



**Verified Carbon
Standard**

WIND ENERGY PROJECT IN HARAPANAHALLI, KARNATAKA

Document Prepared by CLP Wind Farms (India) Private Limited

Project Title	Wind Energy Project in Harapanahalli, Karnataka
Version	1.2
Date of Issue	19-01-2023
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1 PROJECT DETAILS

1.1 Summary Description of the Project

CLP Wind Farms (India) Private Limited (CLPWFPL) has implemented a wind power project of capacity 39.6 MW comprising of 24 number of Wind Turbine Generators (WTGs), each with rated capacity of 1650 kW. The project area is spread across 4 villages - Harakanalu, Arsanahalu, Hyarada, Dasanahalli which are part of Harapanahalli Taluk of Davangere District in the State of Karnataka. The electricity generated from the Project activity is sold to the local electricity distribution company in the state.

Purpose of the project activity

To generate electricity by utilizing the wind power potential using WTGs at a site located in Harapanahalli taluk of Davangere district in the State of Karnataka. The Project activity is contributing towards reduction of the Green House Gas (GHG) emissions thereby contributing to sustainable development. The electricity generated from the wind farm will be exported to the Integrated Indian electricity grid. Distribution Licensee thereby marginally contributing towards reduction in the energy demand supply gap in the state of Karnataka, diversification of grid supply and reduction of greenhouse gas emissions. Initially, the Indian electricity system was divided into two regional grids, the synchronous Northern, Eastern, Western, and North Eastern (NEWNE) grid and the Southern grid. Each grid covers several states. However, both the grids have now merged and termed as Integrated Indian Grid.

Technology

Vestas India will be supplying the wind energy technology to CLPWFPL. WTG is ingeniously devised to convert kinetic energy from the “air in motion” directly into electricity without using conventional sources like coal, oil or natural gas for power generation. The project activity involves the installation of V82- 1650 kW WTGs. The specification for the WTGs is provided in section 1.11.

Project Boundary

The Indian electricity system is an integrated grid system now which encompasses all regional grids, viz Northern, Eastern, Western, and North Eastern (NEWNE) grid and the Southern grid (SR Grid). Each grid covers several states. The project activity is connected to Integrated Indian Grid which includes the project sites and all power plants connected physically to the electricity system and this has been considered as the project boundary.

Baseline Scenario:

In accordance with ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system” (version 07).

The project activity involves installation of wind power plant at locations where no renewable power plant was operated prior to the implementation of the project activity (green-field plant). Hence, pre-project scenario and baseline scenario are the same.

The project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 75,597 tCO₂e per year, thereon displacing 81,200 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.

Since project is undergoing crediting period renewal and verification, audit history of the project is provided below:

<u>Audit Type</u>	<u>Period</u>	<u>Program</u>	<u>VVB Name</u>	<u>Number of years</u>
Gap Validation and Verification	21/01/2011 - 31/05/2013	<u>VCS</u>	Bureau Veritas Certification	1 year 4 months
Verification	01/06/2013 - 31/05/2016	<u>VCS</u>	Bureau Veritas Certification	3 years
Verification	01/06/2016 - 01/11/2017	<u>VCS</u>	LGAI Technological Center, S.A.	1 year 6 months
Verification	02/11/2017 - 01/02/2019	<u>VCS</u>	Earthood Services Pvt Ltd	1 year 3 months
Verification	02/02/2019 - 01/02/2020	<u>VCS</u>	LGAI Technological Center, S.A.	1 year
Verification	02/02/2020 - 20/01/2021	<u>VCS</u>	Earthood Services Pvt Ltd	0 year 11 months
Validation and Verification	21/01/2021 - 30/09/2022	<u>VCS</u>	LGAI Technological Center, S.A.	1 year 8 months
<u>Total</u>	21/01/2011 - 30/09/2022			11 years, 8 months

1.2 Sectoral Scope and Project Type

According to the VCS list of sectoral scopes-1, the project activity may be categorized in: Scope Number: 1

Sectoral Scope: Energy (renewable/non-renewable)

Methodology: “Grid-connected electricity generation from renewable sources” Reference: ACM0002, Version 21

The project activity is not a grouped project.

1.3 Project Eligibility

In line with VCS Standard, the project shall be validated against the (current) scope of the VCS. Such validation report shall be issued after the end of the (previous) project crediting period but within two years after the end of the (previous) project crediting period. In this project activity, first Crediting Period of this registered project activity has been completed on 20-01-2021. This is the renewal of crediting period of existing registered project activity. Thus, this project is eligible under VCS Scheme.

1.4 Project Design

The project activity entails installation and operation of 24 WTGs (Model V-82) supplied by Vestas. Each WTG is having a rated capacity of 1.65 MW. The generated power will be supplied to the high voltage electrical grid through dedicated Haraknal substation located at Harapanahalli.

This project activity is not a grouped *project*.

Eligibility Criteria

The project does not consist of grouped projects. Hence, there is no requirement to identify eligibility criteria for inclusion of new instances of each project activity.

This project activity is not a grouped project.

1.5 Project Proponent

Organization name	CLP Wind Farms (India) Private Limited
Contact person	Navneet Kumar
Title	Manager - Carbon & Sustainability
Address	7th Floor, Fulcrum, Sahar Road, Andheri (East), Mumbai – 400099, India
Telephone	+ 91-22 6758 8888
Email	carbon@clpindia.in

1.6 Other Entities Involved in the Project

Organization name	NA
Role in the project	NA
Contact person	NA
Title	NA
Address	NA
Telephone	NA
Email	NA

1.7 Ownership

CLP Wind Farms (India) Private Limited is the legal owner of project activity. The project activity entails the installation and operation of 24 WTGs (Model V-82) supplied by Vestas. Each WTG is having a rated capacity of 1.65 MW. The generated power will be supplied to the high voltage electrical grid through dedicated Haraknal substation located at Harapanahalli. All the WTGs are owned by CLP Wind Farms (India) Private Limited. CLP Wind Farms (India) Private Limited is the sole owner of project activity, hence it possesses right of use of all emission reduction. Further the ownership is demonstrated through the following documents.

- 1) Commissioning certificates for the project WTGs in the name of CLP Wind Farms (India) Private Limited
- 2) Power Purchase Agreement between CLP Wind Farms (India) Private Limited and state utilities.

1.8 Project Start Date

The project start date for this project is 21-January-2011. This is the day on which the first WTG was commissioned under the Project activity.

1.9 Project Crediting Period

Project has begun generating GHG emission reductions from 21-January-2011. Hence, first crediting period for VCS begins on 21-January-2011 and ends on 20-January-2021 i.e. 10 years. This is the second crediting period of the project activity.

Start date of the crediting period : 21-January-2021

End date of the crediting period : 20- January-2031

Project crediting period : 10 years 0 months (renewable).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
21/01/2021 - 20/01/2022	75,597
21/01/2022 - 20/01/2023	75,597
21/01/2023 - 20/01/2024	75,597
21/01/2024 - 20/01/2025	75,597
21/01/2025 - 20/01/2026	75,597
21/01/2026 - 20/01/2027	75,597
21/01/2027 - 20/01/2028	75,597
21/01/2028 - 20/01/2029	75,597
21/01/2029 - 20/01/2030	75,597
21/01/2030 - 20/01/2031	75,597
Total estimated ERs	755,970
Total number of crediting years	10
Average annual ERs	75,597

1.11 Description of the Project Activity

The project involves installation of 24 Vestas make WTGs of 1650 kW capacity each at Harapanahalli in Davangere district of Karnataka. Brief technical details of the WTGs used in the Project are as follows.

Model: V82- 1650 kW

The average lifetime of the wind turbine: 20 years

Technical Specifications:

Turbine

1. Cut in wind speed : 3 m/s

2. Cut out wind speed : 20 m/s
3. Rated wind speed : 13 m/s
4. Hub height : 78 m

Generator

1. One speed and water cooled
2. Capacity : 1650 kW
3. Type : Asynchronous

Gear box

- 1) Step planet, B. Step helical
- 2) Ration : 1:70.2

Tower

- 1) Type: Conical, Tubular
- 2) Material : S355 or ASTM A 709 grade 50

Rotor

- 1) No of blades : 3
- 2) Diameter : 82 m
- 3) Swept area : 5281 m²

In present project activity, the electricity being generated by 24 wind turbines is monitored at the dedicated Haraknal substation located at Harapanahalli. In the substation, metering is done at two outgoing feeders.

No events or situations happened during the reported monitoring period which can alter the applicability of the applied methodology.

Relevant dates for the project activity

Serial No	WTG ID	Commissioning date
1	H 28	21-January-2011
2	H 29	21-January-2011
3	H 30	21-January-2011
4	H 31	21-January-2011
5	H 32	21-January-2011
6	H 33	21-January-2011
7	H 34	21-January-2011
8	H 35	21-January-2011
9	H 15	25-February-2011
10	H 16	25-February-2011
11	H 17	25-February-2011
12	H 18	25-February-2011
13	H 19	25-February-2011

Serial No	WTG ID	Commissioning date
14	H 20	25-February-2011
15	H 21	25-February-2011
16	H 22	25-February-2011
17	H 23	25-February-2011
18	H 24	25-February-2011
19	H 25	25-February-2011
20	H 26	25-February-2011
21	H 27	25-February-2011
22	H 36	25-February-2011
23	H 37	25-February-2011
24	H 38	25-February-2011

1.12 Project Location

The project activity is located at Karnataka State of India. The project is implemented in Villages Harakanalu, Arsanahalu, Hyarada, Dasanahalli of Taluka Harapanahalli in District Davangere of Karnataka State in India. The geo- coordinates and commissioning date of WTG under the project activity are provided below:

Serial No	WTG ID	Commissioning date	Latitude	Longitude
1	H 28	21-January-2011	14° 50' 00.1" N	75° 48' 46.3" E
2	H 29	21-January-2011	14° 50' 17.2" N	75° 48' 37.5" E
3	H 30	21-January-2011	14° 50' 26.2" N	75° 48' 44.1" E
4	H 31	21-January-2011	14° 50' 37.6" N	75° 48' 37.3" E
5	H 32	21-January-2011	14° 50' 42.2" N	75° 48' 22.1" E
6	H 33	21-January-2011	14° 50' 50.3" N	75° 48' 17.2" E
7	H 34	21-January-2011	14° 50' 47.4" N	75° 48' 35.7" E
8	H 35	21-January-2011	14° 51' 00.5" N	75° 48' 33.2" E
9	H 15	25-February-2011	14° 48' 20.5" N	75° 50' 36.5" E
10	H 16	25-February-2011	14° 48' 31.6" N	75° 50' 25.8" E
11	H 17	25-February-2011	14° 48' 42.6" N	75° 50' 21.2" E
12	H 18	25-February-2011	14° 48' 50.1" N	75° 50' 24.4" E
13	H 19	25-February-2011	14° 48' 36.9" N	75° 49' 47.5" E
14	H 20	25-February-2011	14° 48' 47.8" N	75° 49' 43.2" E
15	H 21	25-February-2011	14° 49' 07.4" N	75° 49' 42.0" E
16	H 22	25-February-2011	14° 49' 16.4" N	75° 49' 46.1" E
17	H 23	25-February-2011	14° 49' 24.1" N	75° 49' 42.5" E
18	H 24	25-February-2011	14° 49' 19.3" N	75° 49' 22.7" E
19	H 25	25-February-2011	14° 49' 37.0" N	75° 49' 14.7" E

Serial No	WTG ID	Commissioning date	Latitude	Longitude
20	H 26	25-February-2011	14 ° 49' 50.4" N	75 ° 49' 12.6" E
21	H 27	25-February-2011	14 ° 49' 43.7" N	75 ° 48' 50.4" E
22	H 36	25-February-2011	14 ° 51' 13.9" N	75 ° 48' 08.0" E
23	H 37	25-February-2011	14 ° 51' 24.7" N	75 ° 47' 59.6" E
24	H 38	25-February-2011	14 ° 51' 33.0" N	75 ° 47' 54.5" E

1.13 Conditions Prior to Project Initiation

The project activity is a greenfield electricity generation project utilizing kinetic energy of wind for generation and sale of electricity to the Integrated Indian Grid under Power Purchase Agreements. Therefore, the project activity reduces GHG emissions by displacing an equivalent amount of electricity that would have been generated by power plants already operational and proposed to be added to the grid, which relies predominantly on fossil fuels. The project activity has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

In accordance with ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (version 7).

The project activity involves installation of wind power plant at locations where no renewable power plant was operated prior to the implementation of the project activity (green-field plant). Hence, pre-project scenario and baseline scenario are the same. further details of baseline scenario is described in Section 2.4

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Indian power sector was primarily dominated by the public sector and was regulated by the Electricity (Supply) Act, 1948 until the amendment of the act in 1991 to create the provision for private generating companies to setup projects. This was replaced by the Electricity Act, 2003 which is the applicable regulation for the project activity. However, the Electricity Act, 2003 did not provide any incentive to less GHG-intensive technologies.

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

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 Project activity conforms to all the applicable laws and regulations in India, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. The project activity comes under white category, thus there shall be no necessity of obtaining the Consent to Operate” for White category of industries. Since project activity falls under white category and the non-polluting nature of project fulfils the 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

KERC Regulations. Codes (<https://kerc.karnataka.gov.in/27/regulations/en>)

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

- Power generation using renewable energy is not a legal requirement or a mandatory option*
- There are state and sectoral policies, framed primarily to encourage Renewable 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*

Thus, the project is in compliance with laws and regulations required. There is no mandatory requirement to implement the project activity. Thus, the present national and/or sectoral policies and circumstances toward installation of any electricity generation is similar compared to at the time of project registration. Thus, baseline of this project has not changed.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

All the 24 WTGs of this project activity are registered under CDM Project activity as follows:

Project Title: Wind Energy Project in Harapanahalli, Karnataka

UNFCCC Registration Number: 6390¹

Crediting period: 01 Jun 13 - 31 May 20 (Renewable)

Renewal Status: Renewal of crediting period of the CDM has been successfully registered

Duration of 2nd crediting period: 01 Jun 20 - 31 May 27

There is no issuance of CERs from any crediting periods mentioned above.

1.15.2 Projects Rejected by Other GHG Programs

The project activity has been registered under CDM. Apart from CDM, it has neither applied nor been rejected under any other GHG program.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The host country regulations do not require the project proponent to comply with any emissions trading program or meet any binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

The project proponent neither has nor intends to generate any other form of GHG-related environmental credit under CDM or any other program for GHG emission reductions claimed under the VCS Program for this particular project activity.

1.16.3 Supply Chain (Scope 3) Emissions

The project activity is a registered Wind Power Project. Hence supply chain (scope 3) emissions are not applicable.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project is already registered with VCS and currently undergoing renewable of crediting period (RCP) and verification for the period 01/01/2021 to 30/09/2022. The contribution of this project activity in terms of following four indicators of sustainable development as stipulated by the National CDM Authority (NCDMA) of India is provided below:

¹ <http://cdm.unfccc.int/Projects/DB/LRQA Ltd1339417262.04/view>

Social wellbeing:

Since, the project activity is in a rural area, it will aid in the development of the region by generating direct and indirect employment opportunities for the local people. The project activity will also cause development of infrastructure like roads which will benefit the population in the nearby areas.

Economical wellbeing:

The project has created a business opportunity for local stakeholders such as suppliers, manufacturers, contractors etc. Use of wind as a source of energy reduces the dependence on imported fossil fuels like coal and associated price variation thereby leading to increased energy security. It will also narrow the existing electricity supply gap in the State of Karnataka as well as India.

Environmental wellbeing:

Since, the project uses renewable source for power generation; it does not lead to any greenhouse gas emission. Avoidance of fossil fuel consumption results in reduction of Sulphur oxides (SO_x), Oxides of nitrates (NO_x) and particulate matter emission thus avoiding air pollution. The project activity is a step towards environmental sustainability by preventing exploitation and depletion of a natural, finite and non-renewable resource (fossil fuels). Consumption of large quantities of water that is required in generation of electricity in current mix of power plants is avoided.

Technological wellbeing:

The technology leads to utilization of environmentally safe and sound technologies in power sector. The project harnesses wind power potential in the region and encourages setting up such projects in near future. Increased interest in wind energy projects will encourage Research & Development efforts by technology providers to develop more efficient and better equipment in future..

1.17.2 Sustainable Development Contributions Activity Monitoring

The project activity contributes towards sustainable development but PP does not monitor the sustainable development contributions. Hence, PP has not reported the SD contribution below:

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
Sequential row number	SDG Target number	Number and text of SDG indicator or, if no official SDG indicator is applicable, user-defined indicator	Indicate the project's contribution to the SDG Indicator (implemented activities to increase or decrease)	Brief description of the quantifiable impact of the project's activities related to the SDG indicator, during the monitoring period.	Brief description of the cumulative quantifiable impact of the project's activities related to the SDG indicator, over the project lifetime.

1.18 Additional Information Relevant to the Project

Leakage Management

As per the applied methodology ACM0002 Version 21.0.0, there is no possibility of leakage in the project activity.

Commercially Sensitive Information

There is no commercially sensitive information that has been excluded from the public version of the project description.

Further Information

There is no additional relevant information that has a bearing on the eligibility of the project, the net GHG emission reductions, or the quantification of the project's net GHG emission reductions.

2 SAFEGUARDS

2.1 No Net Harm

In line with Ministry of Environment Forest and Climate Change, Govt. of India, Environmental Impact Assessment (EIA) is not mandatory for wind energy project. However, as per CLP's internal governance system, EIA is mandatory for all projects. Thus, EIA has been conducted before project installation and found that this project does not have any negative environmental and socio-economic impacts. Thus, this is not applicable for this project activity.

2.2 Local Stakeholder Consultation

CLP Wind Farms (India) Private Limited had identified different stakeholders for its wind power project at Harapanahalli in the district Davangere of Karnataka. The meeting was carried out by CLP Wind Farms (India) Private Limited on 01/02/2011 at Harapanahalli Substation. Following are the stakeholders who attended the meeting.

1. Representatives from Vestas India
2. Employees of CLP Wind Farms (India) Private Limited
3. Villagers from nearby villages

All the stakeholders were invited via personal invitation letters and open public notice. During the meeting, representative of CLP Wind Farms (India) Private Limited explained all the stakeholders

about the project activity. He also discussed CLP's aim to generate energy from a renewable source (viz. wind) and how they intended to avail CDM benefits under the Kyoto Protocol.

The Deputy Manager, CLP Wind Farms (India) Private Limited described the project activity to all stakeholders. He further explained the business activities of CLP Wind Farms (India) Private Limited. He described the different reasons of climate change and highlighted the importance of the renewable energy. The representative from Vestas India shared his experience of the project development.

School teachers from nearby schools appreciated the project activity. They expressed their gratitude towards the project developers and project proponents for providing different facilities for schools and students. They also anticipated that such positive initiatives would be taken by CLP Wind Farms (India) Private Limited in near future in their region.

Other villagers mentioned about job opportunities created in their villages due to the project activity. They also revealed that the present project activity has created positive development in their villages in terms of infrastructure, employment and environment.

In summing up, the project has not received any negative or discouraging from the stakeholders. All the stakeholders appreciated and encouraged project proponent to carry out such activity in the region. In view of direct and indirect benefits (social, economic, and environmental), all stakeholders have supported the project activity. Hence, it is not required to take due account of the comments.

This stakeholder consultation was conducted during registration of the project.

Since this is the joint renewal of crediting period and verification of the project activity, hence, additional local stakeholders' consultation details are not applicable in this project activity. Further, As a part of continuous feedback from stakeholders, along with the 3rd party O&M contractor, CLP has also appointed independent Asset Managers at every site. These assets managers are responsible for site supervision and continuous day-to-day interaction with the local stakeholders e.g. local villagers, local govt. authorities and others. Based on the local requirements, CLP has initiated several CSR/sustainable development activities in the project catchment area. Further, CLP has also placed a grievance register onsite where-in, the stakeholders can put down their request/complaint/requirements. Same is continuously monitored and appropriate action are also being taken by management. Furthermore, CLP has also placed a notice board on site to communicate any necessary information/updates to local stakeholders. CLP has found this two-way communication with local stakeholders is very effective towards sustainability of the project in long run. In both the project sites, CLP has not received any complaints from the stakeholders of the project. However, all the stakeholders of the project supported these projects for uninterrupted operations.

2.3 Environmental Impact

According to Indian regulations, the implementation of the wind project does not require an environmental impact assessment. The Ministry of Environment and Forests (Government of India) notification S.O. 1533 (E) dated September 14, 2006 regarding the requirement of Environment Impact Assessment (EIA) studies as per the Environment Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) MINISTRY OF ENVIRONMENT AND FORESTS) states that any project developer in India needs to file an application to the Ministry of Environment and Forests² (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Wind power projects are not included in this list and thus an EIA is not required. Further, the project activity does not have any significant impact on the environment.

2.4 Public Comments

This activity is the renewal of crediting period of this project activity. Thus, this clause is not applicable.

2.5 AFOLU-Specific Safeguards

This section is not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The approved consolidated baseline and monitoring methodology ACM0002 (Version 21), has been used to determine the baseline emissions and emission reduction due to the project activity. The title of this baseline methodology is “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”.

The other UNFCCC documents referred are as below:

1. Tool for the demonstration and assessment of additionality (Version 07.0.0, EB 65)
2. Tool to calculate the emission factor for an electricity system (version 7)
3. Guidance on assessment of investment analysis (05, EB 62)
4. Guidelines on demonstration of and assessment of prior consideration of the CDM (Version 04, EB 62)

² Ministry name is changed as “Ministry of Environment, Forest and climate change (MoEFCC)”. Previously known as “Ministry of Environment and Forests” (MoEF)

3.2 Applicability of Methodology

The methodology being applied for the said project, ACM0002 (Version 21), is applicable to renewable power generation projects. The said project is a wind based renewable energy project and is designed to export the power generated to the grid and is thus suitable for the said methodology. This methodology has certain specific applicability criterion, which are stated and accordingly addressed below:

S.N.	Applicability conditions of ACM0002	Project under consideration
1.	This methodology is applicable to grid-connected renewable energy power generation project activities that: 1. Install a Greenfield power plant; 2. Involve a capacity addition to (an) existing plant(s); 3. Involve a retrofit of (an) existing operating plants/units; 4. Involve a rehabilitation of (an) existing plant(s)/unit(s); or 5. Involve a replacement of (an) existing plant(s)./unit(s)	The project activity is installation of Wind power plant at locations where no renewable power plant was operated prior to the implementation of the project activity (green-field plant). The proposed project activity is a Greenfield, grid connected renewable power project. The project activity uses renewable wind source to generate electricity that will be fed into the Indian grid. In the absence of the project activity this power would have been produced by the current grid generation mix which is predominantly fossil fuel based, thus the project activity meets this criterion.
2.	In case the project activity involves the integration of a BESS, the methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Integrate BESS with a Greenfield power plant; (b) Integrate a BESS together with implementing a capacity addition to (an) existing solar photovoltaic or wind power plant(s)/unit(s); (c) Integrate a BESS to (an) existing solar photovoltaic or wind power plant(s)/unit(s) without implementing any other changes to the existing plant(s);	The proposed project activity involves the installation of a new greenfield wind power generation plant. Therefore, the project activity does not satisfying the said criteria.

S.N.	Applicability conditions of ACM0002	Project consideration under															
	(d) Integrate a BESS together with implementing a retrofit of (an) existing solar photovoltaic or wind power plant(s)/unit(s). Table 2. Combinations of renewable energy technologies and mode of BESS applicable for integration <table border="1"> <thead> <tr> <th>Renewable Energy Technology Mode of installation of BESS</th><th>Solar photovoltaic or wind</th><th>Other renewable technologies</th></tr> </thead> <tbody> <tr> <td>BESS + (a) Greenfield plant(s)</td><td>Eligible</td><td>Eligible</td></tr> <tr> <td>BESS+ capacity addition to existing plant(s)</td><td>Eligible</td><td>Not eligible</td></tr> <tr> <td>BESS with no other changes to the existing plant(s)</td><td>Eligible</td><td>Not eligible</td></tr> <tr> <td>BESS + retrofit to existing plant(s)</td><td>Eligible</td><td>Not eligible</td></tr> </tbody> </table>	Renewable Energy Technology Mode of installation of BESS	Solar photovoltaic or wind	Other renewable technologies	BESS + (a) Greenfield plant(s)	Eligible	Eligible	BESS+ capacity addition to existing plant(s)	Eligible	Not eligible	BESS with no other changes to the existing plant(s)	Eligible	Not eligible	BESS + retrofit to existing plant(s)	Eligible	Not eligible	
Renewable Energy Technology Mode of installation of BESS	Solar photovoltaic or wind	Other renewable technologies															
BESS + (a) Greenfield plant(s)	Eligible	Eligible															
BESS+ capacity addition to existing plant(s)	Eligible	Not eligible															
BESS with no other changes to the existing plant(s)	Eligible	Not eligible															
BESS + retrofit to existing plant(s)	Eligible	Not eligible															
3.	The methodology is applicable under the following conditions: (a) 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; (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; (c) In case of Greenfield project activities applicable under paragraph 5 (a) above, the project participants shall demonstrate that the	The proposed project activity involves the installation of a new greenfield wind power generation plant. Therefore, the project activity is satisfying the said criteria.															

S.N.	Applicability conditions of ACM0002	Project consideration under
	BESS was an integral part of the design of the renewable energy project activity (e.g. by referring to feasibility studies or investment decision documents); (d) The BESS should be charged with electricity generated from the associated renewable energy power plant(s). Only during exigencies may the BESS be charged with electricity from the grid or a fossil fuel electricity generator. In such cases, the corresponding GHG emissions shall be accounted for as project emissions following the requirements under section 5.4.4 below. The charging using the grid or using fossil fuel electricity generator should not amount to more than 2 per cent of the electricity generated by the project renewable energy plant during a monitoring period. During the time periods (e.g. week(s), months(s)) when the BESS consumes more than 2 per cent of the electricity for charging, the project participant shall not be entitled to issuance of the certified emission reductions for the concerned periods of the monitoring period.	
4.	In case of hydro power plants, one of the following conditions shall apply³: 1.The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or 2.The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (7), is greater than 4 W/m²; or 3.The project activity results in new single or multiple reservoirs and the power	Not applicable as the proposed project activity involves electricity generation by installation of a wind power generation plant/unit. As the criteria are related to hydro power project, therefore, the said criteria are not applicable.

³ Project participants wishing to undertake a hydroelectric project activity that results 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.

S.N.	Applicability conditions of ACM0002	Project consideration under
	density, calculated using equation (7), is greater than 4 W/m²; or 4. The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m², all of the following conditions shall apply: 1. The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m²; 2. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; 3. Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m² shall be: 1. Lower than or equal to 15 MW; and 2. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
5.	In the case of integrated hydro power projects, project proponent shall: 1. 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 2. 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	Not applicable as the proposed project activity involves electricity generation by installation of a wind power generation plant/unit. As the criteria are related to hydro power project, therefore, the said criteria are not applicable.

S.N.	Applicability conditions of ACM0002	Project consideration under
	power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum of five years prior to the implementation of the CDM project activity.	
6.	The methodology is not applicable to: 1. 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; 2. Biomass fired power plants/units	The proposed project activity involves installation of a wind power plant. As the given criteria. are related to switching from fossil fuel and biomass fired power plants, therefore, the said criteria are not applicable.
7.	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 involves the installation of a new wind power plant. Hence, this is a greenfield project. Thus, criterion is not relevant to the project activity, thus, not applicable.
8.	In addition, the applicability conditions included in the tools referred to below apply.	Please refer tables below:

Applicability Criteria	Project Case
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).	The project is a grid connected Greenfield wind power project and thus the tool is applicable.
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 II.a and option II.b. If option II.a 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.	Steps involved in calculation of Emission Factor are included below in section 4.1 as per the requirement of the tool.
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.	Project is located in non-Annex I country and hence the tool is applicable
Under this tool, the value applied to the CO ₂ emission factor of bio fuels is zero.	The project is a wind project and there is no involvement of biofuels

In light of the above discussion it can be stated that the present project activity is in compliance with the applicability condition stipulated in the approved consolidated baseline and monitoring methodology ACM0002, Version 21.

3.3 Project Boundary

According to ACM0002 for the baseline emission factor, the spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

Power generation and supply is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Depending on the demand and generation, there are electricity exports and imports between states in the Indian grid. A small power exchange also takes place with neighbouring countries like Bhutan and Nepal.

Since the proposed project activity is a wind power project according to the methodology, the baseline emission sources are limited to the CO₂ emissions from the power plants displaced by the project activity.

Haraknal Substation,
Harapanahalli for
metering of energy
with main meter and
check meter

All other Power plants
connected to Indian

Integrated
Indian Grid

Representation of the Project Boundary

Source		Gas	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are	CO2	Yes	This is the main emission source because the combustion of fossil fuels for electricity generation leads to emission of CO2.

	Source	Gas	Included?	Justification/Explanation
Project	displaced due to the project activity.	CH ₄	No	This is a minor emission source because the emission of CH ₄ from the combustion of fossil fuels is low.
		N ₂ O	No	This is a minor emission source because the emission of N ₂ O from the combustion of fossil fuels is low.
	Electricity generation from the wind power Project	CO ₂	No	Wind energy generation does not have any direct GHG emissions.
		CH ₄	No	
		N ₂ O	No	

3.4 Baseline Scenario

The proposed project is located in the state of Karnataka, which is a part of Integrated Electricity Grid of the Indian electricity system. Generated power from the project activity will be exported to the integrated Indian Electricity Grid. The proposed project activity is the installation of a new wind power project and is not a modification/retrofit of an existing grid-connected renewable power plant/unit. Thus, the methodology ACM0002 Version 21 clearly states that if the proposed project activity is the installation of a new grid-connected renewable power unit/plant, the baseline scenario is the following:

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 proposed CDM project activity the electricity delivered to the grid by the project would be generated in the future by the continued operation of grid-connected power plants and by the addition of new generation sources to meet the existing and future power requirement.

Accordingly, the baseline is all the generation sources connected to the Integrated Indian grid to which the power generated by the proposed project activity would be exported. This consists of the existing grid mix along with newly built additions to the grid and is calculated based on data published by the Central Electricity Authority, Government of India under the CO₂ Baseline Database (Version 18.0)⁴.

In line with the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (EB66 Annex 47), the demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have been resulted from that scenario. The “CDM project standard for project activities” (Version 03.0) states in paragraph 284 that project participants shall assess and incorporate the impact of national and/or sectoral policies

⁴ <https://cea.nic.in/cdm-co2-baseline-database/?lang=en>

and circumstances existing at the time of requesting renewal of the crediting period, on the current baseline GHG emissions, without reassessing the baseline scenario.

As such and in accordance with above Tool and ACM0002 Version 21, the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” is applied for the demonstration of the validity of the current baseline;

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

The validity of the current baseline is assessed using the following sub-steps:

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

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 Project activity conforms to all the applicable laws and regulations in India, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. The project activity comes under white category, thus there shall be no necessity of obtaining the Consent to Operate” for White category of industries. Since project activity falls under white category and the non-polluting nature of project fulfils the compliance to the local laws and regulations.

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

1. Electricity Act 2003
2. National Electricity Policy 2005
3. Tariff Policy 2006
4. TNERC Regulations. Codes (<http://www.tnerc.gov.in/website/Regulation.aspx>)

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

1. Power generation using renewable energy is not a legal requirement or a mandatory option
2. There are state and sectoral policies, framed primarily to encourage Renewable power projects
3. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments
4. The Indian Electricity Act, 2003 (May 2007 Amendment) does not influence the choice of fuel used for power generation
5. There is no legal requirement on the choice of a particular technology for power generation

Thus, the project is in compliance with laws and regulations required. There is no mandatory requirement to implement the project activity. Thus, the present national and/or sectoral policies and circumstances toward installation of any electricity generation is similar compared to at the time of project registration. Thus, baseline of this project has not changed.

Step 1.2: Assess the impact of circumstances

An assessment of the impact of circumstances exists at the time of requesting renewal of the crediting period on the current baseline emissions has been conducted, without reassessing the baseline scenario. The emission factor for the Indian grid as well as the current grid matrix in the country has been revised. Accordingly, Baseline CO₂ Emission Database, Version 18, published by Central Electricity Authority (CEA), Government of India has been used for estimation of baseline emissions.

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

Since the project activity is a Greenfield project with a life time of 20 years, the baseline scenario identified during the validation of the project was electricity generation in power plants which are connected to Indian Integrated grid, that are displaced due to the project activity and was not the continued use of the current equipment(s) or investment for the crediting period of which the renewal is being requested. Hence this sub step is not applicable for this project activity.

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

The emission factor for the grid as well as the current grid matrix in the country has been revised. Accordingly, Baseline CO₂ Emission Database, Version 18, published by Central Electricity Authority (CEA), Government of India has been used for estimation of baseline emissions.

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

As a result of Step 1.4 above, this Step 2 is applied.

Step 2.1: Update the current baseline

Based on the latest approved ACM0002 and the assessment results of Steps 1.1, 1.2 and 1.4 above, the current baseline has been updated.

Step 2.2: Update the data and parameters

In line with Step 1.4, the following data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are updated according to relevant data sources listed in table below. All parameters regarding the grid emission factor are updated in the second crediting period. These data and parameters are applied to calculate the grid emission factors are described under section B.6.2 as well as described below;

As per the approved consolidated Methodology ACM0002 (Version 21) para 22:

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

The project activity involves setting up of wind project to harness the power of wind to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the Indian grid, which is fed mainly by fossil fuel fired plants. In the absence of the project activity, the equivalent amount of power would have been drawn

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

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source⁵ (where available) and made publicly available. Since the project activity is a new grid-connected power plant, the above stated baseline is applicable for the project. Further, as per paragraph 39, Baseline emissions include only CO₂ 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:

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

Where:

$$BE_y = \text{Baseline emissions in year y; (t CO}_2\text{)}$$

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

$$EF_{grid,y} = \text{Combined margin CO}_2\text{ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO}_2\text{/MWh)}$$

$$EG_{PJ,y} = EG_{PJ,facility,y} \quad (\text{for Greenfield projects and as per paragraph 41 methodology ACM0002,(Version 21)})$$

Where,

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

As per ACM0002 Version-21, The emission factor can be calculated in accordance with the procedure provided in the "Tool to calculate the emission factor for an electricity system", Version 7.0.

Following information would be used for the calculation of baseline emissions:

1. Net electricity supplied by the project activity to the grid in year y taken from monthly Energy Statement / Joint Meter Reading sheets
2. CO₂ Baseline Database (Version- 18) published by Central Electricity Authority (CEA), Government of India under Baseline Carbon Dioxide Emissions from Power Sector

⁵<http://cea.nic.in/tpeandce.html>

Sr. No.	Parameters	Unit	Value	Reference
1.	$EF_{grid,OM,y}$	tCO ₂ /MWh	0.9518	Operating margin CO ₂ emission factor for the project electricity system. The value is calculated for year 2019-20, 2020-21 and 2021-22.
2.	$EF_{grid,BM,y}$	tCO ₂ /MWh	0.8687	Build margin CO ₂ emission factor for the project electricity system. The value is calculated for year 2021-22
3.	$EF_{grid,CM,y}$	tCO ₂ /MWh	0.9310	Combined margin CO ₂ emission factor for the project electricity system

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

The Combined Margin has been calculated using the “Tool to calculate the emission factor for an electricity system” Version 07. The Operating Margin (OM) and Build Margin (BM) emission factors have been considered from the information (CO₂ Baseline Database for the Indian Power Sector -Version 18.0) published by the Central Electricity Authority (CEA), Ministry of Power, Govt. of India which has been computed according to the procedures prescribed in the ‘Tool to calculate the emission factor for an electricity system’, version 07. Considering the individual weightings assigned to the OM and the BM emission factors, the combined margin emission factor for the Integrated Indian Grid has been estimated at 0.9310 tCO₂e/MWh.

3.5 Additionality

The additionality of the project is ascertained in line with the applicable guidance from the UNFCCC. Accordingly, the decision 17/cp.7, paragraph 43 is consulted; which states a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in absence of registered CDM project activity.

The demonstration of the additionality of the said 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 7.0.0. This tool provides a step-wise approach to demonstrate additionality, which is dealt with below:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations**Sub-step 1a: Define alternatives to the project activity:**

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

The proposed project activity envisages the installation of 24 WTGs of Vestas V-82 make, with each WTG having a capacity of 1650 kW. The project activity will have a total installed generation capacity of 39.6 MW. Thus, in view of the purpose of the project activity being to generate electrical power to be fed to the grid, the following alternatives are considered:

Alternative 1 - The proposed Project activity not undertaken as a CDM project activity.

The Project Proponent would have gone ahead with the implementation of the Project without CDM benefits. The Project would have produced electricity from the renewable source and the generating electricity would have been sold to the grid. This is in compliance with all applicable legal and regulatory requirements and can be a part of the baseline. However, the project activity is not feasible enough without CDM revenues. This argument has been discussed in step 2 of the Additionality section.

Alternative 2: No Project activity and equivalent amount of energy would have been produced by the Project grid electricity system through its currently running power plants and by new capacity addition to the grid i.e. Continuation of current situation

The Project Proponent would have continued without investment in Project activity and would have continued with usual business activities. The grid could have continued with the fossil fuel based power projects and thus there would also be the associated GHG emissions. Thus new capacity add-on from a fossil fuel based power plant is the most probable baseline alternative for the project.

Outcome of Sub-step 1a:

All the credible and realistic alternatives for the project activity have been mentioned above and Alternative 2 has been selected as the appropriate baseline alternative.

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 regulation pertaining to generation of energy are:

- (1) Electricity Act 2003
- (2) National Electricity Policy 2005

(3) Tariff Policy 2006

(4) 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 above are found to comply with the mandatory legislation and regulations taking into account the enforcement of in the region or country and EB decisions on national and/or sectoral policies and regulations.

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 certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps:

Sub-step 2a: Determine appropriate analysis method.

The Project activity envisages the export of the power generated by the WTGs to the grid and the revenues from the sale would be generated in accordance with the terms and tariffs established in the PPA. Thus, simple cost analysis cannot be used as the analysis method as the sale of the units of generated electricity shall result in a revenue stream during the operations of the project.

After eliminating Option I, the use of Benchmark analysis (Option III) is the method of analysis that has been selected as the most suitable method. This method determines the attractiveness of the project activity for the investors, as well as provides a measure of the viability of the investment to generate revenues during its operation, as compared with other avenues and investment options. Hence, the Benchmark analysis method is to be employed for analysis of the said project.

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

The investment analysis using Benchmark analysis (Option III) is determined to be the most accurate indicator of the financial attractiveness of the project. Further, this method illustrates the evaluation of the project by the Project Proponent before the decision to undertake the project was taken and management approval granted.

CLP wind Farms (India) Pvt Ltd follows a business model of an Independent Power Producer (IPP) which is different as compared to other small scale investors (who largely investing in the wind power sector for availing tax benefits due to accelerated depreciation & other such incentives). The typical CLPWFPL business model is described in brief below:

CLPWFPL selects the number of locations out of the proposed site/locations. This selection is based on the Energy output/ wind assessment carried out by third party. Size of the project gets determined by selecting locations from the site offered to CLPWFPL that gives the optimum output. CLPWFPL selects the location from proposed sites for the optimum output.

Choice of Financial Indicator:

As allowed by the Guidance on the Assessment of Investment Analysis (Version 05), Equity Internal Rate of Return (Post Tax) was selected as the financial indicator to assess the attractiveness of the project.

Choice of Benchmark:

The Project Proponent has conducted financial analysis taking the Equity IRR as the financial indicator to prove additionality.

As per paragraph 12 of the Guidance on the Assessment of Investment Analysis (Version 5.0) “Required/expected returns on equity are appropriate benchmarks for an equity IRR.” The return on equity has been calculated using the Capital Asset Pricing Model (CAPM). The following formula has been used:

Expected Return on Equity = $R_f + \beta * (R_m - R_f)$ Where:

R_f = Risk free rate of return

β = Beta

R_m = Expected Return of the market

In order to calculate the benchmark for the Equity IRR, following steps have been undertaken:

Risk free rate of return (R_f):

The Yield-To-Maturity (YTM) of SGL transactions in central government dated securities for 20 Yr

Maturity at the end of June 2010⁶(viz. 8.2307%) has been considered as the risk free rate of return (R_f).

Beta (β): The beta (β) for this project has been calculated taking the variance in the market (BSE 500) and variance in stocks (For a set of comparable companies engaged predominantly in the business of power generation) for a period of five years (60 months) prior to the decision making date.

The list of companies used for comparison is as below:

Sr. No	Company Name
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⁶ http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/26CT_BU090810_F.pdf

1	CESC Ltd.
2	Gujarat Industries Power Co.Ltd.
3	Neyveli Lignite Corpn.
4	BF Utilities
5	Reliance Infrastructure Ltd.
6	Tata Power Co. Ltd.
7	Torrent Power Ltd.
8	Jaiprakash Power Ventures Limited
9	NTPC

Note: For some companies which do not have data available for 60 months prior to decision making date, the β has been calculated using the data available from the date of listing on the stock exchange. The companies which were listed for a period of less than 24 months at the time of decision making, have been excluded in this analysis. Based on the calculations, the average β for these companies comes out to be 1.38. After removing certain outliers (companies with $\beta > 1.4$), an average β of 1.0642 has been arrived at for the project. This is conservative.

Return on market (Rm):

This is calculated based on BSE 500 close value for base year (February 1999) and data prior to decision making (June 2010). Using Compound Annual Growth Rate (CAGR) formula,

$$Rm = (7092.2/1000)^{(1/11.41)} - 1 = 18.72\%$$

This beta (β), return on market (Rm) and risk free rate of return (Rf) has been used in the standard Capital Asset Pricing Model (CAPM) formula to arrive at a benchmark for comparing the Equity IRR i.e Return on Equity (ROE). Using the above values in the CAPM formula, benchmark has been calculated as 19.40%.

Equity IRR:

The Equity IRR has been calculated to be 7.54%. The key assumptions/parameters used for this calculation are listed in the table below:

Particulars	Value	Unit	Source
No. of wind turbines	24	Nos	Vestas Proposal
Capacity of each wind turbine	1.65	MW	Vestas Proposal
Capacity of the project	39.6	MW	Calculated
Net Generation	81.20	Million units	Third party Assessment Report, page 69, Table
Plant Load Factor	23.41	%	Calculated
Project Cost	2316.00	INR Million	Vestas Proposal and other supporting
Debt	70	%	As per CLP Group's earlier
Equity	30	%	As per CLP Group's earlier
Debt	1,621.20	INR Million	Calculated

Particulars	Value	Unit	Source
Equity	694.80	INR Million	Calculated
Interest rate	11.25	%	As per CLP Group's earlier
Debt tenure	12	Years	As per CLP Group's earlier
Moratorium	0	Year	As per CLP Group's earlier
Operation and Maintenance (first 3 years)	0	INR Million	Vestas proposal
Operation and Maintenance (4th year)	40.80	INR Million	Vestas proposal
Escalation in O & M (5 to 20)	5	%	Vestas proposal
Service tax on O & M fees	10.30	%	As per prevalent service tax
Insurance cost per turbine	0.07227	INR Million	As per quotation received from insurance brokers
Insurance cost for the project	1.73	INR Million	Calculated
Tariff	3.70	INR/kWh	Karnataka Electricity Regulatory Commission (KERC)'s tariff order for non-conventional energy
Depreciation Rate (Book)	5.28	%	Indian Companies Act
IT Depreciation Rate	7.69	%	Appendix IA of Income Tax
Generation Based Incentive (GBI)	0.5	INR/kWh	Ministry of New and Renewable Energy (MNRE)'s Generation Based Incentive (GBI)
GBI cumulative cap	6.20	INR Million	MNRE GBI scheme/ IREDA
Max. GBI allowed in a year	1.55	INR Million	MNRE GBI scheme/ IREDA
Max. GBI allowed in a year	61.38	INR Million	MNRE GBI scheme/ IREDA
GBI cumulative cap	245.52	INR Million	MNRE GBI scheme/ IREDA
Max duration for GBI	10	Years	MNRE GBI scheme/ IREDA
Income tax rate	33.22	%	IT rate
MAT rate	19.93	%	Finance Bill 2010
Salvage Value	5.00	%	Assumed

Sub-step 2c: Sensitivity Analysis:

As per guidance provided in the latest version of “Tool for the demonstration and assessment of additionality”, the variables, including the initial investment cost, that constitute more than 20% of

total project costs or total project revenues have been identified and subjected to a reasonable variation and the results of this variation have been presented below:

Change in net generation	+10%	0%	-10%
Equity IRR	10.54%	7.54%	3.76%
Change in Power Sale tariff	+10%	0%	-10%
Equity IRR	10.49%	7.54%	3.78%
Change in O&M Cost	+10%	0%	-10%
Equity IRR	7.06%	7.54%	8.00%
Change in Total Project Cost	+10%	0%	-10%
Equity IRR	4.68%	7.54%	10.56%

The purpose of the sensitivity analysis is to demonstrate the sensitivity of the returns from the project activity due to uncertainty in plant load factor, capital cost and Operation and Maintenance (O&M) costs for the project. This is an assessment of the impact of variations in above parameters from the assumed/design values and represents magnitude of the sort of effects these variations may have on the returns from the project.

The break-even point (scenario when the Equity IRR crosses the benchmark) has also been calculated for all the above parameters. Since a significant increase/decrease (at least 30%) in the respective parameters demonstrated above is required for Equity IRR to cross the benchmark, the likelihood of occurrence of such a scenario is low.

It can be observed from above table that in various scenarios wherein there are changes in tariff, O&M cost, net saleable units and project's capital cost, the Equity IRR does not cross the benchmark. Thus, it can be concluded that revenue from sale of CERs is important to alleviate this gap and hence the project has been considered to be additional.

Step 4 – Common practice Analysis

In the context of the present project activity, the following parameters are defined in line with paragraphs 5 – 10 of this approved methodological tool:

Measure: As per paragraph 6, the project activity falls under the following measure:

“(b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);”

Output: As per paragraph 7, “power generation” may be considered to be the output in the context of the project activity. Further as per Step 1 of paragraph 47 of the same tool, the applicable output range will be 19.80 MW to 59.40 MW, i.e. $\pm 50\%$ of installed capacity of the project activity (39.6 MW)

As per Guidelines on Common Practice EB 63, Annex 12 the following Stepwise approach for Common Practice has been followed for the project activity.

Step 1: Calculate applicable output range as $\pm 50\%$ of the design output or capacity of the proposed project activity

The capacity of the project activity is 39.6 MW. The project capacity has been subject to the variation in the range of +/- 50%, the following table depicts the outcome of the variation applied. Hence, the applicable output range will be 19.80 MW to 59.40 MW, i.e. $\pm 50\%$ of installed capacity of the project activity (39.6 MW)

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{allR} . Registered CDM project activities shall not be included in this step.

India has been considered applicable geographical area as a default, for the common practice analysis of project activity. All power plants generating electricity within the capacity range of 19.6 MW to 59.4 MW and having commercial operations date before project activity start date(27/07/2010) have been considered. The power generation plants identified in this step are hydro, thermal, nuclear, solar, biomass and wind power projects. The total number of power plants is 439.

Category of Power plants	No. of Projects
Thermal (Including Coal, Gas, Naptha, Lignite and Liquid fuel)	140
Hydro	222
Wind	9
Nuclear	0
Solar	0
Biomass	68
Total (N_{allR})	439

Therefore $N_{allR} = 439$.

Registered/Under Validation CDM project activities have been excluded in this step.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff} .

In accordance with Guidelines on Common practice following criterion has been used to arrive at the number of different technology power plants;

Different technologies in the context of the project activity:

Energy Source / Fuel:

The project activity involves electricity generation from wind. The other project activities using water (Hydro), conventional fuels (Coal, Lignite, Natural Gas & Liquid Fuel based – Thermal), Nuclear, Biomass and Solar as energy sources for the generation of electricity respectively are considered as plants with different technologies and included under N_{diffR} .

The N_{diff} value is thus arrived at as tabulated below:

Category of Power plants	No. of Projects
Thermal (Including Coal, Gas, Naptha, Lignite and Liquid fuel)	140
Hydro	222
Wind	0
Nuclear	0
Solar	0
Biomass	68
Total (Ndiff)	430

Step 4: Calculate factor $F = 1 - N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity

NR_{all}	439
NR_{diff}	430
$NR_{all}R - NR_{diff}$	9
$NR_{diff}R/NR_{all}$	0.9795
$F = 1 - NR_{diff}R/NR_{all}$	0.0205

The factor F and $N_{all} - N_{diff}$ is calculated and following values are arrived at; $F = 0.0205$;

$N_{all} - N_{diff} = 9$

As value of F is less than 0.2, it can be concluded that the project activity is not a common practice in the applicable geographical area.

Awareness of CDM and Seriousness of CDM consideration

As per paragraph 6(a) of the latest version 04 of the “Guidelines on the demonstration and assessment of prior consideration of CDM”, Annex 13, EB 62, Project Participants must indicate awareness of CDM and that CDM was a decisive factor for investment in the project.

It can be noted that the PP already has various projects under the CDM cycle and hence they were well aware of CDM prior to conceptualization of this particular project activity.

With respect to this project activity, right at the outset, while the PP (Project Proponent) was analyzing the feasibility of investing in wind power in Karnataka, the intention was always to take the project forward as a CDM initiative. The board resolution taken by PP’s board clearly spells out the PP’s intentions of taking up the wind project as a CDM project.

The chronology of events related to the project activity and the efforts of the project proponent to secure CDM funding for the project activity are summarized below:

Sl. No.	Event	Date
1	Board Decision to implement the project	27/07/2010
2	Intimation to UNFCCC & DNA for the CDM project	17/08/2010
3	Signing of Power Purchase Agreement (PPA) with Bangalore Electricity Supply Company (BESCOM)	28/12/2010
4	Commissioning of Phase – I	21/01/2011
5	Commissioning of Phase – II & III	28/02/2011
6	Appointment of CDM Consultant	16/03/2011
7	Appointment of DoE	01/04/2011

3.6 Methodology Deviations

There are no deviations from the applied baseline and monitoring methodology ACM0002 Version 21 “Grid-connected electricity generation from renewable sources”.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

The Project Activity envisages implementation of a 39.6 MW wind power project consisting of 24 Wind Turbine Generators (WTGs) of individual capacity 1.65 MW in Karnataka state of India by CLP Wind Farms (India) Private Limited.

The project has been under operation since commissioning without any major breakdowns. Though normal breakdowns due to O&M measures are continuously being worked upon by the dedicated O&M contractor for the project’s WTGs. There have been no events that may have an impact on the GHG emissions or removals during the current monitoring period.

Further, there are no changes to the project participant for the project activity during the monitoring.

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per ACM0002 Version 21.0, Baseline emissions include only CO₂ 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:

$$BE_y = EG_{PJ, y} * EF_{grid, CM, y} \quad (1)$$

Where:

BE_y Baseline emissions in year y (tCO₂)

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

$EF_{grid, CM, y}$ Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO₂e/MWh)

Calculation of $EG_{PJ, y}$

The methodology ACM0002 (Version 21) has procedures for calculation of $EG_{PJ, y}$ for the following cases:

- (a) Greenfield plants,
- (b) Capacity addition to wind, solar, wave or tidal plant
- (c) Capacity addition to hydro or geothermal power plant
- (d) Retrofit or rehabilitation or replacement of an existing renewable energy power plant

The proposed VCS project activity are Greenfield plants, option (a) as provided in the methodology ACM0002 (Version 21) shall be applicable and is described below:

“If the project activity is the installation of a new grid-connected renewable power plant:

$$EG_{PJ, y} = EG_{facility, y} \quad (2)$$

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)”

Calculation of $EF_{grid, CM, y}$

The methodology ACM0002 (Version 21.0) 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”, Version 7.0.

As per version 7 of Tool to calculate emission factor for an electricity system, following steps are included in the calculation of the emission factor for the baseline scenario:

Step1. 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) emissions factor.

The Central Electricity Authority (CEA) has published CO₂ baseline database in its Version 18. The values for OM, BM, CM are given excluding and including imports. For the present project activity, including imports are considered.

Step 1: Identifying the relevant electricity system

The tool defines that “for the purpose of 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. In April 2016, the Southern grid has also been synchronized with the NEWNE grid, hence forming one unified Integrated Indian Grid. The project activity is located in the state of Karnataka which come under Integrated Indian grid system. 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 may choose between the following two options to calculate the operating margin and build margin emission factor:

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

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

The project participant has chosen Option I for the calculation of the operating and build margin emission factor i.e. off-grid power plants are not being included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods which are described under step 4 (Refer “Tool to calculate the emission factor for an electricity system”, version 07.0):

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

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. The low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Thus, for the proposed project activity simple OM method has been chosen to calculate the operating margin emission factor ($EF_{grid, OM, y}$).

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the Integrated Indian grid in India in the last five years is as follows:

Grid	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Integrated Indian Grid	15.1%	14.6%	14.3%	14.5%	17.0%	16.5 %

Source: CEA Baseline Carbon Dioxide Emission Database Version 18

Ref: CO₂ Baseline Database for the Indian Power Sector – CEA, Version 18 (<https://cea.nic.in/cdm-co2-baseline-database/?lang=en>)

In Indian Grid, the low-cost/must run resources vary from 14.3% to 17.0% of the total net grid generation (From Year 2015-16 to Year 2019-20). The calculation above shows that the generation from low-cost/must-run resources always constitutes less than 50% of total grid generation, hence usage of the Simple OM method in the project case is justified.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

As observed in the CEA database, (Version 18) the percentage of total grid generation by low-cost/must-run plants (on the basis of average of six most recent years) for the Indian grid is much lesser than 50% of the total generation. Thus, Simple OM method has been used for calculating the emission factor.

The project proponents choose the Ex ante option for estimating the simple OM emission factor wherein as described above a 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, without requirement to monitor and recalculate the emissions factor during the crediting period will be undertaken.

Step 4: Calculation of the OM according to the Simple OM method

The simple OM method has been selected as justified above. The simple OM emission factor is calculated based on the net electricity generation of each power unit and a CO₂ emission factor for each power unit, as follows:

$$EF_{grid,OM, simple, y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM, simple, y}$	=	Simple operating margin CO ₂ emission factor of in year y (tCO ₂ /MWh)
$FC_{i,m,y}$	=	Amount of fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fuel type i in year y (GJ / mass or volume unit)
$EF_{CO_2,i,y}$	=	CO ₂ emission factor of fuel type i in year y (tCO ₂ /GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power unit m in year y (MWh)
m	=	All power units serving the grid in year y except low-cost / must-run power units
i	=	All fuel types combusted in power plant / unit m in year y
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

In India, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. This data is the most authentic information available in the public domain. The details of same can be found on CEA website at <http://cea.nic.in/tpeandce.html>.

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

Net Generation in Operating Margin (GWh) (incl. imports)		
2018-19	2019-20	2020-21
960,693	995,957	965,009

Simple Operating Margin Emission Factors (tCO ₂ /MWh) (incl. Imports)		
2018-19	2019-20	2020-21
0.9543	0.9685	0.9555

Therefore, weighted OM average for Indian grid comes out to be 0.9518 tCO₂/MWh

i.e. $EF_{grid,OM,y} = 0.9518 \text{ tCO}_2/\text{MWh}$

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

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

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.

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 has been considered for this project activity

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total} , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET_{\geq 20\%}}$, in MWh);

(c) From $SET_{5-units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

In India, the installed capacity and corresponding annual generation from power plants is quite high. The Central Electricity Authority (CEA) has estimated the annual electricity generation from $SET_{\geq 20\%}$ to be larger than the generation from $SET_{5-units}$. The details of same can be found on CEA website at <http://cea.nic.in/tpeandce.html>.

Further, none of the power units in $SET_{\geq 20\%}$ started to supply electricity to the grid more than 10 years ago.

Therefore, SET_{sample} is selected as $SET_{\geq 20\%}$ for the estimation of build margin.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid, BM, sample, y} = \frac{\sum_m EG_{m, y} \cdot EF_{EL, m, y}}{\sum_m EG_{m, y}}$$

Where:

$EF_{grid, BM, y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m, y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL, m, y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

Calculations for the Build Margin emission factor $EF_{grid, BM, y}$ is based on the most recent information available on the plants already built for sample group m at the time of PDD submission. The sample group m consists of the power plant capacity additions in the electricity system that comprise 20 % of the system generation and that have been built most recently

(SET_{≥20%}). PP has sourced the data from CEA website at <http://cea.nic.in/tpeandce.html> and same in inline with the Tool to calculate the emission factor of the electricity system.

Build margin emission factor is calculated, ex-ante as per the most recent data available. So, build margin emission factor for Indian grid for 2021-22 is 0.8687 tCO₂/MWh

$$EF_{\text{grid, BM, y}} = 0.8687 \text{ tCO}_2\text{e/MWh}$$

The build margin emissions factor is the generation-weighted average emission factor (tCO₂e/MWh) of all power units m during the most recent year y for which power generation data is available and will be calculated as follows:

$$EF_{\text{grid, BM, y}} = \frac{\sum_m EG_{m, y} \times EF_{\text{EL, m, y}}}{\sum_m EG_{m, y}} \quad (4)$$

Where:

$EF_{\text{grid, BM, y}}$: Build margin CO₂ emission factor in year y (tCO₂e/MWh)

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

$EF_{\text{EL, m, y}}$: CO₂ emission factor of power unit m in year y (tCO₂e/MWh)

m: Power units included in the build margin

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

As described above, the Build Margin would be calculated annually during the entire crediting period. For the purpose of ex-ante emission reduction calculations the most recent data available (from CEA for 2021-22) has been used and the build margin thus calculated is 0.8687 (tCO₂e/MWh)

Therefore, $EF_{\text{grid, BM, y}} = 0.8687 \text{ (tCO}_2\text{e/MWh)}$

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

The combined margin emissions factor is calculated as follows:

$$EF_{\text{grid, CM, y}} = EF_{\text{grid, OM, y}} \times W_{\text{OM}} + EF_{\text{grid, BM, y}} \times W_{\text{BM}}$$

Where:

$EF_{\text{grid, BM, y}}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{\text{grid, OM, y}}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

W_{OM} = Weighting of operating margin emissions factor (%)

W_{BM} = Weighting of build margin emissions factor (%)

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

- Wind and solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.
- All other projects: $w_{OM} = 0.5$ 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.

As per the 'Tool to calculate the Emission Factor for an electricity system' version 07, the default values for w_{OM} and w_{BM} are taken as 0.75 and 0.25 respectively as per the guidance provided for wind project activities for the first crediting period and subsequent crediting periods.

Hence, the Baseline Emission Factor is calculated using the formula stated below:

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

$$EF_{grid, CM, y} = 0.75 * 0.9518 + 0.25 * 0.8687 \text{ (tCO}_2\text{/MWh)}$$

$$EF_{grid, CM, y} = 0.9310 \text{ tCO}_2\text{/MWh}$$

5.2 Project Emissions

The project activity involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 21, there will be no project emissions in the project activity

$$PE_y = 0.$$

5.3 Leakage

As per ACM0002 Version 21, no leakage has been considered for the calculation of emission factor.

According to ACM0002, No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, & transport).

5.4 Estimated Net GHG Emission Reductions and Removals

Baseline emissions

<i>Parameter</i>	<i>Value</i>	<i>Units</i>	<i>Source</i>
<i>Number of turbines installed</i>	<i>24</i>	<i>Nos.</i>	<i>Installed capacity</i>
<i>Installed Capacity</i>	<i>39.6</i>	<i>MW</i>	<i>Installed capacity</i>
<i>Net Generation</i>	<i>81,200</i>	<i>MWh</i>	<i>Wind Assessment Report by third party</i>
<i>Indian Grid Emission Factor</i> ($EF_{Integrated, grid, CM, y}$)	<i>0.9310</i>	<i>tCO_{2e}/MWh</i>	<i>CEA Database, Version 18.0</i>

Baseline emissions (BE_y) are calculated as follows:

$$\begin{aligned} BE_y &= 0.9310 \text{ tCO}_2\text{e/MWh} \times 81,200 \text{ MWh/year} \\ &= 75,597 \text{ MWh/year} \end{aligned}$$

Project activity emissions

Since, the project activity is a wind power project, there are no project emissions from fossil fuel consumption, release of non-condensable gases or water reservoirs.

$$\text{Hence, } PE_y = 0$$

Emission Reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$$\begin{aligned} ER_y &= \text{Emission reductions in year } y \text{ (t CO}_2\text{e)} \\ BE_y &= \text{Baseline emissions in year } y \text{ (t CO}_2\text{)} \\ PE_y &= \text{Project emissions in year } y \text{ (t CO}_2\text{e)} \end{aligned}$$

$$\begin{aligned} \text{Emission Reductions: } ER_y &= BE_y - PE_y \\ &= 75,597 \quad \text{tCO}_2\text{e} \end{aligned}$$

The ex-ante estimate of baseline emissions, project emissions, leakage emissions and net emission reductions are provided in the table below:

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
21/01/2021 - 20/01/2022	75,597	0	0	75,597
21/01/2022 - 20/01/2023	75,597	0	0	75,597
21/01/2023 - 20/01/2024	75,597	0	0	75,597
21/01/2024 - 20/01/2025	75,597	0	0	75,597
21/01/2025 - 20/01/2026	75,597	0	0	75,597
21/01/2026 - 20/01/2027	75,597	0	0	75,597
21/01/2027 - 20/01/2028	75,597	0	0	75,597
21/01/2028 - 20/01/2029	75,597	0	0	75,597

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
21/01/2029 - 20/01/2030	75,597	0	0	75,597
21/01/2030 - 20/01/2031	75,597	0	0	75,597
Total	755,970	0	0	755,970

6 MONITORING

6.1 Data and Parameters Available at Validation

Data / Parameter	W _{OM}
Data unit	%
Description	Weightage of operating margin emissions factor
Source of data	"Tool to calculate the emission factor for an electricity system"
Value applied:	0.75
Justification of choice of data or description of measurement methods and procedures applied	Default values used as per the "Tool to calculate the emission factor for an electricity system"
Purpose of Data	Baseline Emission calculation
Comments	-

Data / Parameter	W _{BM}
Data unit	%
Description	Weightage of build margin emissions factor
Source of data	"Tool to calculate the emission factor for an electricity system"

Value applied:	0.25
Justification of choice of data or description of measurement methods and procedures applied	Default values used as per the “Tool to calculate the emission factor for an electricity system”
Purpose of Data	Baseline Emission calculation
Comments	-

6.2 Data and Parameters Monitored

Data / Parameter	EF _{grid,CM,y}							
Data unit	tCO2/MWh							
Description	Combined CO ₂ emission factor of Indian Integrated Grid							
Source of data	Central Electricity Authority: CO2 Emission Database CEA CO ₂ Baseline database Version 18.0. ⁷							
Description of measurement methods and procedures to be applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”. The data are obtained from “CO2 Baseline Database for Indian Power Sector” version 18.0 published by the Central Electricity Authority, Ministry of Power, Government of India.							
Frequency of monitoring/recording	Annually during the crediting period for the relevant year							
Value monitored	<table><tr><td>Operating margin CO₂ emission factor (tCO₂/MWh)</td><td>0.9518</td></tr><tr><td>Build margin CO2 emission factor (tCO₂/MWh)</td><td>0.8687</td></tr><tr><td>Weighted Average (tCO₂/MWh)</td><td>= 0.9518* 0.75 + 0.8687 *0.25 = 0.9310</td></tr></table>		Operating margin CO ₂ emission factor (tCO ₂ /MWh)	0.9518	Build margin CO2 emission factor (tCO ₂ /MWh)	0.8687	Weighted Average (tCO ₂ /MWh)	= 0.9518* 0.75 + 0.8687 *0.25 = 0.9310
Operating margin CO ₂ emission factor (tCO ₂ /MWh)	0.9518							
Build margin CO2 emission factor (tCO ₂ /MWh)	0.8687							
Weighted Average (tCO ₂ /MWh)	= 0.9518* 0.75 + 0.8687 *0.25 = 0.9310							
Monitoring equipment	Not applicable							
QA/QC procedures to be applied	The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.							
Purpose of the data	Calculation of Baseline emissions							

⁷ <https://cea.nic.in/cdm-co2-baseline-database/?lang=en>

Calculation method	Calculated as per “Tool to calculate the emission factor for an electricity system”
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.

Data / Parameter	EF _{grid,OM,y}			
Data unit	tCO ₂ /MWh			
Description	Operating margin CO ₂ emission factor of Indian Integrated Grid			
Source of data	Central Electricity Authority: CO2 Emission Database CEA CO2 Baseline database Version 18.0			
Description of measurement methods and procedures to be applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”. The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.			
Frequency of monitoring/recording	Annually during the crediting period for the relevant year			
Value monitored		2019-20	2020-21	2021-22
	Net Generation in Operating Margin (GWh)	965,009	958,218	1,035,672
	Simple Operating Margin (tCO ₂ /MWh)	0.9541	0.9402	0.9605
	Wt. Average (tCO ₂ /MWh)	0.9518		
Monitoring equipment	Not applicable			
QA/QC procedures to be applied	The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.			
Purpose of the data	Calculation of Baseline emissions			
Calculation method	Calculated as per “Tool to calculate the emission factor for an electricity system” version 07			
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.			

Data / Parameter	EF _{grid,BM,y}
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Data unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor of Indian Intergard grid
Source of data	Central Electricity Authority: CO ₂ Emission Database CEA CO ₂ Baseline database Version 18.0
Description of measurement methods and procedures to be applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”. The data are obtained from “CO ₂ Baseline Database for Indian Power Sector” 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Frequency of monitoring/recording	Annually during the crediting period for the relevant year
Value monitored	0.8687
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The data are obtained from “CO ₂ Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of the data	Calculation of Baseline emissions
Calculation method	Calculated as per “Tool to calculate the emission factor for an electricity system” version 07
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.

Data / Parameter	EG _{facility,y}
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Form-B of Karnataka Power Transmission Corporation Limited (KPTCL)
Description of measurement methods and procedures to be applied	These values were monitored through the main meter readings at two outgoing feeders Archiving: Paper/Electronic Responsibility: The plant management was responsible for the regular recording of data. This parameter accounts for the project imports and export, hence showing the net (export – import) electricity supplied to the grid.

Frequency of monitoring/recording	Continuous monitoring and monthly recording
Value monitored	81,200 MWh
Monitoring equipment	The main and check meters have been calibrated and maintained by BESCO as per their own schedule and this frequency of meter calibration is not within the control of the Project Proponent. Accuracy class of Main meter and Check meter: 0.2 Frequency of testing: Once in five years
QA/QC procedures to be applied	Cross check measurement results with records for sold electricity (Invoices raised by CLPWFIPL)
Purpose of the data	Baseline Emissions calculations
Calculation method	The net electricity generated by the project is calculated as the difference between export and import values as recorded at the metering points.
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.

6.3 Monitoring Plan

Vestas Wind Technology India Private Limited is the O&M contractor for the project activity. O&M contractor is responsible for the maintaining all the monitoring data on behalf of state utility in respect of the project activity. The Monitoring and Verification procedures define a project specific standard against which the project's performance (i.e. GHG emissions) and compliance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and techniques for data interpretation, for monitoring and verifying GHG emissions with specific focus on technical/efficiency/performance parameters. It also allows scope for review, scrutiny and benchmarking against established norms for monitoring and verification.

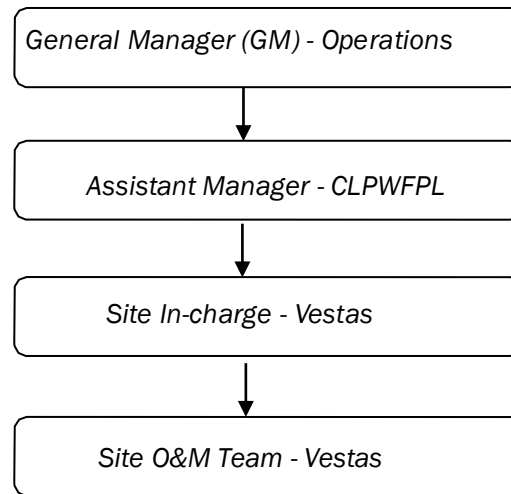
The Monitoring & Verification protocol provides a range of data estimation, measurement and collection options and techniques, in each case indicating preferred options consistent with good practice to allow Asset Manager, Site In-charge and the Site O&M team to apply the most practical and cost-effective measurement approaches to the proposed project activity. The aim is to enable this project to have clear, credible and accurate monitoring, evaluation and verification procedures.

QA/QC Procedure

All the meters are calibrated/ tested once in five years. The calibration is done by the officials of the state utility. The accuracy of monitoring parameter is ensured by adhering to the calibration and testing of the metering equipment once in five years. QA/QC procedures have been as implemented by Discom/ State utility pursuant to the provisions of the power purchase agreement. Vestas Wind Technology provides the daily generation report to the Project

participant. In case the main meter(s) is found to operate outside the permissible limits, the main meter will be either replaced or calibrated immediately. Whenever a main meter goes defective, the consumption recorded by the Check meter will be referred. The project participant, is monitoring the data for electricity generation and calibration reports post project implementation. Vestas Wind Technology is O&M contractor who has responsibility of maintaining electricity generation records, calibration records and maintenance of the WTGs (Wind Energy Convertors). The project participant also maintains the records of daily generation report and joint meter report.

The operation and management structure implemented by the project proponent for the purpose of the project activity is illustrated below:



In present project activity, the electricity being generated by 24 wind turbines is monitored at the dedicated Haraknal substation located at Harapanahalli. In the substation, there are two meters namely- Main Meter and Check Meter (static type Trivector meter, Accuracy class: 0.2). Every month BESCO Official visits the substation in the presence of O&M team of wind turbine supplier (Vestas) and the main meter reading is taken jointly and recorded by BESCO. The said meter readings are reported by the Field Officer to the concerned distribution circle who in turn informs to the consumption circle, which is authorized to prepare the Bill and give the credit for the energy generated by the wind turbines.

Currently the Haraknal sub-station handles only 24 WTGs which are owned by CLPWFL. The meter readings are taken at the sub-station every 24 hours. A 33 kV reference meter is also present which is generally used by KPTCL for comparison. Since the capacity of the wind farm is higher, there is a possibility of more machines (WTGs) being installed and hence the bulk meter may have (in future) more machines connected to it. If this scenario occurs, the following apportioning mechanism will be used:

Apportioning Mechanism

The net electricity recorded at the substation is apportioned to individual WTGs based on the generation at the WTG as per the formula given below:

Electricity exported by WTG to Grid, $EGR_{exp,y}R = (\% \text{ generation of individual WTG connected to feeder}) \times (\text{Electricity Export recorded at substation}),$

Where,

$\% \text{ generation of individual WTG connected to feeder} = (\text{Controller reading @ Individual WTG}) / (\text{Sum of Controller reading of all WTGs connected on feeder})$

Similarly, electricity imported by the WTG from the grid, $EGR_{imp,y}R = (\% \text{ generation of individual WTG connected to feeder}) \times (\text{Electricity Import recorded at substation})$

$$EGR_{facility,y}R = EGR_{exp,y}R - EGR_{imp,y}$$

Emergency Preparedness

In case of Main meter failure or errors, the grid officials would immediately replace the meter with a calibrated meter. There will be two meters provided at the pooling station: a Main Meter and a Check Meter.

Specific Calculation Procedure (For the time period during start and end of each crediting period): For the time period during start and end of each crediting period, the following apportioning formula would be used to estimate the electricity generation for calculating emission reductions:

$X = \text{No. of days between start/end date of crediting period and date of BESCOM's billing cycle}$

$Y = \text{Total no. of days in a particular month for which Form B reading has been taken}$

$Z = \text{No. of units as per Form B for that particular month}$

$$\text{Electricity Generation} = (X/Y) * Z$$

OR alternatively the daily readings taken by the technology supplier at the site will be referred for calculating the generation for X days.

Meter Test Checking:

All the main and check meters shall be tested for accuracy once in every five years with reference to a portable standard meter which shall be of an accuracy class of 0.1. The portable standard meter shall be owned by the BESCOM at its own cost and expense and tested and certified at least once every year against an accepted laboratory standard meter in accordance with electricity standards. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2 accuracy class. The consumption registered by the main meters alone will hold good for the purpose of billing as long as the error in the main meter is within the permissible limits.

- i) If during the tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then billing will be

- as per the main meter as usual. The check meter shall however, be calibrated immediately.
- ii) If during the tests, the main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible limits of error, then the billing for the month up to the date and time of such test shall be as per the check meter. There will be a revision in the bills for the period from the previous calibration test up to the current test based on the readings of the check meter. The main meter shall be calibrated immediately and billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
 - iii) If the during tests, both main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the meters shall be immediately calibrated and the correction applied to the reading registered by the main meter to arrive at the correct reading of energy supplied for billing purposes for the period from the last month's meter reading up to the current test. Billing for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
 - iv) If during any of the monthly meter readings, the variation between the main meter and the check meter is more than that permissible for meters of 0.2% accuracy class, all the meters shall re-tested and calibrated immediately.

The O&M service provider would be responsible for maintenance of the necessary spare parts and consumables for the maintenance of the WTGs such as anemometers, wind vanes and sensors, oil filters, batteries, auxiliary motors and pumps, WTG controllers, slip rings, limit switches and sensors, detergents & solvents etc. The service provider would also be responsible for supply of necessary main components of the WTG such as main gearboxes, blades, generators, towers, hubs, main shafts & bearings, ground and top controller and hydraulic systems. The service provider would also ensure that occupational health and safety procedures are adhered to during the operation & maintenance activities. Calibration Details of billing meters for the project activity are provided in the Appendix 1.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

Data / Parameter	EF _{grid,CM,y}
Data unit	tCO ₂ /MWh
Description	Combined CO ₂ emission factor of Indian Integrated Grid
Source of data	Central Electricity Authority: CO ₂ Emission Database CEA CO ₂ Baseline database Version 18.0. ⁸

⁸ <https://cea.nic.in/cdm-co2-baseline-database/?lang=en>

Description of measurement methods and procedures to be applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”. The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0 published by the Central Electricity Authority, Ministry of Power, Government of India.		
Frequency of monitoring/recording	Annually		
Value monitored	Operating margin CO ₂ emission factor (tCO ₂ /MWh)	0.9518	
	Build margin CO2 emission factor (tCO ₂ /MWh)	0.8687	
	Weighted Average (tCO ₂ /MWh)	= 0.9518* 0.75 + 0.8687 *0.25 = 0.9310	
Monitoring equipment	Not applicable		
QA/QC procedures to be applied	The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.		
Purpose of the data	Calculation of Baseline emissions		
Calculation method	Calculated as per “Tool to calculate the emission factor for an electricity system” version 7.0		
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.		

Data / Parameter	EF _{grid,OM,y}			
Data unit	tCO ₂ /MWh			
Description	Operating margin CO ₂ emission factor of Indian Integrated Grid			
Source of data	Central Electricity Authority: CO2 Emission Database CEA CO2 Baseline database Version 18.0			
Description of measurement methods and procedures to be applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”. The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.			
Frequency of monitoring/recording	Annually			
Value monitored		2019-20	2020-21	2021-22

	Net Generation in Operating Margin (GWh)	965,009	958,218	1,035,672
	Simple Operating Margin (tCO ₂ /MWh)	0.9541	0.9402	0.9605
	Wt. Average (tCO ₂ /MWh)	0.9518		
Monitoring equipment	Not applicable			
QA/QC procedures to be applied	The data are obtained from “CO2 Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.			
Purpose of the data	Calculation of Baseline emissions			
Calculation method	Calculated as per “Tool to calculate the emission factor for an electricity system” version 7.0			
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.			

Data / Parameter	EF _{grid,BM,y}
Data unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor of Indian Intergard grid
Source of data	Central Electricity Authority: CO ₂ Emission Database CEA CO ₂ Baseline database Version 18.0
Description of measurement methods and procedures to be applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07”. The data are obtained from “CO ₂ Baseline Database for Indian Power Sector” 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Frequency of monitoring/recording	Annually
Value monitored	0.8687
Monitoring equipment	Not applicable
QA/QC procedures to be applied	The data are obtained from “CO ₂ Baseline Database for Indian Power Sector” Version 18.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of the data	Calculation of Baseline emissions

Calculation method	Calculated as per “Tool to calculate the emission factor for an electricity system” version 7.0
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.

Data / Parameter	EG _{facility,y}
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Form-B of Karnataka Power Transmission Corporation Limited (KPTCL)
Description of measurement methods and procedures to be applied	These values were monitored through the main meter readings at two outgoing feeders Archiving: Paper/Electronic Responsibility: The plant management was responsible for the regular recording of data. This parameter accounts for the project imports and export, hence showing the net (export – import) electricity supplied to the grid.
Frequency of monitoring/recording	Continuous monitoring and monthly recording
Value monitored	140,613.87 MWh
Monitoring equipment	The main and check meters have been 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. Accuracy class of Main meter and Check meter: 0.2 Frequency of testing: Once in five years
QA/QC procedures to be applied	Cross check measurement results with records for sold electricity (Invoices raised by CLPWFIPPL)
Purpose of the data	Baseline Emissions calculations
Calculation method	The net electricity generated by the project is calculated as the difference between export and import values as recorded at the metering points.
Comments	The data will be archived both in electronic and paper format for crediting period + 2 years.

7.2 Baseline Emissions

The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{\text{Integrated grid,CM, y}}$$

Where:

BE_y = Baseline emissions in year y (tCO_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 project activity in year y (MWh)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for Integrated Indian grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”

Since the project activity is the installation of a new grid-connected renewable power plant/ unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore:

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

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 project activity in year y (MWh)

Baseline Emission (BE_y):

Baseline emissions (BE_y) are calculated as follows:

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

<i>Vintage Period</i>	<i>Net Electricity Export (MWh)</i>	<i>Emission Factor (tCO_2/MWh)</i>	<i>Baseline Emissions (tCO_2)</i>
2021 (21-01-2021 to 31-12-2021)	77,188.87	0.9310	71,864
2022 (01-01-2022 to 30-09-2022)	63,425.00	0.9310	59,050
	140,613.87		130,914

Baseline emissions for Project activity:

Vintage Period	Baseline Emissions (tCO_2)
2021 (21-01-2021 to 31-12-2021)	71,864
2022 (01-01-2022 to 30-09-2022)	59,050
	130,914

7.3 Project Emissions

The project activity involves harnessing of wind energy and its conversion to electricity. Hence according to ACM0002 Version 21.0.0, there will be no project emissions in the project activity $PE_y = 0$

7.4 Leakage

As per ACM0002 Version 21.0.0, no leakage has been considered for the calculation of emission factor.

7.5 Net GHG Emission Reductions and Removals

According to the approved methodology ACM0002 (Version 21) Emission Reductions are calculated as

$$ER_y = BE_y - PE_y$$

Where:

ER_y Emission reductions in year y (tCO₂e/yr)

BE_y Baseline Emissions in year y (tCO₂e/yr)

PE_y Project Emissions in year y (tCO₂e/yr)

Thus,

$$ER_y = 130,914 - 0 \text{ tCO}_2\text{e}$$

$$= 130,914 \text{ tCO}_2\text{e}$$

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021 (21-01-2021 to 31-12-2021)	71,864	0.00	0.00	71,864
2022 (01-01-2022 to 30-09-2022)	59,050	0.00	0.00	59,050
Total	130,914	0.00	0.00	130,914

<u>Ex-ante emissions reductions /removals</u>	<u>Achieved emissions reductions /removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
127,997	130,914	2.28%	The actual emission reductions for the current monitoring period are 2.28 % higher than estimated emission reductions. Wind availability is a natural phenomenon which is beyond the control of CLP. Further, higher generation was already considered during validation in the sensitivity analysis and

			breakeven point due to higher generation is 39.9%. Thus, project is still additional considering higher PLF.
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APPENDIX 1: < CALIBRATION DETAILS >

Calibration details of the relevant monitoring point in the project activity are as follows:-

Meter Identification No	Calibration Date	Calibration Validity
Main Meter: RR No: HARA-01; Sr. No: 11068937 Make - L & T Class - 0.2s Check Meter RR No: HARA-01; Sr. No: 11068943 Make - L & T Class - 0.2s	12/11/2019	11/11/2024