check meters shall be calibrated and maintained by BESCOM as per their own schedule and this frequency of meter calibration is not within the control of the Project Proponent. The electricity supplied to grid can also be cross-checked from invoice raised by PP.
Purpose of data	For the calculation of Baseline Emissions
Calculation method	NA.
Comments	Data will be kept for crediting period + 2 Years

4.3 Monitoring Plan

The proposed project activity is operated and managed by the project proponent with the help of site in charge (personal from the project proponent) and site O & M contractor (personal from the EPC). For the accurate execution of the Project activity a project team has been constructed. The project will abide by all regulatory and statutory requirements as prescribed under the state and central laws and regulations. The project team is delegated with the responsibility of monitor and record the electricity generated and also safe keeping of the recorded data. The project team is also responsible for calculation of actual creditable emission reduction in the most transparent and relevant manner.

QA/QC Procedures

The energy meter of 0.2s accuracy class will be used. The individual inverters/WTGs are also equipped with digital energy meters. If some defect occurs to energy meters, the readings taken at these meters shall be used for calculation of net electricity supplied. All energy meters will be calibrated at least once in a three-year. However the energy meters installed at grid feeder are owned and maintained by DISCOMS, PP has no control on the calibration of those meters.

Data Management & Data Archiving

Monitoring data will be retained and archived for the entire crediting period plus two years by the project proponent.

Emergency Plan

Operation and Maintenance team is trained for emergency situations.

Training

Operation and maintenance team will train the staff on operation and maintenance aspects of the plant. The training will ensure preventive maintenance and better operational control of the plant.

Data Adjustments & Uncertainties

If there is any problem in energy meters, digital meters at inverters will be used for monitoring. If a situation appears that any meter is faulty then the energy meter will be sent for maintenance and maintaining a conservative approach, VERs will be calculated from reading taken at inverters deducting technical losses at inverters. Technical losses shall be calculated based on historical generation (previous one month) of reading at inverters less meter readings or as per manufacturer specification. Similarly the backup meters may be used in case of fault in meter for WTGs.

The VCS monitoring team will composed the following staff:

Position	Report to
Operators	Site Engineers
Site Engineers	Site In-charges
Site In-charges	Project Owner
VCS Project Manager	Project Owner

5 SAFEGUARDS

5.1 No Net Harm

The facility does not produce any pollution in process of power generation as it utilises renewable energy sources in all its project sites - wind energy and solar energy. Hence there is positive impact on the environment due to this small-scale project activity of reducing the pollution caused by fossil fuels used in mix power plants in grid. Further this project activity will have no air pollution, no water pollution and no noise pollution.

The project activity has obtained all the required clearance from nodal agencies.

5.2 Environmental Impact

As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India, Environment Impact Assessment Notification no. 3067 dated 01/12/2009[7] and Feb 2016 the project activity does not require Environment Impact Assessment to be conducted.

5.3 Local Stakeholder Consultation

The local stakeholder consultation meeting for the proposed project activity has been conducted at project sites as per table below. The PP has identified the relevant stakeholders and sends personal invitation letters well in advance.

Venue	Invitation Date	Stakeholder Meeting Date
Upprahalli, Karnataka	04th Dec 2018	12th Dec 2018
Vijayapar, Karnataka	04th Dec 2018	14th Dec 2018
Bachau, Kuchh, Gujarat	10th Dec 2018	20th Dec 2018

The stakeholder meeting process is followed in the following sequence

- Welcome Speech by the organizers.
- Introduction to 'GHG' programme
- Interactive Sessions with the stakeholders.
- Vote of Thanks

5.4 Public Comments

Issues Raised by Villagers and response:

A. Does this project help the villagers in employment generation?
(By Mr Takkirappa)

Answer: Yes. The project would make a significant contribution to the socio-economic development of the region, as it has generated direct and indirect employment to locals during construction and operation of the project activity.

B. How the project will reduce the GHG emission to atmosphere?
(By Mr Uday Kumar)

Answer: The project is utilising solar energy to generate the electricity, which is emission free and will replace grid electricity being produced by grid mix power plant dominated by fossil fuel based thermal power plant. The project will displace grid electricity and lead to avoidance of around emission to atmosphere.

C. Any negative impact of the project activity on nearby villages?
(By Mr Mithun Shah)

Answer: The project is a wind energy-based power generation project and implemented in barren land has no impact to villagers. It has no associated emissions or other impact on nearby villages.

D. How one can approach to know if there is any vacancy at site?
(By Mr Shrinivas)

Answer: The site incharge will contact local people through representative and will also publish notice on site as needed.

[7] http://ismenvis.nic.in/Database/Notification_01st_Dec_2009-SO3067_EIA-Notification-2009_11456.aspx

There were no negative comments raised by stakeholders in the local stakeholder consultation meetings and due to the associated benefits stakeholders have appreciated the proposed project activity.