

# BUNDLED WIND POWER PROJECT IN KOPPAL KARNATAKA

Document Prepared by Infinite Solutions

<b>Project Title</b>	Bundled Wind Power project in Koppal Karnataka
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## 1 PROJECT DETAILS

### 1.1 Summary Description of the Project and its Implementation Status

The main purpose of this project activity is to generate clean form of electricity through renewable Wind energy source for sale of electricity to the grid.

The details of the project are mentioned in the table:

Name of Project Developer	WTG Capacity	No. of WTGs	Project Capacity	Project Already commissioned Capacity	Location
Skeiron Renewable Energy Kushtagi Private Limited	2.1 MW/WTG	24	50.4	50.4	Koppal District & Bagalkot district, Karnataka
Saroja Renewables Limited	2.1 MW/WTG	25	52.5	35.7	Bagalkot district, Karnataka
Shanay Renewables Ltd.	2.1 MW/WTG	15	31.5	21	Kushtagi, Koppal District
<b>Total</b>		<b>64</b>	<b>134.4 MW</b>	107.1 MW	

The project activity involves installation of 64 WTGs of 2.1 MW each, totalling 134.4 MW Wind power project in Karnataka. However, the total capacity already commissioned is 107.1 MW and rest is yet to be commissioned. The project is connected to total 6 feeders bus bar and spare 2 feeders connected to substation of 110/33kV at Shiragumpi.

The project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 335,085 tCO<sub>2</sub>e per annum, thereon displacing 357,692 MWh/year amount of electricity from the generation-mix of power plants connected to the Indian electricity grid, which is mainly dominated by thermal/ fossil fuel based power plant.

However, for already commissioned capacity in the project activity i.e. 107.1 MW, the project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 266,634 tCO<sub>2</sub>e per annum, thereon displacing 284,623 MWh/year amount of electricity

The project activity is the installation of a new grid-connected renewable power plant/unit and this is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs.

All the WTGs in this project activity were commissioned in phases in March 2018. The earliest commissioning was on 02-Mar-2018. The total capacity already commissioned is 107.1 MW and the details are as follows:

Skerion Renewable Energy Kushtagi Private Limited			
Metering Loc.no.	WTG Loc. No.	Comm. Dates	Total Capacity
KST - 147	100, 126, 152, 153, 154, 155	02-03-2018	50.4 MW
KST - 147	99, 147, 98, 123, 125	02-03-2018	

KST - 177	177, 148, 149, 188, 189, 233, 234, 235	02-03-2018	
KST - 177	191, 236	31-03-2018	
KST - 230	230	31-03-2018	
KST - 101	101, 102	31-03-2018	

Saroja Renewables Limited			Total Capacity
Metering Loc.	WTG Loc. No.	Comm. Dates	35.7 MW
KST - 51	51	28-03-2018	
KST - 67	65, 67, 105, 106, 122	28-03-2018	
KST - 67	66, 103, 121	31-03-2018	
KST - 71	47, 48, 70, 71, 124, 46, 49, 68	28-03-2018	

Shanay Renewables Ltd.			Total Capacity
Metering Loc.	WTG Loc. No.	Comm. Dates	21 MW
KST -131	90, 131	28-03-2018 & 31-03-2018	
KST-130	95, 97, 42, 75, 96, 128, 130, 72	28-03-2018 & 31-03-2018	

The rest Capacity of 27.3 MW is not commissioned till the time of Validation.

The monitoring period is from 02-Mar-2018 to 30-September-2019. The total GHG emission reductions generated in this monitoring period are 461,033 tCO<sub>2</sub> displacing thereon.

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

The scenario existing prior to the implementation of the project activity, is electricity delivered to the grid by the project activity that 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 7.0 EB 100 Annex 4.

#### Baseline Scenario:

As per the applicable methodology, a Greenfield power plant is defined as "a new renewable energy power plant that is constructed and operated at a site where no renewable energy power plant was operated prior to the implementation of the project activity".

As the project activity falls under the definition of a Greenfield power plant, the baseline scenario as per paragraph 24 of Section 5.2.1 of applied methodology is the following:

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

Hence, pre-project scenario and baseline scenario are the same.

## 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 Projects

Methodology : ACM0002: Grid-connected electricity generation from renewable sources - Version 19<sup>1</sup>

The project is not a grouped project activity.

## 1.3 Project Proponent

Organization name	Skeiron Renewable Energy Kushtagi Private Limited
Contact person	Murali Krishnam Raju M
Title	Senior Manager - Commercial
Address	Plot No. #1131/A, Road no. 36 Jubilee Hills, Hyderabad – 500033. Telangana, India.
Telephone	+91 40 40301004
Email	<a href="mailto:muraliraju.m@greenkogroup.com">muraliraju.m@greenkogroup.com</a>

Organization name	Saroja Renewables Limited
Contact person	Murali Krishnam Raju M
Title	Senior Manager - Commercial
Address	Plot No. #1131/A, Road no. 36 Jubilee Hills, Hyderabad – 500033. Telangana, India.
Telephone	+91 40 40301004
Email	<a href="mailto:muraliraju.m@greenkogroup.com">muraliraju.m@greenkogroup.com</a>

Organization name	Shanay Renewables Ltd.
Contact person	Murali Krishnam Raju M

<sup>1</sup> <https://cdm.unfccc.int/UserManagement/FileStorage/58IAGB7SZUDEO2VN6LYM30K41HFPRQ>

Title	Senior Manager - Commercial
Address	Plot No. #1131/A, Road no. 36 Jubilee Hills, Hyderabad – 500033. Telangana, India.
Telephone	+91 40 40301004
Email	<a href="mailto:muraliraju.m@greenkogroup.com">muraliraju.m@greenkogroup.com</a>

**1.4 Other Entities Involved in the Project**

Organization name	Infinite Solutions
Role in the project	Project Consultant
Contact person	Richa Thakur
Title	Manager - Operations
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**1.5 Project Start Date**

Project Start Date: 02-Mar-2018;

The project start date is the earliest commissioning date amongst all the project WTGs which are part of this Large-Scale Wind power project.

**1.6 Project Crediting Period**

Crediting Period Start date: 02-Mar-2018

Crediting Period End date: 01-Mar-2028

Estimated life time of the project: 25 years

The project activity adopts renewable crediting period with the first crediting period of 10 years and with an option to renew twice, considering the lifetime of the project activity to be 25 years.

**1.7 Project Scale and Estimated GHG Emission Reductions or Removals**

Project Scale	
Project	
Large project	√

For 134.4 MW (Total Project capacity)

Year	Estimated GHG emission
------	------------------------

	reductions or removals (tCO <sub>2</sub> e)
Year 1	335,085
Year 2	335,085
Year 3	335,085
Year 4	335,085
Year 5	335,085
Year 6	335,085
Year 7	335,085
Year 8	335,085
Year 9	335,085
Year 10	335,085
<b>Total estimated ERs</b>	3,350,850
<b>Total number of crediting years</b>	10
<b>Average annual ERs</b>	335,085

For 107.1 MW (Already Commissioned Capacity)

Year	Estimated GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1	266,634
Year 2	266,634
Year 3	266,634
Year 4	266,634
Year 5	266,634
Year 6	266,634
Year 7	266,634
Year 8	266,634
Year 9	266,634
Year 10	266,634
<b>Total estimated ERs</b>	2,666,340
<b>Total number of crediting years</b>	10
<b>Average annual ERs</b>	266,634

## 1.8 Description of the Project Activity

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy.

Wind has considerable amount of kinetic energy when blowing at high speeds. The kinetic energy passes through the blades of the wind turbines is converted into mechanical energy and rotates the turbine. When the wind blades rotate, the connected generator rotor also rotates, thereby producing electricity. The technology is a clean technology since there are no GHG emissions associated with the electricity generation.

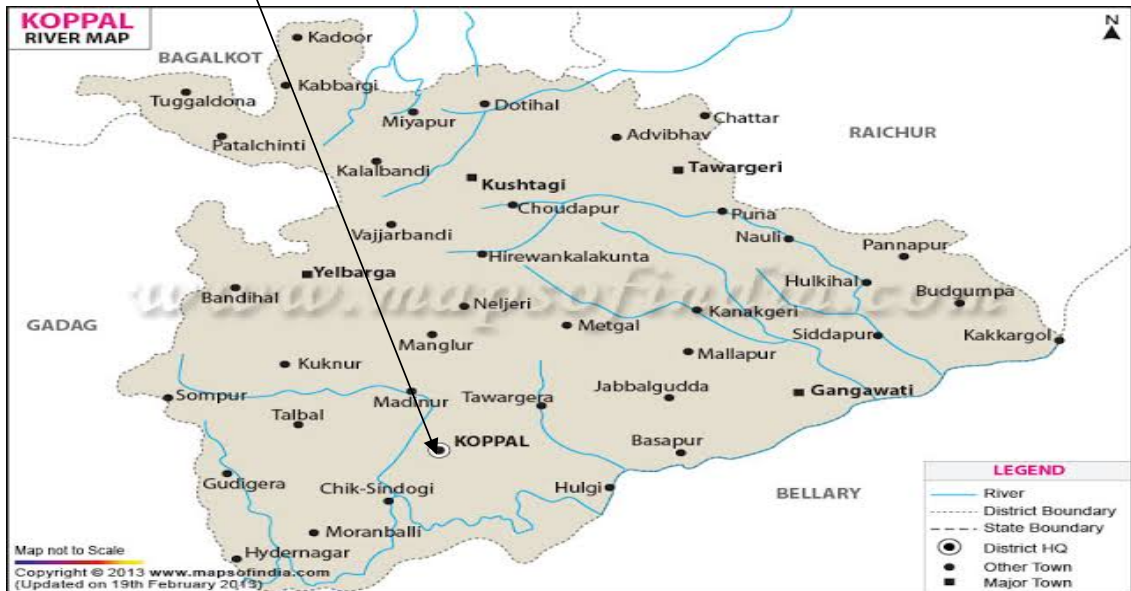
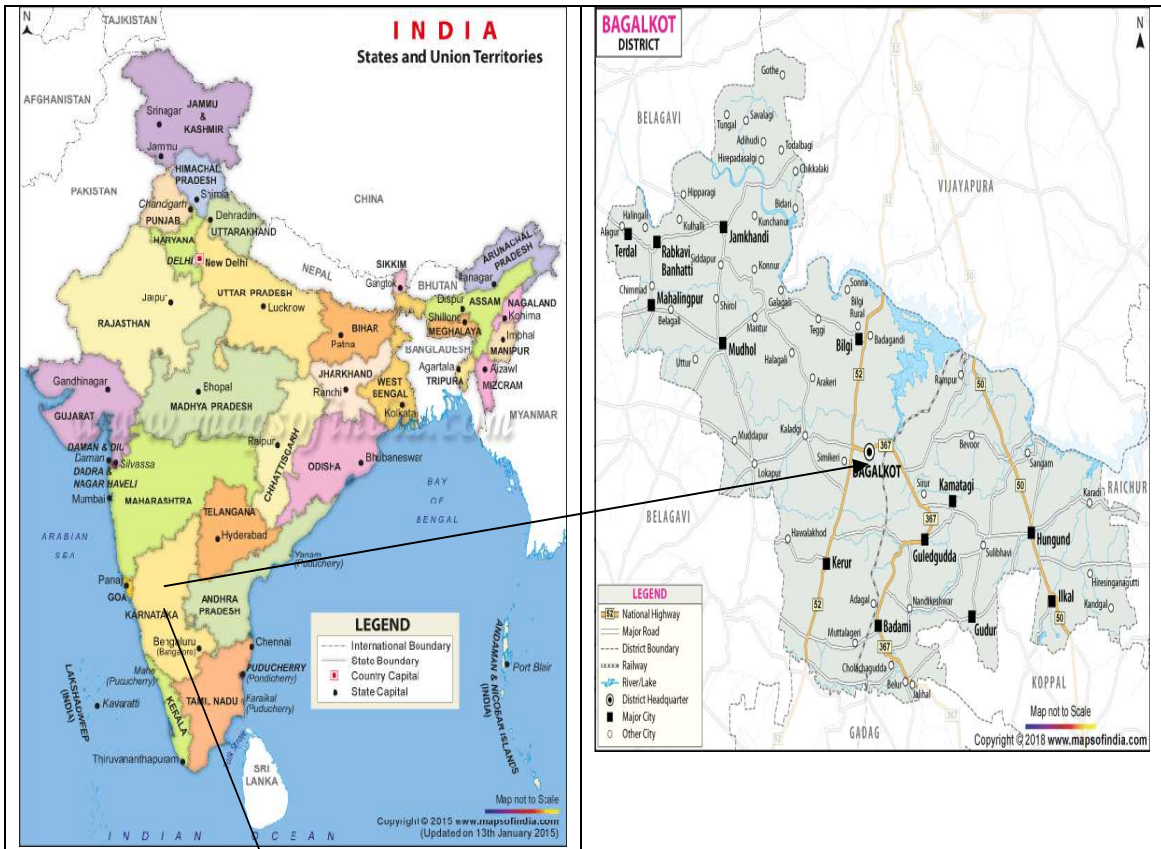
The project installs Suzlon make WTGs of individual capacity 2.1 MW. The salient Features of Suzlon S- S111-2.1 MW WTG are as Follows: -

Parameter	Specifications
	<b>2.1 MW -Suzlon</b>
<b>Rotor</b>	
Installed electrical output	2100 kW
Diameter	111.8 m
Cut-in wind speed	3 m/s
Rated wind speed	12.5 m/s
Cut-out wind speed	30 m/s
Rotor swept area	9852 m <sup>2</sup>
Regulation	Pitch
<b>Generator</b>	
Type	Asynchronous, 3 Phase Induction
Rated output	2100 kW
Operating voltage	690 V
Frequency	50 Hz / 60 Hz

## 1.9 Project Location

The WTGs installed by the project proponent are distributed across the Bagalkot & Koppal District of Karnataka.

Details of Project coordinates is mentioned in the Appendix 3 of this PD& MR.



## 1.10 Conditions Prior to Project Initiation

The pre project scenario is same as baseline scenario. Please refer section 2.4 for the description of baseline scenario.

## 1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project has received necessary approvals for development and commissioning for Wind project from the state Nodal agencies and is in compliance to the local laws and regulations.

The relevant national laws and regulations pertaining to generation of energy in India are:

- Electricity Act 2003
- National Electricity Policy 2005
- Tariff Policy 2006

The Project activity conforms to all the applicable laws and regulations in India:

- Power generation using Wind energy is not a legal requirement or a mandatory option.
- There are state and sectoral policies, framed primarily to encourage Wind power projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments.
- 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

## 1.12 Ownership and Other Programs

### 1.12.1 Project Ownership

The ownership of the Project and its right to use is completely entrusted to individual project investors which can be verified by the following evidences:

- Power Purchase Agreements signed with the Grid
- Purchase orders issued for the project WTGs, Loan Sanction Letters from the bank

### 1.12.2 Emissions Trading Programs and Other Binding Limits

Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits.

### 1.12.3 Other Forms of Environmental Credit

The Project has no intent to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

#### 1.12.4 Participation under Other GHG Programs

The Project has not participated in any other GHG programs.

#### 1.12.5 Projects Rejected by Other GHG Programs

The Project is not rejected by other GHG programs.

### 1.13 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

Project does not involve any leakage emissions other than methodology requirement for wind power project. Hence there are no any extra Leakage Management Plan and risk mitigation measures are required.

#### Commercially Sensitive Information

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

#### Sustainable Development

##### Legislative:

The project participants obtained all clearances from stakeholders hence no legal risks are anticipated.

##### Socio-economic wellbeing:

- Project activity has generated direct and indirect employment for skilled and unskilled manpower during construction phase as well as during operational stage and thus helped in controlling migration from the region and alleviation of poverty.
- The project activity's contribution of power supply towards the Indian grid is helping in the upliftment of the social life of the people by ensuring a sustainable and reliable source of power for the region.
- The Project activity has improved the infrastructural facilities like water availability, road, and medical facilities etc in the region.

##### Environmental wellbeing:

- The project activity generates clean and green power thus causing negligible emissions of greenhouse gases. By building and operating the wind power project, much pollution is avoided. In the absence of the project activity, equivalent power would have been

generated based on the fossil fuels resulting in more Green House Gas emissions into the atmosphere.

- The project activity has reduced the dependence on fossil fuels for power generation thus conserving the natural reserves. The project has led to greenhouse gas emission reduction and hence contributed in mitigating climate change.

**Technological wellbeing:**

The project activity has increased awareness and interest among the private players to make investments in similar areas. The project activity envisages installation of high efficiency turbines and generators and the power will be transmitted at high voltage to ensure low losses. Moreover, the technology being used is well established, most updated and environmentally safe.

**Further Information**

There are no information or incidents that will have bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project’s net GHG emission reductions or removals.

**2 APPLICATION OF METHODOLOGY**

**2.1 Title and Reference of Methodology**

**Methodology:**

**ACM0002: Grid-connected electricity generation from renewable sources --- Version 19.0, Sectoral Scope: 01, EB 100, Annex 6**

<https://cdm.unfccc.int/methodologies/DB/VJI9AX539D9MLOPXN2AY9UR1N4IYGD>

The project activity also takes reference from following Tools from the tools prescribed by applied methodology:

**1. Tool for the demonstration and assessment of additionality --- Version 07.0.0, EB 70, Annex 8**

<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf>

**2. Tool to calculate the emission factor for an electricity system --- Version 07.0, EB 100, Annex 4**

<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

**2.2 Applicability of Methodology**

The following steps will show the applicability of the project under this methodology

Applicability Criterion (with Para number reference)		Project Case
1.	This methodology is applicable to grid-connected renewable energy power generation project activities that:	The Project activity is installation of Greenfield Wind Power Project. Hence the project

	<ul style="list-style-type: none"> <li>(a) Install a Greenfield power plant;</li> <li>(b) Involve a capacity addition to (an) existing plant(s);</li> <li>(c) Involve a retrofit of (an) existing operating plants/units;</li> <li>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</li> <li>(e) Involve a replacement of (an) existing plant(s)/unit(s).</li> </ul>	<p>activity satisfies this applicability criterion of the methodology.</p>
<p>2.</p>	<p>The methodology is applicable under the following conditions:</p> <ul style="list-style-type: none"> <li>(a) 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;</li> <li>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.</li> </ul>	<p>The option (a) of applicability criteria 1 is applicable as project activity is generation of electricity through Wind Power Plant which is renewable energy power plant. Hence the project activity satisfies this applicability criterion of the methodology</p>
<p>3.</p>	<p>In case of hydro power plants, one of the following conditions shall apply:<sup>2</sup></p> <ul style="list-style-type: none"> <li>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</li> <li>(b) The project activity is implemented in existing single</li> </ul>	<p>The project activity is wind power project thus this condition is not applicable.</p>

<sup>2</sup> Project participants wishing to undertake a hydroelectric project activity that result in a new reservoir or an increase in the volume of an existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

	<p>or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</p> <p>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</p> <p>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m<sup>2</sup>, all of the following conditions shall apply:</p> <ul style="list-style-type: none"> <li>(i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m<sup>2</sup>;</li> <li>(ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m<sup>2</sup> shall be: <ul style="list-style-type: none"> <li>a. Lower than or equal to 15 MW; and</li> <li>b. Less than 10 per cent of the total installed capacity of integrated hydro power project.</li> </ul> </li> </ul>	
4.	<p>In the case of integrated hydro power projects, project proponent shall:</p> <ul style="list-style-type: none"> <li>(a) 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</li> <li>(b) 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</li> </ul>	<p>The project activity is wind power project thus this condition is not applicable</p>

	the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	
5.	<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>(b) Biomass fired power plants/units.</p>	The project activity is wind power project thus this condition is not applicable
6.	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 a Greenfield project; thus, this criterion is not applicable.
7.	In addition, the applicability conditions included in the tools referred to below apply. <sup>3</sup>	<p>The project applies the following tools and is in compliance to the same;</p> <ul style="list-style-type: none"> <li>• "Tool to calculate the emission factor for an electricity system";</li> <li>• "Tool for the demonstration and assessment of additionality";</li> </ul>

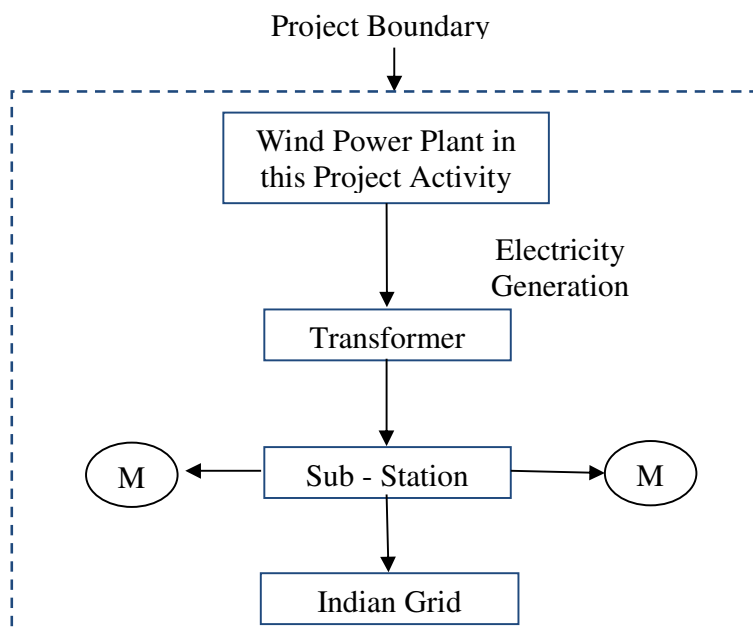
<b>Applicability conditions of “Tool to calculate the emission factor for an electricity system”</b>	
<b>Applicability Criterion (with Para number reference)</b>	<b>Project Case</b>

<sup>3</sup> The condition in “TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality” that all potential alternative scenarios to the proposed project activity must be available options to project participants; does not apply to this methodology, as this methodology only refers to some steps of this tool.

1.	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity 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 3.1 for calculating baseline emissions.
2.	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, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in “Appendix 1: 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.
3.	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity.
4.	Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	The project activity is a grid connected wind power plant. Therefore, this criterion is not applicable for the project activity.

### 2.3 Project Boundary

As per ACM0002 version 19, for wind projects, the project boundary includes the physical site of the power plant and all power plants connected physically to the electricity system that the project power plant is connected to. The project boundary consists of turbines, generators, transformers, transmission lines, metering equipment, connected grid sub-stations and Indian Grid.



Source		Gas	Included	Justification/Explanation
Baseline	CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO <sub>2</sub>	Yes	Major emission source
		CH <sub>4</sub>	No	Minor emission source
		N <sub>2</sub> O	No	Minor emission source
Project	On site fossil fuel consumption due to project activity	CO <sub>2</sub>	No	Electricity generation through wind does not lead to emission of greenhouse gases.
		CH <sub>4</sub>	No	Electricity generation through wind does not lead to emission of greenhouse gases.
		N <sub>2</sub> O	No	Electricity generation through wind does not lead to emission of greenhouse gases.

## 2.4 Baseline Scenario

Since, the project activity is a Greenfield power plant and meets all the applicability criteria for the ACM0002 Version 19,

As per para 22 of ACM0002 version 19.0; If the project activity is the installation of a Greenfield power plant

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

In the absence of the project activity, the equivalent amount of power would have been drawn from the Indian grid. Hence, the baseline for the project activity is the equivalent amount of power from the Indian grid.

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) (having weightage 75%) and build margin (BM) (having weightage 25%). Calculations for this combined margin must be based on data from an official source<sup>4</sup> (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
$EF_{grid,BM,y}$	0.8644 tCO2/MWh	Build margin CO2 emission factor for the project electricity system in year y.	Baseline CO2 Emission Database, Version 14, published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9610 tCO2/MWh	Operating margin CO2 emission factor for the project electricity system in year y.	Calculated as the last 3-year (2015-16, 2016-17 & 2017-18) generation-weighted average, sourced from Baseline CO2 Emission Database, Version 14, published by Central Electricity Authority (CEA), Government of India
$EF_{grid,CM,y}$	0.9368 tCO2/MWh	Combined margin CO2 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 CO2 Emission Database, Version 14 published by Central Electricity Authority (CEA), Government of India

## 2.5 Additionality

In line with VCS Standard version 3.7, the additionality of the Project activity is ascertained in line with the applicable guidance from the UNFCCC. The demonstration of additionality for the proposed Project activity is being carried out in accordance with the additionality tool provided by the UNFCCC i.e. "Tool for demonstration and assessment of Additionality" Version 07.0.0.,. The tool provides a step-wise approach to demonstrate additionality which is displayed below:

### 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. Hence not applicable.

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

<sup>4</sup> [http://cea.nic.in/reports/others/thermal/tpece/cdm\\_co2/user\\_guide\\_ver14.pdf](http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf)

As per the applied methodology ACM0002 version 19; Para 22, “If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plant and by the addition of new generation sources”.

**Outcome of Sub-step 1a:** As the baseline scenario is prescribed by applied methodology for Greenfield Project, hence no further analysis is carried out to identify alternatives

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

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

The relevant national laws and regulations pertaining to generation of energy in India are:

- Electricity Act 2003
- National Electricity Policy 2005
- Tariff Policy 2006

The Project activity conforms to all the applicable laws and regulations in India:

- Power generation using wind energy is not a legal requirement or a mandatory option.
- There are state and sectoral policies, framed primarily to encourage wind power projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments.
- 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.

**Outcome of Sub-step 1b:** Hence, both the alternatives enlisted above are found to comply with the mandatory laws and regulations taking into account the enforcement of the legislations in the region or country and EB decisions on national and/or sectoral policies and regulations. However, Alternative 2 has been selected as the appropriate baseline alternative for this project activity.

## Step 2: Investment analysis

**Determine whether the proposed project activity is economically or financially less attractive than at least one other alternative, identified in step 1, without the revenue from the sale of emission reductions credits. To conduct the investment analysis, use the following sub-steps:**

### 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. Option II also does not apply since there is no comparable investment alternative available to the project participant in line with para 32 of the Methodological tool: “Tool for the demonstration and assessment of additionality” (version 07.0.0).

The most appropriate financial analysis method is therefore option III: the benchmark analysis, where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country.

#### **Sub-step 2b (Option III): Apply benchmark analysis**

Project proponents have considered Post-Tax Equity IRR for investment analysis at the time of decision-making. As Project proponent is only interested in the returns project is generating on the portion of investment costs, which is financed by them in the form of equity.

As per Para 15 of EB 105 annex 06 states that Required/expected returns on equity are appropriate benchmarks for an equity IRR. Therefore, the Expected return on equity is considered appropriate benchmark. Accordingly, the post-tax Equity IRR has been considered as the relevant financial indicator for Investment Analysis.

#### **Benchmark estimation:**

The Cost of Equity has been considered using the “Methodological tool: Investment analysis” available at the time of decision making as well as the latest available value. As a conservative approach, the minimum value of benchmark has been considered as calculated using these 2 approaches.

Default Value at the time of investment decision:

Table under Appendix in EB 97 annex 8 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **10.73%**<sup>5</sup>

Default Value as per latest version of Investment Analysis Tool version 10: Table under Appendix in EB 105 annex 06 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **10.24%**<sup>6</sup>

Thus, Minimum Default Value considered for calculation of Benchmark = 10.24%

Inflation Forecast for India as per RBI website<sup>7</sup> and corresponding benchmark values:

Project Promoters' Name	Inflation Forecast <sup>8</sup>		Benchmark	
	5 Years	10 Years	5 Years	10 Years
Skeiron Renewable Energy Kushtagi Private Limited	4.50%	4.30%	15.20%	14.98%
Saroja Renewables Limited	4.50%	4.30%	15.20%	14.98%
Shanay Renewables Ltd.	4.50%	4.30%	15.20%	14.98%

<sup>5</sup> <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-27-v8.pdf>

<sup>6</sup> <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-27-v10.0.pdf>

<sup>7</sup> <https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=18046>

<sup>8</sup> Minimum of the two inflation forecasts has been considered.

As a conservative approach, benchmark of **14.98%** has been selected for this project activity.

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

The Equity IRR is evaluated for the entire lifetime of the project activity, i.e. 20 years. It is calculated based on the cash outflows from and cash inflows into the project activity.

### **Key Assumptions supporting financial projections:**

Input Parameters	Shanay	Skeiron	Saroja
Capacity of Project	31.5	50.4	52.5
Expected Date of Commissioning	31-Mar-18	31-Mar-18	31-Mar-18
Life of the plant (Yrs.)	25	25	25 <sup>9</sup>
PLF (%)	28.00%	27.40%	27.60% <sup>10</sup>
Total Annual generation (kWh)	77,263,200	120,972,096	126,932,400
Tariff rate at the decision making (INR/kWh)	3.74	3.74	3.74 <sup>11</sup>
O & M Expenses (INR Mn.)	44.25	70.8	73.75 <sup>12</sup>
Escalation in the operational expenses (%)	5.00%	5.00%	5.00%
O & M free for (Yr.)	1	1	1
TOTAL COST (INR Mn.)	2,127.83	3,404.52	3,546.38 <sup>12</sup>
Debt - Equity Ratio	70 : 30	70 : 30	70 : 30
Interest rate (%)	9.23%	9.23%	9.23% <sup>11</sup>
Loan Tenure (Qtr.)	52	52	52
Salvage Value (INR Mn.)	10.00%	10.00%	10.00% <sup>11</sup>
IT Depreciation Rate (%)	7.69%	7.69%	7.69% <sup>13</sup>
Income tax rate (%)	28.33%	28.33%	28.33% <sup>14</sup>
MAT (%)	20.96%	20.96%	20.96% <sup>14</sup>
GST (%)	18.00%	18.00%	18.00% <sup>15</sup>

Name of Project Developer	Project Capacity	Equity IRR	Benchmark
Skeiron Renewable Energy Kushtagi Private Limited	50.4	7.09%	14.98%
Saroja Renewables Limited	52.5	7.29%	14.98%

<sup>9</sup> <http://www.cercind.gov.in/2017/regulation/Noti131.pdf>

<sup>10</sup> Third Party PLF Report

<sup>11</sup> [https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT\\_MA.pdf](https://www.karnataka.gov.in/kerc/Downloads/Tariff%202017/Dated%2004.09.2017-Wind%20Tariff%20Order-DT_MA.pdf)

<sup>12</sup> Offer Letter

<sup>13</sup> <http://www.incometaxindia.gov.in/charts%20%20tables/depreciation%20rates.htm>

<sup>14</sup> <http://www.incometaxindia.gov.in/Tutorials/2%20Tax%20Rates.pdf>

<sup>15</sup> <http://www.exportgenius.in/gst-tax-rates/wind-turbine>

Shanay Renewables Ltd.	31.5	7.74%	14.98%
<b>Total</b>	<b>134.4 MW</b>		

The project activity cannot be considered as financially attractive as the equity IRR for the project activity is less than the Benchmark.

**Sub-step 2d: Sensitivity Analysis:**

As per Guidance 27 & 28 of EB 105, Annex 06, the sensitivity analysis of the project parameters which may substantially influence the Equity IRR is carried out to assess the robustness of the conclusion. The results of the sensitivity analysis are presented below:

Skeiron Renewable Energy Kushtagi Private Limited

Variation %	-10%	Normal	10%	Variation required to reach benchmark
PLF	4.43%	7.09%	9.81%	35.00%
O&M	7.69%	7.09%	6.48%	-152.71%
Project Cost	9.47%	7.09%	5.24%	-25.69%
Tariff Rate	4.43%	7.09%	9.81%	28.19%

Saroja Renewables Limited

Variation %	-10%	Normal	10%	Variation required to reach benchmark
PLF	4.61%	7.29%	10.03%	27.26%
O&M	7.88%	7.29%	6.68%	-148.76%
Project Cost	9.70%	7.29%	5.42%	-25.03%
Tariff Rate	4.61%	7.29%	10.03%	27.26%

Shanay Renewables Ltd.

Variation %	-10%	Normal	10%	Variation required to reach benchmark
PLF	5.00%	7.74%	10.54%	25.15%
O&M	8.33%	7.74%	7.14%	-139.17%
Project Cost	10.22%	7.74%	5.81%	-23.49%
Tariff Rate	5.00%	7.74%	10.54%	25.15%

The results of sensitivity analysis show that even with a variation of +10% & -10% in project cost, O&M cost, PLF and Tariff Rate, Equity IRR is significantly lower than the benchmark. And it is

evident from the results given above; the project remains additional even under the most favourable conditions.

<b>Probability to breach the benchmark:</b>
<b>Sensitivity Parameter 1 : PLF</b>
PLF considered in financials is as per “ <b>Guidelines for the reporting and validation of Plant load factors</b> ” stated in EB48 Annex11 <sup>16</sup> .
Variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third-Party Report based.
<b>Sensitivity Parameter 2 : O&amp;M</b>
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.
<b>Sensitivity Parameter 3 : Project Cost</b>
Estimated Project Cost for financial analysis is considered from Offer Letter. However, even if we consider the actual cost of the project even then the benchmark is not breached. Moreover, the Sensitivity is carried out for +/-10%.
<b>Sensitivity Parameter 4 : Tariff Rate</b>
Tariff Rate is considered as per the latest Tariff Order available at the time of investment decision and the Tariff Rate as per PPA is same as available at the time of investment decision and is fixed for the entire life of the Project. However, Sensitivity is carried out for +/-10% variation in the tariff. Even then the benchmark is not breached.
Hence, there is no probability of variation for the same.

This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark Equity IRR) for any of the investor. Thus it can be concluded that project activity is additional & is not business as usual scenario.

**Step 3: Barrier analysis**

Barrier analysis has not been used.

**Step 4: Common practice Analysis**

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<sup>16</sup>[http://cdm.unfccc.int/EB/048/eb48\\_repan11.pdf](http://cdm.unfccc.int/EB/048/eb48_repan11.pdf)

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

The common practice analysis is carried out step by step as per “Methodological tool: Common Practice, version 03.1” para 5. Stepwise approach for common practice are as follows:

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

Range	Capacity	Unit
+50%	201.60	MW
Capacity of the proposed project activity	134.4	MW
-50%	67.20	MW

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

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

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

- a. As the project is located in Karnataka state of India, therefore, the applicable geographical area of Karnataka has been chosen for analysis.
- b. The project activity is a green-field wind power project and uses measure (b) “Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies”. Therefore, all projects applying same measure (b) as the proposed project activity are candidates for similar projects.
- c. The energy source used by the project activity is wind. Hence, only wind energy projects have been considered for analysis.
- d. The project activity produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.
- e. The capacity range of the projects is within the applicable capacity range from 67.20 MW to 201.60 MW.

- f. The start date of the project activity is 02-Mar-18. As Kyoto Protocol was ratified by India on 26/08/2002<sup>17</sup>, therefore projects, which had started commercial operation between 26/08/2002 to 02/03/2018, have been identified.

Numbers of Similar projects (CDM and non-CDM) identified, which fulfil above-mentioned conditioned are:

Particulars	No. of Projects	Source
N <sub>Wind</sub>	1	Directory, India Windpower 2017, 17th Edition

Sources: Directory, India Windpower 2017, 17th Edition

Refer Common Practice Analysis Excel Sheet for Project Details & Analysis

**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<sub>all</sub>.*

Out of the projects identified in step-2, 7 projects are either registered or project activities submitted for registration, or project activities undergoing validation.

Thus N<sub>all</sub> = 1

**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<sub>diff</sub>.*

From the projects identified above, those projects which employ “different technologies” have been excluded and the number of such projects has been identified as N<sub>diff</sub>.

Since the project activity is located in Karnataka and has signed Power Purchase Agreement (PPA) with respective Discom which is wholly owned by the Government of Karnataka. The policies and tariff are regulated/governed by the respective Karnataka Electricity Regulatory Commission.

So, projects in Karnataka that have been allocated through Bidding process and have PPA with NTPC can be assumed that such projects are governed by different investment climate. Therefore, these projects come under different investment climate and have been considered under N<sub>diff</sub>.

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As N<sub>all</sub> = 1; thus N<sub>diff</sub> = 0

<sup>17</sup> [http://unfccc.int/kyoto\\_protocol/status\\_of\\_ratification/items/2613.php](http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php)

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

Calculate  $F=1-N_{diff}/N_{all}$

As  $N_{all} = 1$  thus,  $N_{all}-N_{diff} = 1$ ; is less than 3

**Outcome of Step 5:**

As,

- i.  $F = 1$ ; is more than 0.2
- ii.  $N_{all}-N_{diff} = 1$ ; is less than 3

The project activity does not satisfy condition (ii). Hence, project activity is not a common practice. Thus, the proposed project activity is not a “common practice” within a sector in the applicable geographical area.

**2.6 Methodology Deviations**

There is no methodology deviation

**3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS**

**3.1 Baseline Emissions**

Baseline emissions include only CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

- $BE_y$  = Baseline emissions in year  $y$  (t CO<sub>2</sub>/yr)
- $EG_{PJ,y}$  = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year  $y$  (MWh/yr)
- $EF_{grid,CM,y}$  = Combined margin CO<sub>2</sub> 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<sub>2</sub>/MWh)

**I. Calculation of  $EG_{PJ,y}$**

If the project activity is the installation of a Greenfield power plant, then:

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

Where:

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

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

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

**Net electricity generation supplied by the project plant/unit to the grid:**

For wind projects, the PP need to provide schedule for electricity to be injected and based on electricity meters measured data, the actual injected electricity is monitored. Monthly Joint Meter Readings in presence of Grid officials, project proponent as well the Substation in charge is carried out and serves the official data for calculation of generation from the project.

Therefore,

PPs	Capacity (MW)	PLF	Generation (MWh)
Skerion Renewable Energy Kushtagi Private Limited	50.4	30.10%	50.4*30.1*8760= 132892.704
Saroja Renewables Limited	52.5	30.40%	52.5*30.4*8760= 139809.6
Shanay Renewables Ltd.	31.5	30.80%	31.5*30.8*8760= 84989.52
Total	134.4		357692

PPs	Capacity (MW)	PLF	Generation (MWh)
Skerion Renewable Energy Kushtagi Private Limited	50.4	30.10%	50.4*30.1*8760= 132893
Saroja Renewables Limited	35.7	30.40%	35.7*30.4*8760= 95071
Shanay Renewables Ltd.	21	30.80%	21*30.8*8760= 56660
Total	107.1		284623

$$EG_{PJ,y} = 357,692 \text{ MWh}$$

$$EG_{PJ,y} = 284,623 \text{ MWh}$$

II. Calculation of  $EF_{grid,cm,y}$

The methodology ACM0002 (Version 19.0) requires that the combined margin for the grid be calculated in accordance with the procedure provided in the “*Tool to calculate the emission factor for an electricity system*”.

As per “Tool to calculate the emission factor for an electricity system, Version 7.0.0”;

The baseline emission factor ( $EF_{grid,y}$ ) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors.

The methodology provides following approaches for emission factor calculations:

- (a) *Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology “Tool to calculate the emission factor for an electricity system”.*

OR

- (b) *The weighted average emissions (in t CO<sub>2</sub>/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 i.e.**

CO<sub>2</sub> Baseline Database for the Indian Power Sector, Version 14, December 2018<sup>18</sup>, 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, all the 5 zones have now been synchronized and called as Indian Grid.

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<sup>18</sup> [http://cea.nic.in/reports/others/thermal/tpece/cdm\\_co2/user\\_guide\\_ver14.pdf](http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf)

**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.

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

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

	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, Dec'2018*

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

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

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

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

PP has chosen ex ante option for the calculation of OM with 3 years generation weighted average of the most recent years available at the time of submission of CDM-PDD to the DOE for validation.

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

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

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

Net Generation in Operating Margin (MWh) (incl. Imports)			
	2015-16	2016-17	2017-18
Indian Grid	871,753	916,278	960,693

Simple Operating Margin (tCO <sub>2</sub> /MWh) (incl. Imports)			
	2015-16	2016-17	2017-18
Indian Grid	0.9655	0.9636	0.9543

Weighted Generation Operating Margin	
Indian Grid	0.9610

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

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

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

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

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

Build Margin (tCO <sub>2</sub> /MWh) (not adjusted for imports)	
	<b>2017-18</b>
Indian Grid	<b>0.8644</b>

#### STEP 6: Calculate the combined margin (CM) emissions factor

**Combined Margin** – The combined margin is the weighted average of the simple operating Margin and the build margin. In reference to para 81 (b) of the Tool to calculate the emission factor for an electricity system, Version 04.0.0, EB 75, Annex 15, all projects other than wind and solar photovoltaic :

$w_{OM} = 0.5$  and  $w_{BM} = 0.5$  for the first crediting period, and

$w_{OM} = 0.25$  and  $w_{BM} = 0.75$  for the second and third crediting period,

unless otherwise specified in the approved methodology which refers to this tool.

The baseline emission factor is calculated using the combined margin approach as described in the following steps:

#### Calculation of Baseline Emission Factor ( $EF_{grid,y}$ )

The baseline emission factor  $EF_{grid,y}$  is calculated as the weighted average of the Operating Margin emission factor ( $EF_{grid,OM,y}$ ) and the Build Margin emission factor ( $EF_{grid,BM,y}$ ):

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

Where,

WOM	75% weight of operating margin emissions factor (%)
WBM	25% weight of operating margin emissions factor (%)
$EF_{grid,OM,y}$	Build margin CO <sub>2</sub> emission factor of a particular grid in year y; calculated as described in Steps 3&4 above (tCO <sub>2</sub> /MWh)
$EF_{grid,BM,y}$	Build margin CO <sub>2</sub> emission factor of a particular grid in year y; calculated as described in Steps 5 above (tCO <sub>2</sub> /MWh)

#### Baseline Emission factor (Indian Grid)

$$\begin{aligned}
 EF_{Grid,CM,y} &= 0.75 * 0.9610 + 0.25 * 0.8644 \\
 &= 0.9368 \text{ tCO}_2/\text{MWh}
 \end{aligned}$$

Therefore, Baseline Emissions:

$$\begin{aligned}
 BE_y &= EG_{PJ,y} \times EF_{grid,CM,y} \\
 BE_y &= 357,692 \times 0.9368 = 335,085 \text{ tCO}_2 \quad (\text{for } 134.4 \text{ MW})
 \end{aligned}$$

and,

$$BE_y = 284,623 \times 0.9368 = 266,634 \text{ tCO}_2 \quad (\text{for } 107.1 \text{ MW})$$

### 3.2 Project Emissions

The project emission calculation as per para 34 of ACM0002 version 19,

$$PE_y = PE_{FF,y} + PE_{GF,y} + PE_{HF,y}$$

Where:

- $PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>e/yr)
- $PE_{FF,y}$  = Project emissions from fossil fuel consumption in year  $y$  (t CO<sub>2</sub>/yr)
- $PE_{GF,y}$  = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year  $y$  (t CO<sub>2</sub>e/yr)
- $PE_{HF,y}$  = Project emissions from water reservoirs of hydro power plants in year  $y$  (t CO<sub>2</sub>e/yr)

$$PE_{FF,y} = 0$$

As per para 37 of ACM0002 version 19,

*“For most renewable energy power generation project activities”*

$$PE_{GF,y} = 0$$

Therefore,  $PE_y = 0$

### 3.3 Leakage

As per para 56 of ACM0002 version 19, No leakage emissions need to be considered for the project activity.

### 3.4 Estimated Net GHG Emission Reductions and Removals

As per para 57 of ACM0002 version 19; Emission Reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$  = Emission reductions in year  $y$  (t CO<sub>2</sub>e/yr)

$BE_y$  = Baseline emissions in year  $y$  (t CO<sub>2</sub>/yr)

$PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>e/yr)

Therefore, Net GHG Emission Reductions and Removals are calculated as follows:

$$ER_y = BE_y - PE_y$$

$$ER_y = 335,085 - 0 = 335,085 \text{ tCO}_2 \text{ (for 134.4 MW)}$$

And

$$ER_y = 266,634 - 0 = 266,634 \text{ tCO}_2 \text{ (for 107.1 MW)}$$

**For 134.4 MW**

Year	Estimated baseline emissions or removals (tCO <sub>2</sub> e)	Estimated project emissions or removals (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Estimated net GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1	335,085	0	0	335,085
Year 2	335,085	0	0	335,085
Year 3	335,085	0	0	335,085
Year 4	335,085	0	0	335,085
Year 5	335,085	0	0	335,085
Year 6	335,085	0	0	335,085
Year 7	335,085	0	0	335,085
Year 8	335,085	0	0	335,085
Year 9	335,085	0	0	335,085
Year 10	335,085	0	0	335,085
<b>Total</b>	<b>3,350,850</b>	<b>0</b>	<b>0</b>	<b>3,350,850</b>

**For 107.1 MW**

Year	Estimated	Estimated	Estimated	Estimated net
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	baseline emissions or removals (tCO <sub>2</sub> e)	project emissions or removals (tCO <sub>2</sub> e)	leakage emissions (tCO <sub>2</sub> e)	GHG emission reductions or removals (tCO <sub>2</sub> e)
Year 1	266,634	0	0	266,634
Year 2	266,634	0	0	266,634
Year 3	266,634	0	0	266,634
Year 4	266,634	0	0	266,634
Year 5	266,634	0	0	266,634
Year 6	266,634	0	0	266,634
Year 7	266,634	0	0	266,634
Year 8	266,634	0	0	266,634
Year 9	266,634	0	0	266,634
Year 10	266,634	0	0	266,634
<b>Total</b>	2,666,340	0	0	2,666,340

## 4 MONITORING

### 4.1 Data and Parameters Available at Validation

Data / Parameter	EF <sub>grid,OM,y</sub>
Data unit	tCO <sub>2</sub> /MWh
Description	Operating Margin CO <sub>2</sub> emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018 <sup>19</sup>
Value applied:	0.9610 (Indian Grid)
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0.0" as 3-year generation weighted average using data for the years 2015-16, 2016-17 & 2017-18. The data are obtained from "CO <sub>2</sub> Baseline Database for Indian

<sup>19</sup> [http://www.cea.nic.in/reports/planning/cdm\\_co2/user\\_guide\\_ver10.pdf](http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf)

	Power Sector” version 14.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO <sub>2</sub> /MWh
Description	Build Margin CO <sub>2</sub> emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018
Value applied:	0.8644 (Indian Grid)
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07.0.0” as 3-year generation weighted average using data for the years 2017-18. The data are obtained from “CO <sub>2</sub> Baseline Database for Indian Power Sector” version 14.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO <sub>2</sub> /MWh
Description	Combined Margin CO <sub>2</sub> emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018
Value applied:	0.9368 (Indian Grid)
Justification of choice of data or description of measurement methods and procedures applied	<p>The combined margin emissions factor is calculated as follows:</p> $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ <p>Where:</p> <p><math>EF_{grid,BM,y}</math> = Build margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)  <math>EF_{grid,OM,y}</math> = Operating margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)  <math>W_{OM}</math> = Weighting of operating margin emissions factor (%) = 75%  <math>W_{BM}</math> = Weighting of build margin emissions factor (%) = 25%</p>
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

## 4.2 Data and Parameters Monitored

Data / Parameter	EG <sub>y</sub>
Data unit	MWh
Description	Net Electricity supplied to Grid
Source of data	Form B electricity generated sheet from State Electricity Board
Description of measurement methods and procedures to be applied	<p>Net electricity generated will be calculated at the main meter connected to the Grid Substation.</p> <p>The procedures for metering will be as per the provisions of the power purchase agreement. The WTGs of a single customer (individual PPS) at a particular site are connected to a to a feeder that ultimately leads to the main meter at the substation maintained by O&amp;M team.</p> <p>Data monitoring takes place at the metering yard and Main meter at the substation. The electricity metered at the main meter is proportionally divided among the customers connected to the meter on the basis of the pro-rata readings taken at the individual WTGs. The emission reduction calculations are done on the basis of the Main meter reading (net electricity exported to the grid) after deducting imports from the grid as mentioned in the share certificate issued on monthly basis.</p> <p>Net electricity exported= Export-115%Import- Transmission loss</p> <p>The electricity measurements at main meter are continuous and recorded on monthly basis.</p>
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied:	357,692 MWh for 134.4 MW 284,623 MWh for 107.1 MW
Monitoring equipment	Electricity Meters of 0.2s Class
QA/QC procedures to be applied	<p>Calibration of all the meters will be undertaken at required intervals and faulty meters will be duly replaced immediately based on CEA guidelines which specifies calibration once in 5 years.</p> <p>The data will be cross checked with sales receipts.</p>
Purpose of data	Calculation of Baseline emissions
Calculation method	N/A
Comments	The data will be archived electronically for two years after the end of the last crediting period or the last issuance of VERs for this project activity, whichever occurs later.

### 4.3 Monitoring Plan

The project proponents at the power station have a procedure to ensure proper monitoring of the VCS project activity. The project activity has installed monitoring and control equipment that measure, record, report, monitor and control various key parameters.

The methodology requires monitoring of the net electricity supplied from the project activity.

The proponent shall maintain complete and accurate records and all other data required for the purpose of proper administration and operation of the wind power project. The data will be kept for at least 2 years after the end of the crediting period.

1. Purpose - The purpose of monitoring the project is to assess the annual emission reductions in tonnes of CO<sub>2</sub> that the project activity has achieved.
2. Data to be reported - EGP<sub>J,y</sub> in MWh and periodical calibrations of monitoring equipment's.
3. Monitoring times and periods - The data will be monitored on a continuous basis but will be recorded on a monthly basis with the energy meters installed at the site.
4. Data Accuracy - Metering Arrangement of the Power Purchase Agreement (PPA) the metering arrangement including its installation, testing, maintenance and collection transportation and processing of data required for energy exchange shall be governed as per the notification/ directives issued/or to be issued by Central Electricity Regulatory Commission and as per relevant provisions contained in IEGC as amended from time to time. The Central Electricity Authority (CEA) notification regarding Installation and Operation of meters regulations, 2006, says that meters are required to be tested once in 5 years (refer clause 18 of the guideline)<sup>20</sup>. Thus, the meters recording the electricity exported will be calibrated at least once 5 years.
5. Emission Reduction Calculation Approach - The emission reductions are calculated as a product of the net electricity generated from the project activity and the combined margin emission factor. The calculation approach is explained in detail under section 3 of this document.
6. Approach to be followed in following cases:

In case monitoring period is between the billing cycle, pro rata calculation for the number of days in the monitoring period shall be estimated for emissions reduction calculation.

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<sup>20</sup> CEA metering regulation clause 18 on page 12 of the regulation

[http://www.powermin.nic.in/whats\\_new/pdf/Metering\\_Regulations.pdf](http://www.powermin.nic.in/whats_new/pdf/Metering_Regulations.pdf)

## 5 SAFEGUARDS

### 5.1 No Net Harm

As per the notification from MoEF dated September 14, 2006 and its amendment notification S.O.-3067(E) dated 1/12/2009, the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed project activity type as it involves wind power generation. Thus, no harm has been identified from the project and hence no mitigations measures are applicable.

Nonetheless, the PP during the construction and Implementation came with the below studies:

- **Air quality:** The project is wind power plant which replaces the fossil fuel intensive electricity generation.

Also report on “**Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects**” prepared by MNRE dated September 2013. This report clearly mentioned that Wind farms operations do not result in direct air pollution. Further, mitigation measures were implemented on ground for air quality issues and thus, the project will have a positive impact on air quality.

- **Water quality and quantity:** The project has no effect on water quality and quantity because it neither generates any waste nor consume any water. The consumption of freshwater during construction was also pretty much limited.

Hence the parameter is indicated as neutral.

- **Soil condition:** There are negligible impacts foreseen during operation of the project activity and for mitigating the impacts during construction, various mitigation measures were taken. The top soil excavated during construction, was stockpiled and used for compaction. The roads were not paved and soling was done with excavated earth & rock material, so land disturbance could be minimized, also the vegetation done at site helps for soil erosion.

Therefore, it can be concluded that the project has no effect on soil conditions during its operation because it has no waste coming out.

- **Biodiversity:** Many Vegetation activities were undergone after the implementation of the project activity. This has improved the greenery in and around the vicinity of the project. The project site is not on the migration route of migratory bird. As Such Wind power plant does not have any obstruction in the path of migratory birds.
- **Employment Generation:** The Implementation of the project activity generates employment for the nearby villages. Before the implementation of the project, the villagers use to work as bonded labourers in the agricultural field and after the implementation many of them got permanent jobs which improved their lifestyles. The personnel employed by the project activity are also provided trainings and exposed to various awareness programs. This is a positive impact due to the implementation of the project activity.

- **Livelihood of the poor:** The employment generation in and around the vicinity of the project not only provided permanent employment but also improved lifestyle among the poor family. The project is also associated with infrastructure development like roads in the nearby areas and promoting economic activities like grants to local school and communities temples. This is a positive impact due to the implementation of the project activity.

## 5.2 Environmental Impact

The proposed project activity is using renewable energy generation technology (Wind energy) which is free from any kind of anthropogenic emission. Project activity is not having any negative environmental impacts.

As per the notification from MoEF dated September 14, 2006 and its amendment notification S.O.-3067(E) dated 1/12/2009, the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed project activity type as it involves wind power generation. Hence the proposed project activity does not require any Environmental impact analysis. Thus, the section is not applicable.

## 5.3 Local Stakeholder Consultation

The Local Stakeholder Meetings were organized at the project site substation.

The local stakeholder were informed regarding the meeting on 20<sup>th</sup> Jan 2018. The following are the stakeholders for the project activity:

- Local community
- Local village administration
- Technology suppliers
- Local vendors

All the stakeholders have been invited through invitation letters and/ or public notice to attend the stakeholders meeting 25<sup>th</sup> Jan 2018

The meeting was organized by the project proponent with the help of the developer Suzlon Energy Ltd. All participants were informed in their local language about the salient features and environmental benefits of the project activity.

In the introductory speech, the representatives of PP welcomed the gathering and given a brief about the VCS/CDM project activity. Suzlon presented the project idea, discussed issues regarding the general energy production with the focus on wind power. Afterwards the presentation by officials was conducted, who explained in detail the aim of the meeting and the process of stakeholder evaluation. Subsequent to the introductory speech, stakeholders were explained about the electricity generation from wind power project/ unit is an environmental friendly power generation technology contributing to reduction in GHG emissions. They were also explained about the benefits of the wind power project/ unit like, increasing energy availability and improving quality of power and its assistance to the local population by providing employment opportunities to both skilled & unskilled labours. After all the presentations, Project representative and Suzlon officials answered the stakeholder's questions. In parallel all the comments were collected and documented. The Minutes of LSH meeting along with List of Attendees and other supporting's is now submitted to the DOE.

The project proponent has a grievance cell and kept a complaint box and complaint /feedback register at project site to take continuous feedback from the stakeholders at the site office.

No other major issues were identified for the project. All the minor issues were addressed and also the concerned departments are keeping a tight vigil for assessing any changes likely that may take place.

#### 5.4 Public Comments

The project has been listed for 30 days period from 13/11/2019 to 13/12/2019. No comments were received. [https://www.vcsprojectdatabase.org/#/pipeline\\_details/PL1993](https://www.vcsprojectdatabase.org/#/pipeline_details/PL1993) can be checked for the same.

### 6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

#### 6.1 Data and Parameters Monitored

Data / Parameter	EGy
Data unit	MWh
Description	Quantity of Net Electricity supplied to the grid
Source of data	Export Readings of Bi-directional Tri-vector meter installed at respective WEG and Monthly bills.
Description of measurement methods and procedures applied	Measured continuously using calibrated meter by grid officials, recorded monthly and aggregated annually. Meter accuracy class: 0.2
Frequency of monitoring/recording	The meter will be calibrated as per Gulbarga Electricity Supply Company Limited (GESCOM) norms. Sales invoices and other records are used for cross verification to ensure consistency.
Value applied:	461,033
Monitoring equipment	Electricity Meters of 0.2s Class
QA/QC procedures applied	Test procedure: As per relevant National Standards

#### 6.2 Baseline Emissions

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where,

$BE_y$	=	Baseline Emissions in year y (t CO <sub>2</sub> )
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO_2,grid,y}$	=	CO <sub>2</sub> emission factor of the grid in year y (t CO <sub>2</sub> /MWh)

$$BE_y = 461,033 \text{ tCO}_2$$

### 6.3 Project Emissions

The project activity involves in harnessing wind power. So, the emissions from the project are zero

### 6.4 Leakage

No leakage emissions have been considered and hence the leakage emission is zero.

### 6.5 Net GHG Emission Reductions and Removals

As per the applied methodology, emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where,

$ER_y$  = Emission Reduction in tCO<sub>2</sub>/year

$BE_y$  = Baseline emission in tCO<sub>2</sub>/year

$PE_y$  = Project emissions in tCO<sub>2</sub>/year

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
2018	215,723	0	0	215,723
2019	245,310	0	0	245,310
<b>Total</b>	<b>461,033</b>	<b>0</b>	<b>0</b>	<b>461,033</b>

There was no major break down during this monitoring period; however, the break down details have been mentioned in the ER Sheet. Further, the comparison for estimated emission reductions as per validated VCS PD and actual observed are detailed below. The emission reductions are lower than the estimated value.

Parameters	tCO <sub>2</sub> e
Estimated Annual Emission Reduction per year for 134.4MW	335,085
Estimated Annual Emission Reduction per year for 107.1 MW (already commissioned)	266,634
Estimated Emission Reductions for the monitoring period for 107.1 MW (578 days)	422,231
Emission reductions achieved in monitoring period	461,033
Percentage of variation when compared with estimated ERs	9.19%

	Skeiron	Shanay	Saroja
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Actual PLF	34.67%	31.37%	31.98%
Estimated PLF	30.10%	30.80%	30.40%

The actual emission reductions for the current monitoring period is 9.19% higher than the estimated values in the registered VCS PD corresponding to the similar period.

The variation in the Emission Reductions are due to higher PLF observed. The Values are within the sensitivity analysis carried out for the project activity.

**APPENDIX 1: CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE**

<b>CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE</b>	
<b>VERSION</b>	14
<b>DATE</b>	Dec'18
<b>Tool Applied</b>	"Tool to Calculate the Emission Factor for an Electricity System", Version 7.0

<b>Net Generation in Operating Margin (GWH) (incl. Imports)</b>			
	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>
<b>Indian Grid</b>	871,753	916,278	960,693

<b>Simple Operating Margin (tCO2/MWh) (incl. Imports) (1) (2)</b>			
	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>
<b>Indian Grid</b>	0.9655	0.9636	0.9543

<b>Build Margin (tCO2/MWh) (not adjusted for imports)</b>			
	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>
<b>Indian Grid</b>	0.9083	0.8723	0.8644

<b>Weighted Generation Operating Margin</b>	
<b>Indian Grid</b>	0.9610

<b>Combined Margin Emission Factor</b>	
<b>Indian Grid</b>	0.9368

**APPENDIX 2: CALIBRATION DETAILS**

<b>Skeiron Renewable Energy Kushtagi Private Limited</b>				
	Main	Check	Calibration Date	Due Date of calibration
<b>KST147</b>	16112943	16112944	10.01.2018	09.01.2023
<b>KST177</b>	16112934	16112937	10.01.2018	09.01.2023
<b>KST101</b>	18015394	18015396	10.01.2018	09.01.2023
<b>KST230</b>	18015386	18015387	10.01.2018	09.01.2023

<b>Saroja Renewables Limited</b>				
	Main	Check	Calibration Date	Due Date of calibration
<b>KST51</b>	18015411	18015426	10.01.2018	09.01.2023
<b>KST67</b>	18015412	18015416	10.01.2018	09.01.2023
<b>KST71</b>	18015440	18015441	10.01.2018	09.01.2023

<b>Shanay Renewables Ltd.</b>				
	Main	Check	Calibration Date	Due Date of calibration
<b>KST130</b>	18015383	18015384	10.01.2018	09.01.2023
<b>KST131</b>	18015438	18015379	10.01.2018	09.01.2023

### Appendix-3: WTG COORDINATES

#### Skerion WTG Location No

WTG ID	Degrees	Minutes	Seconds		Degrees	Minutes	Seconds	
KST098	15.00	55.00	1.18	N	76.00	10.00	56.69	E
KST099	15.00	55.00	18.07	N	76.00	10.00	55.78	E
KST100	15.00	55.00	36.86	N	76.00	10.00	53.80	E
KST101	15.00	54.00	40.72	N	76.00	15.00	42.32	E
KST123	15.00	55.00	51.57	N	76.00	11.00	40.67	E
KST125	15.00	54.00	45.33	N	76.00	12.00	36.97	E
KST126	15.00	54.00	27.38	N	76.00	12.00	46.92	E
KST147	15.00	53.00	42.58	N	76.00	13.00	36.41	E
KST148	15.00	54.00	19.33	N	76.00	13.00	51.50	E
KST149	15.00	54.00	23.17	N	76.00	13.00	18.10	E
KST152	15.00	55.00	28.71	N	76.00	13.00	11.26	E
KST153	15.00	55.00	38.44	N	76.00	12.00	48.45	E
KST154	15.00	55.00	53.58	N	76.00	12.00	35.26	E
KST155	15.00	56.00	14.49	N	76.00	12.00	18.97	E
KST177	15.00	53.00	50.92	N	76.00	14.00	26.29	E
KST188	15.00	53.00	15.44	N	76.00	15.00	19.90	E
KST189	15.00	53.00	42.34	N	76.00	15.00	21.52	E
KST191	15.00	52.00	55.13	N	76.00	15.00	43.78	E
KST230	15.00	54.00	22.74	N	76.00	16.00	2.65	E
KST233	15.00	54.00	2.66	N	76.00	17.00	4.56	E
KST234	15.00	53.00	49.30	N	76.00	17.00	1.96	E
KST235	15.00	53.00	31.31	N	76.00	17.00	6.69	E
KST236	15.00	52.00	55.12	N	76.00	16.00	50.86	E
KST102	15.00	55.00	2.48	N	76.00	15.00	50.43	E

**SAROJA WTG Location No**

WTG ID	Degrees	Minutes	Seconds		Degrees	Minutes	Seconds	
KST071	15.00	54.00	47.93	N	76.00	10.00	33.47	E
KST046	15.00	53.00	41.36	N	76.00	9.00	25.87	E
KST047	15.00	52.00	56.68	N	76.00	9.00	33.35	E
KST048	15.00	52.00	36.25	N	76.00	9.00	32.90	E
KST049	15.00	52.00	9.93	N	76.00	8.00	59.73	E
KST051	15.00	55.00	14.79	N	76.00	9.00	31.75	E
KST065	15.00	56.00	27.83	N	76.00	9.00	45.29	E
KST066	15.00	56.00	2.42	N	76.00	9.00	25.91	E
KST067	15.00	55.00	27.17	N	76.00	10.00	5.39	E
KST068	15.00	55.00	41.20	N	76.00	10.00	21.71	E
KST070	15.00	55.00	1.33	N	76.00	10.00	5.98	E
KST103	15.00	56.00	15.59	N	76.00	10.00	51.91	E
KST105	15.00	57.00	28.11	N	76.00	11.00	24.32	E
KST106	15.00	56.00	37.51	N	76.00	10.00	48.88	E
KST121	15.00	56.00	0.96	N	76.00	10.00	50.24	E
KST122	15.00	56.00	23.88	N	76.00	9.00	5.98	E
KST124	15.00	53.00	6.23	N	76.00	9.00	11.31	E

**SHANAY WTG Location No**

WTG ID	Degrees	Minutes	Seconds		Degrees	Minutes	Seconds	
KST072	15.00	54.00	29.32	N	76.00	10.00	40.06	E
KST075	15.00	52.00	6.47	N	76.00	11.00	21.12	E
KST090	15.00	52.00	50.70	N	76.00	11.00	1.47	E
KST095	15.00	54.00	7.41	N	76.00	11.00	22.30	E
KST096	15.00	51.00	44.55	N	76.00	11.00	24.55	E
KST097	15.00	54.00	34.51	N	76.00	11.00	18.52	E
KST128	15.00	51.00	24.03	N	76.00	10.00	40.66	E
KST130	15.00	53.00	44.67	N	76.00	11.00	16.62	E
KST131	15.00	53.00	22.60	N	76.00	13.00	8.18	E
KST042	15.00	51.00	25.02	N	76.00	11.00	32.37	E