100 MW BUNDLED WIND POWER PROJECT IN ANANTAPURAM, ANDHRA PRADESH

Document Prepared by Infinite Solutions

Project Title	100 MW Bundled Wind Power Project in Anantapuram, Andhra Pradesh
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Prepared By	Richa Thakur
Contact	Infinite Solutions Address: 611, Chetak Centre Main, 12/2 R.N.T. Marg, Indore, MP – 452001 Landline No.: 0731-4050174 Email: richa@infisolutions.org Website: www.infisolutions.org

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Project

Brief Summary of the Project

The project activity consists of a bundle of 50 Wind Electric Generators (WEG) of Gamesa Wind Turbines Private Limited make in Anantapuram District, Andhra Pradesh. 40 machines of 2 MW capacity have been set up by Guttaseema Wind Energy Company Private Limited (GWECPL) and the other 10 machines of 2 MW have been setup by Vayuputhra Energy Private Limited (VEPL). The Project is owned by Guttaseema Wind Energy Company Private Ltd. and Vaayuputra Energy Private Ltd. which is part of Greenko Group.

The project activity generates power by using the kinetic energy of wind, thus resulting in zero emissions during electricity production. The generated electricity from the implemented WEGs will be supplied to the Southern Power Distribution Company of AP Limited. Both companies have entered Power Purchase Agreement (PPA) with State utility i.e. Southern Power Distribution Company of AP Limited for a period of 20 years from the date of implementation of project.

Project Name	No. of WTGs	Capacity	Location
Guttaseema Wind Energy Company Private Ltd.	40	80 MW	Andhra Pradesh
Vayuputra Energy Private Ltd.	10	20 MW	Andhra Pradesh

* Only part of 40 MW has been commissioned.

Technology employed

The project activity comprises of 21 and 29 numbers of G97- 2 MW and G114 – 2 MW WEGs respectively supplied by Gamesa Wind Turbines Private Limited. The technology / machines have been supplied by Gamesa Wind Turbines Private Limited. The WEGs contemplating this project activity are generating electricity through the available wind potential at the site and the generated electricity is exported through the grid substations of 110/33kV at East Kodipalli. The technical specifications of the WEG have been provided in Section A.4.2.

Scenario existing prior to the implementation of project activity:

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

As a result, for the project capacity 100 MW, GHG emission reductions by project is estimated to be approximately 192,849 tCO2e per year and total GHG emission reductions of 1,928,490 tCO2e for the crediting period, thereon displacing 205,860 MWh/year amount of electricity from the gird.

However as only 40 MW power is commissioned yet, hence GHG emission reductions by already commissioned project is estimated to be approximately 77,139 tCO2e per year and total GHG emission reductions of 771,390 tCO2e for the crediting period, thereon displacing 82,344 MWh/year amount of electricity from the gird.

GHG emission reduction by the Project in this monitoring period

The monitoring period is from 22-03-2018 to 03-10-2019. The total GHG emission reductions or removals generated in this monitoring period are 110,988 tCO2.

1.2 Sectoral Scope and Project Type

The bundled project will generate renewable electricity from WEGs. The generated electricity will be exported to the grid. Therefore, in accordance with Appendix B2 of the simplified modalities and procedures for small scale CDM project activities the applicable methodology is ACM0002. Grid connected renewable electricity generation. The relevant type and category are shown below:

Sectoral Scope : 01 – Energy Industries (renewable / non-renewable sources)

Project Type : I - Renewable Energy Projects

Methodology : ACM0002 “Grid-connected electricity generation from renewable sources” Version 19.0

1.3 Project Eligibility

The project activity involves installation and generation of electricity using wind energy resources i.e. by using the renewable sources replacing electricity supply from a fossil-fuel dominated electricity, thus leads to reductions of anthropogenic GHG emissions from atmosphere. Hence the project activity is eligible Sectoral scope 1 i.e. energy industries (renewable/ non-renewable sources) under the scope of the VCS Program.

1.4 Project Design

The Project activity involves setting up a wind farm of 54.4 MW (“Project”) in the state of Gujarat, India. Hence, the project has been designed to include a single installation of an activity and is not a grouped activity.

Eligibility Criteria

Not applicable to this project activity as this is not a grouped project.

1.5 Project Proponent

Organization name	Guttaseema Wind Energy Company Private Ltd.
Contact person	Murali Krishnam Raju M
Title	Senior Manager - Commercial
Address	Plot No. #1131/A, Road no. 36 Jubilee Hills, Hyderabad – 500033, Telangana, India.
Telephone	+91 40 40301004
Email	muraliraju.m@greenkogroup.com

Organization name	Vaayuputra Energy Private Ltd
Contact person	Murali Krishnam Raju M
Title	Senior Manager - Commercial
Address	Plot No. #1131/A, Road no. 36 Jubilee Hills, Hyderabad – 500033, Telangana, India.
Telephone	+91 40 40301004
Email	muraliraju.m@greenkogroup.com

1.6 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the project	Project Consultant
Contact person	Mr. Richa Thakur
Title	Project Manager- Operations
Address	611, Chetak Centre Main, 12/2 RNT Marg, Indore- 452001

Telephone	+91-9589804304
Email	richa@infisolutions.org

1.7 Ownership

The Project is owned by Guttaseema Wind Energy Company Private Ltd. and Vayuputhra Energy Private Ltd. which is part of Greenko Group. Further the Ownership is demonstrated through Commissioning certificates for WTGs in the name of individual Project Owner's.

1.8 Project Start Date

Project Start Date: 22-Mar-2018;

The project start date is the date on which first WTG of the project was commissioned.

1.9 Project Crediting Period

Crediting Period Start date: 22-Mar-2018

Crediting Period End date: 21-Mar-2028

The project activity adopts renewable crediting period of 10 years period which can be renewed for 2 times.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

As the estimated annual average GHG emission reductions or removal per year for total project capacity 100 MW is 192,849 tCO2e, also for already commissioned project power 40 MW is 77,139 tCO2e which is less than 300,000 tonnes of CO2e per year, thus the project falls in the category of Project.

Project Scale	
Project	√
Large project	

For total capacity 100 MW

Year	Estimated GHG emission reductions or removals (tCO_2e)
22-03-2018 to 21-03-2019	192,849
22-03-2019 to 21-03-2020	192,849
22-03-2020 to 21-03-2021	192,849
22-03-2021 to 21-03-2022	192,849
22-03-2022 to 21-03-2023	192,849
22-03-2023 to 21-03-2024	192,849
22-03-2024 to 21-03-2025	192,849
22-03-2025 to 21-03-2026	192,849
22-03-2026 to 21-03-2027	192,849
22-03-2027 to 21-03-2028	192,849
Total estimated ERs	1,928,490
Total number of crediting years	10
Average annual ERs	192,849

For already commissioned capacity 40 MW:

Year	Estimated GHG emission reductions or removals (tCO_2e)
22-03-2018 to 21-03-2019	77,139
22-03-2019 to 21-03-2020	77,139
22-03-2020 to 21-03-2021	77,139
22-03-2021 to 21-03-2022	77,139
22-03-2022 to 21-03-2023	77,139
22-03-2023 to 21-03-2024	77,139
22-03-2024 to 21-03-2025	77,139
22-03-2025 to 21-03-2026	77,139
22-03-2026 to 21-03-2027	77,139
22-03-2027 to 21-03-2028	77,139
Total estimated ERs	771,390
Total number of crediting years	10
Average annual ERs	77,139

1.11 Description of the Project Activity

Guttaseema Wind Energy Company Private Ltd. (80 MW) and Vayuputhra Energy Private Limited (20 MW) is located at Rudrampalli, Borampalli, Elagalavanka and Basavapuram villages of Anatapuram District in Andhra Pradesh. Generation of Electricity is by using Wind energy.

The total capacity of the project is 100 MW. The project activity comprises of total 50 WTGs which comprises of 2 MW capacity each.

The technology of electricity generation from renewable wind resource is environment friendly as it does not use any fossil fuel. The power (electricity) thus produced by the project activity would be transmitted to the state electricity grid, thereby displacing equivalent amount of power in the grid which is dominated by emission intensive thermal power plants.

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

The project activity comprises of 21 WEGs of G97-2 MW and 29 WEGs of G114-2 MW WEGs supplied by Gamesa Wind Turbines Private Limited.

The salient Features of Gamesa G97 are as follows: -

Parameter	Specifications
	Gamesa- G97 - 2.0MW
Power	
Installed electrical output	2,000 kW
Cut-in wind speed	3 m/s
Rated wind speed	11 m/s
Cut-out wind speed	25 m/s
Regulation	Pitch
Rotor	
Diameter	97.0 m
Rotor swept area	7,390.0 m^2
Number of blades:	3
Tip speed:	90 m/s
Generator	
Type	Double Fed Asyn
Speed, max	1,904.0 U/min
Operating voltage	690 V
Frequency	50 Hz / 60 Hz

The salient Features of Gamesa G114 2.0MW WTG are as follows: -

Parameter	Specifications
	Gamesa- G114 CS 2.0MW
Power	
Installed electrical output	2,000 kW
Cut-in wind speed	2.5 m/s
Rated wind speed	10 m/s
Cut-out wind speed	25 m/s
Regulation	Pitch
Rotor	
Diameter	114.0 m
Rotor swept area	10,207.0 m²
Number of blades:	3
Tip speed:	96 m/s
Generator	
Type	Double Fed Asyn
Speed, max	1,280.0 U/min
Operating voltage	690 V
Frequency	50 Hz / 60 Hz

Details of the installation of project in Andhra Pradesh are as follows:

Project Investors' Name	Commissioning Date	Capacity (MW)	Location (Village/State)
Guttaseema Wind Energy Company Private Limited	22-03-2018	16	Rudrampalli, Borampalli, Elagalavanka and Basavapuram villages of Anatapuram District in Andhra Pradesh
	07-02-2019	4	
Vayuputhra Energy Private Limited	22-03-2018	10	
	07-02-2019	10	

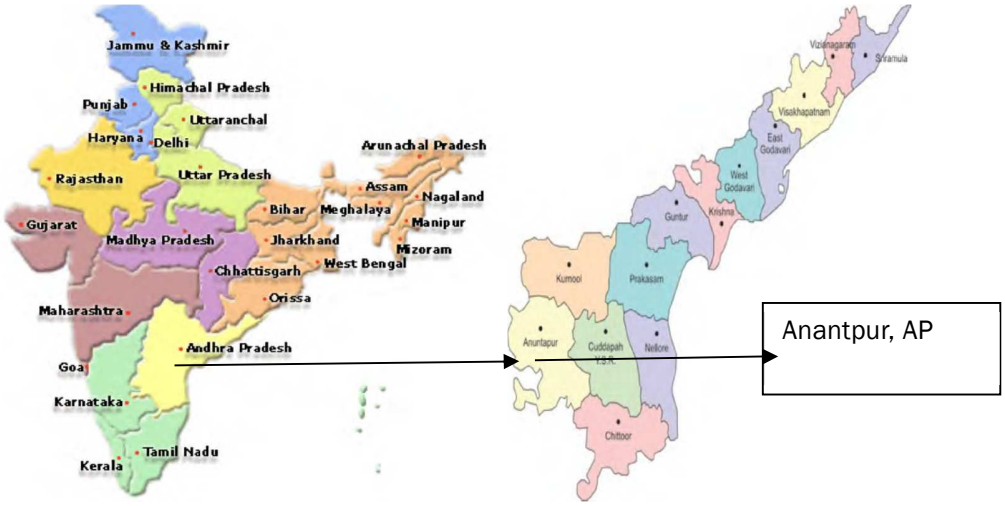
1.12 Project Location

Guttaseema Wind Energy Company Private Ltd. and Vayuputhra Energy Private Ltd. have established wind mills in multiple villages in Anantapuram District, Andhra Pradesh and the details of physical location of each sub project in the bundled project activity are furnished below.

The Geo-Coordinates of the WTGs already commissioned:

Guttaseema Wind Energy Company Private Limited				
Sl. No.	WTG Loc. No.	Latitude	Longitude	Villages
1	WTG-G01	N14◦27'37.5"	E77◦12'8.7"	Rudrampalli, Borampalli, Elagalavanka and Basavapuram villages of Anatapuram District in Andhra Pradesh
2	WTG-G02	N14◦27'54.9"	E77◦12'10.7"	
3	WTG-G03	N14◦28'4.8"	E77◦12'9.3"	
4	WTG-G06	N14◦28'13.2"	E77◦12'52.8"	
5	WTG-G08	N14°28'41.10"	E77°13'17.60"	
6	WTG-G09	N14°28'15.6"	E77°12'52.50"	
7.	WTG-G10	N14◦29'20.5"	E77◦13'11.4"	
8	WTG-G11	N14°29'43.00"	E77°14'33.80"	
9	WTG-G12	N14°29'24.20"	E77°14'31.10"	
10.	WTG-G23	N14°29'32.10"	E77°15'28.50"	

Vayuputhra Energy Private Limited				
Sl. No.	WTG Loc. No.	Latitude	Longitude	Villages
1.	WTG-V01	N14°28'3.10"	E77°14'53.00"	Rudrampalli, Borampalli, Elagalavanka and Basavapuram villages of Anatapuram District in Andhra Pradesh
2.	WTG-V02	N14°27'48.00"	E77°14'50.20"	
3.	WTG-V03	N14°27'37.80"	E77°14'51.90"	
4.	WTG-V04	N14°27'15.10"	E77°14'29.00"	
5.	WTG-V05	N14°26'57.10"	E77°14'5.60"	
6.	WTG-V06	N14°27'41.0"	E77°13'42.50"	
7.	WTG-V07	N14°28'5.6"	E77°14'4.9"	
8.	WTG-V08	N14°28'17.1"	E77°13'40.6"	
9.	WTG-V09	N14°27'47.2"	E77°12'59.2"	
10.	WTG-V10	N14°27'3.5"	E77°12'30.1"	



Map of India **Ananthpur, Andhra Pradesh, India**

Site Location

The Geo-Coordinates of the WTGs yet to be commissioned:

Guttaseema Wind Energy Company Private Limited				
Sl. No.	WTG Loc. No.	Latitude	Longitude	Villages
1	WTG-G05	14° 28' 30.72" N	77° 11' 56.544" E	Rudrampalli, Borampalli, Elagalavanka and Basavapuram villages of Anatapuram District in Andhra Pradesh
2	WTG-G04	14° 28' 17.4" N	77° 12' 4.068" E	
3	WTG-G07	14° 28' 26.94" N	77° 13' 23.26" E	
4	WTG-G13	14° 30' 24.336" N	77° 13' 44.68" E	
5	WTG-G14	14° 29' 59.208" N	77° 13' 50.77" E	
6	WTG-G15	14° 29' 7.08" N	77° 14' 28.716" E	
7	WTG-G16	14° 28' 55.884" N	77° 14' 24.504" E	
8	WTG-G17	14° 28' 45.192" N	77° 14' 28.5" E	
9	WTG-G18	14° 28' 37.416" N	77° 14' 16.51" E	
10	WTG-G19	14° 27' 27.252" N	77° 14' 3.588" E	
11	WTG-G20	14° 29' 0.06" N	77° 15' 16.16" E	
12	WTG-G21	14° 28' 48.072" N	77° 15' 29.016" E	
13	WTG-G22	14° 29' 14.388" N	77° 15' 34.164" E	
14	WTG-G24	14° 29' 49.344" N	77° 15' 37.152" E	
15	WTG-G25	14° 31' 31.332" N	77° 15' 20.736" E	
16	WTG-G26	14° 28' 59.988" N	77° 16' 12.504" E	
17	WTG-G27	14° 29' 13.596" N	77° 16' 15.78" E	
18	WTG-G28	14° 29' 21.336" N	77° 16' 44.076" E	
19	WTG-G29	14° 29' 29.724" N	77° 16' 49.476" E	
20	WTG-G30	14° 29' 37.824" N	77° 16' 43.752" E	
21	WTG-G31	14° 29' 55.896" N	77° 16' 12.36" E	
22	WTG-G32	14° 30' 5.832" N	77° 16' 9.948" E	
23	WTG-G33	14° 30' 17.064" N	77° 15' 59.364" E	
24	WTG-G34	14° 30' 35.496" N	77° 16' 3.324" E	
25	WTG-G35	14° 30' 42.3" N	77° 15' 45.864" E	

26	WTG-G36	14° 31' 41.772" N	77° 15' 40.392" E	
27	WTG-G37	14° 31' 55.164" N	77° 15' 44.568" E	
28	WTG-G38	14° 32' 6" N	77° 15' 33.192" E	
29	WTG-G39	14° 32' 8.196" N	77° 14' 18.708" E	
30	WTG-G40	14° 32' 19.68" N	77° 14' 19.032" E	

1.13 Conditions Prior to Project Initiation

The project is a Greenfield Wind power project and does not involve generation of GHG emissions for the purpose of their subsequent reduction, removal or destruction. Prior to the initiation of the project activity, the equivalent amount of electricity would have been drawn from grid connected or new power plants, in Indian Grid. The grid is predominantly coal based and therefore is a major source of carbon dioxide emissions in India. The main emission in the pre project scenario is the power plants connected to the Indian Grid, and main GHG involved is CO2. The baseline identified in section 2.4 is same as the pre-project scenario.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

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

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

- Electricity Act 2003
- National Electricity Policy 2005
- Tariff Policy 2006
- EIA Notification Environmental, 2018

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

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

1.15 Participation under Other GHG Programs

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

The project has not applied under any other GHG Program.

1.15.2 Projects Rejected by Other GHG Programs

The Project is not rejected by other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

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

1.16.2 Other Forms of Environmental Credit

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

1.17 Additional Information Relevant to the Project

Leakage Management

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

Commercially Sensitive Information

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

Sustainable Development

Ministry of Environment and Forests, Govt. of India has stipulated the social wellbeing, economic wellbeing, environmental wellbeing and technological wellbeing as the four indicators for sustainable development for Clean Development Mechanism (CDM) projects.

Social well being

The project activity generates clean power, without emitting any GHGs during its operations. Hence, it leads to a cleaner environment, reducing the adverse impacts of GHG emissions on the

people. It reduces a part of the electricity deficit being faced in the region and also improves infrastructural development in the areas around the project activities.

Environmental well being

The project activities are an environment friendly clean electricity generation with no significant impact on the environment. There is no pollution as electricity is produced from a clean source of energy, i.e. wind'. This would help in conservation of fast depleting fossil fuels and make it available for other dependent processes. Further, there is no treated effluent.

Economic well being

The project activities contribute to an investment of nearly INR 658.80 million which would increase the economic activity of the local area. The generated electricity is fed into the Grid through the local grid which would improve the grid frequency and availability of electricity to the local consumers. This will provide new opportunities for the industries to set up in the area thereby improving local employment and leading to overall development.

Technological well being

The project activities employ the best available technology and it lead to the promotion of wind technology into the region, demonstrating the success of wind based renewable energy generation, which is fed into the nearest sub-station (part of the Indian Grid), thus increasing energy availability and improving quality of power under the service area of the substation.

Further Information

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

2 SAFEGUARDS

2.1 No Net Harm

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

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

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

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

- Water quality and quantity: The project has no effect on water quality and quantity because it neither generates any waste not consume any water. The consumption of freshwater during construction was also pretty much limited.

  Hence the parameter is indicated as neutral.

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

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

- Biodiversity: No rare species has been found in the around area. The project site is not on the migration route of migratory bird. As such Wind power plant does not have any obstruction in the path of migratory birds. With the implementation of Project, the greening water will be increased significantly; the biodiversity in the vicinity will be improved with the vegetation improvement.

  NO negative impact envisaged.

- Employment Generation: The project activity employed local population as skilled workers as well as security guards. The personnel employed by the project activity are also provided trainings and exposed to various awareness programs therefore a positive indicator has been accepted.

- Livelihood of the poor: The project is associated with infrastructure development like roads in the nearby areas and promoting economic activities like grants to local school and communities' temples etc. Positive impact envisaged.

2.2 Local Stakeholder Consultation

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

The local stakeholder was informed regarding the meeting on 20th Jan 2018. The following are the stakeholders for the project activity:

- Local community
- Local village administration

- Technology suppliers
- Local vendors

All the stakeholders have been invited through invitation letters and/ or public notice to attend the stakeholders meeting 28th Jan 2018

The meeting was organized by the project proponent with the help of the developer Gamesa Wind Turbines Private Limited. All participants were informed in their local language about the salient features and environmental benefits of the project activity.

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

The Minutes of LSH meeting along with List of Attendees and other supporting's shall be submitted to the DOE.

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

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

2.3 Environmental Impact

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

As per the notification from Ministry of Environment, Forest and Climate Change dated September 14, 2006, its amendment notification S.O.-3067(E) dated 1/12/2009 and amendment notification 2018, the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed project activity type as it involves wind power generation. Hence the proposed project activity does not require any Environmental impact analysis. Thus, the section is not applicable.

2.4 Public Comments

The project has been listed for 30 days period from 13/11/2019 to 13/12/2019. No comments were received. https://www.vcsprojectdatabase.org/#/pipeline_details/PL1985 can be checked for the same.

2.5 AFOLU-Specific Safeguards

Not Applicable

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Title: Grid-connected electricity generation from renewable sources

Reference: ACM0002: Version 19.0

Type I: Energy industries (renewable / non-renewable sources)

Tools referred with above methodology and applicable for project activity are:

• Tool to calculate the emission factor for an electricity system - Version 07.0 (EB 100, Annex 04)

• Methodological Tool- Tool for the demonstration and assessment of additionality - Version 07.0.0 (EB 70, Annex 08).

3.2 Applicability of Methodology

The project activity involves generation of grid connected electricity from renewable Wind energy. The project activity has a proposed capacity of 100 MW which will qualify for a small scale CDM project activity under Type-I of the small-scale methodologies. The project status is corresponding to the methodology ACM0002: Version 19.0 and applicability of methodology is discussed below:

Applicability	Project activity vis-à-vis applicability Conditions
This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (a) Involve a capacity addition to (an) existing plant(s); (b) Involve a retrofit of (an) existing operating plants/units; (c) Involve a rehabilitation of (an) existing plant(s)/unit(s); or	The project activity is installation of a new grid connected wind power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant) and hence this criterion is applicable.

(d) Involve a replacement of (an) existing plant(s)/unit(s).	
The methodology is applicable under the following conditions: (a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (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.	The proposed project activity is an installation of a new grid connected wind power plant and hence criteria under point (a) is met. The project does not involve any capacity additions, retrofits or replacements and therefore this criterion under point (b) is not applicable.
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2 ; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2 ; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2 , all of the following conditions shall apply:	The proposed project activity is an installation of a new grid connected wind power plant and not Hydro power plant; therefore, this criterion is not applicable for this project activity.

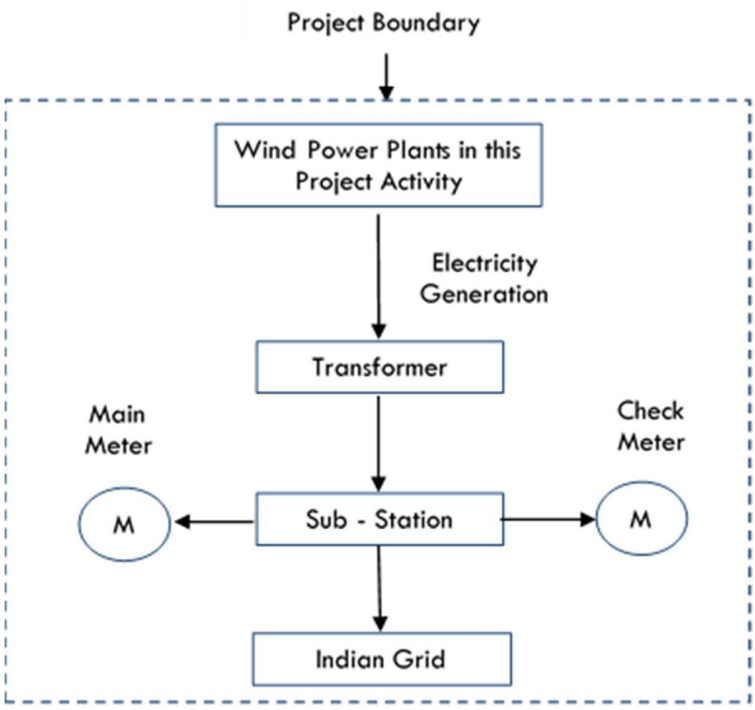
(i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m2 ; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
In the case of integrated hydro power projects, Project Participant shall: • 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 • Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The proposed project activity is an installation of a new grid connected wind power plant and not Hydro power plant, therefore this criterion is not applicable for this project activity.
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	The project activity is installation of a new grid connected wind power project and does not involve switching from fossil fuel to renewable energy, therefore criterion described in point (a) is not relevant to the project activity. This is a wind power plant and not a biomass fired plant, therefore criterion described in point (b) is not applicable to the project activity.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the	The project activity is a new grid connected wind power plant and not a

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".	retrofits, replacement or capacity additions and therefore this criterion is not applicable to the project activity.
Applicability conditions of "Tool to calculate the emission factor for an electricity system"	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This condition is applicable. OM, BM and CM are estimated using the tool under section 3.1 for calculating baseline emissions.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity.
Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	The project activity is a grid connected wind power project and not a hydro power plant. Therefore, this criterion is not applicable for the project activity.

3.3 Project Boundary

As per ACM0002 version 19.0- "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to".

The project boundary includes the wind project, sub-stations, grid and all power plants connected to grid. The proposed project activity will evacuate power to the Indian grid. Therefore, the entire Indian grid and all connected power plants have been considered in the project boundary for the proposed VCS project activity.



Source		Gas	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	In the baseline scenario the electricity would have been sourced from the NEWNE grid which in turn would be connected to fossil fuel fired power plants which emit CO2.

Source		Gas	Included?	Justification/Explanation
		CH_4	No	No Methane emissions are expected.
		N_2O	No	No Nitrous Oxide emissions are expected.
	Greenfield Wind Power Project Activity.	CO_2	No	CO_2 emissions are emitted from the project activity.
		CH_4	No	Project Activity does not emit CH4.
		N_2O	No	Project Activity does not emit N2O.

3.4 Baseline Scenario

As per the approved consolidated Methodology ACM0002 (Version 19.0):

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

The project activity involves setting up of Wind project to harness the power of sun 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 (EFgrid, CM,y) is the result of a weighted average of two emission factors pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publicly available.

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

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.9368 tCO2/MWh	Combined margin CO2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline CO2 Emission Database, Version 14 published by Central Electricity Authority (CEA), Government of India in the month of Dec 2018.
$EF_{grid,OM,y}$	0.9610 tCO2/MWh	Operating margin CO2 emission factor for the project electricity system in year y	Calculated as the last 3-year (2015-16, 2016-17, 2018-19) generation-weighted average, sourced from Baseline CO2 Emission Database, Version 14, published by Central Electricity Authority (CEA), Government of India.
$EF_{grid,BM,y}$	0.8644 tCO2/MWh	Build margin CO2 emission factor for the project electricity system in year y	Baseline CO2 Emission Database, Version 14, published by Central Electricity Authority (CEA), Government of India.

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3.5 Additionality

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

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

The proposed project activity is not the first-of-its-kind. Hence not applicable.

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

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

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

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

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

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

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

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

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

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

Step 2: Investment analysis

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

Sub-step 2a: Determine appropriate analysis method

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

Option I: Simple Cost Analysis

Option II: Investment Comparison Analysis

Option III: Benchmark Analysis

The project will generate revenues from sale of electricity, therefore Option I is not applicable. Option II also does not apply since there is no comparable investment alternative available to the project participant in line with para 32 of the Methodological tool: "Tool for the demonstration and assessment of additionality" (version 07.0.0).

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

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

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

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

Benchmark estimation:

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

Default Value at the time of investment decision:

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

Default Value as per latest version of Investment Analysis Tool version 10:

Table under Appendix in EB 105 annex 06specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **10.24%**[2]

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

Inflation Forecast for India as per RBI website[3] and corresponding benchmark values:

Project Promoters' Name	Inflation Forecast[4]		Benchmark	
	5 Years	10 Years	5 Years	10 Years
Guttaseema Wind Energy Company Private Ltd.	4.50%	4.30%	15.20%	14.98%
Vayuputhra Energy Private Ltd.	4.50%	4.30%	15.20%	14.98%

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

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

[1] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v8.pdf
[2] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v10.0.pdf
[3] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=18046
[4] Minimum of the two inflation forecasts has been considered.

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

Key Assumptions supporting financial projections:

Input Parameters	Guttaseema	Vayuputhra
Capacity of Project	80	20
Expected Date of Commissioning	31-Mar-18	31-Mar-18
Life of the plant (Yrs.)	20	20
PLF (%)	23.50%	23.50%[5]
Total Annual generation (kWh)	41,172,000	164,688,000
Tariff rate at the decision making (INR/kWh)	4.84	4.84[6]
O & M Expenses (INR Mn.)	29.5	118.00[6]
Escalation in the operational expenses (%)	5.72%	5.72%
O & M free for (Yr.)	0	0
Insurance (INR Mn.)	1.83	7.72
TOTAL COST (INR Mn.)	1,031.40	4,362.24[7]
Debt - Equity Ratio	70 : 30	70 : 30
Interest rate (%)	12.76%	12.76%[6]
Loan Tenure (Qtr.)	40	40
Interest on Working Capital Loan (%)	13.26%	13.26%[6]
Residual Value (INR Mn.)	5.00%	5.00%
IT Depreciation Rate (%)	7.69%	7.69%[8]
Tax rates		
Income tax rate (%)	34.61%	34.61%[9]
MAT (%)	21.34%	21.34%[9]
Service Tax (%)	18.00%	18.00%[10]

Name of Project Developer	Project Capacity	*EquityIRR*	Benchmark
Guttaseema Wind Energy Company Private Ltd.	80	*9.31%*	14.98%

[5] Third Party PLF Report
[6] http://aperc.gov.in/admin/upload/15135773708995996225a375b9a21708.pdf
[7] Offer Letter
[8] http://www.incometaxindia.gov.in/charts%20%20tables/depreciation%20rates.htm
[9] http://www.incometaxindia.gov.in/Tutorials/2%20Tax%20Rates.pdf
[10] http://www.exportgenius.in/gst-tax-rates/wind-turbine

Vayuputhra Energy Private Ltd.	20	10.72%	14.98%
Total	**100 MW**		

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

Sub-step 2d: Sensitivity Analysis:

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

Guttaseema Wind Energy Company Private Ltd.

Variation %	-10%	Normal	10%	Variation required to reach benchmark
PLF	5.98%	9.31%	12.61%	17.02%
O&M	10.06%	9.31%	8.53%	-77.56%
Project Cost	12.14%	9.31%	7.03%	-17.90%
Tariff Rate	5.98%	9.31%	12.61%	17.02%

Vayuputhra Energy Private Ltd.

Variation %	-10%	Normal	10%	Variation required to reach benchmark
PLF	7.22%	10.72%	14.27%	11.95%
O&M	11.52%	10.72%	9.92%	-54.46%
Project Cost	13.78%	10.72%	8.31%	-13.29%
Tariff Rate	7.22%	10.72%	14.27%	11.95%

The results of sensitivity analysis show that even with a variation of +10% & -10% in project cost, O&M cost, PLF and Tariff Rate, Equity IRR is significantly lower than the benchmark. And it is evident from the results given above; the project remains additional even under the most favorable conditions.

Probability to breach the benchmark:

Sensitivity Parameter 1: PLF
PLF considered in financials is as per **"Guidelines for the reporting and validation of Plant load factors" stated in EB48 Annex11**[11]. Variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third-Party Report based.
Sensitivity Parameter 2: O&M
The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.
Sensitivity Parameter 3: Project Cost
Estimated Project Cost for financial analysis is considered from Offer Letter. However, even if we consider the actual cost of the project even then the benchmark is not breached. Moreover, the Sensitivity is carried out for +/-10%.
Sensitivity Parameter 4: Tariff Rate
Tariff Rate is considered as per the latest Tariff Order available at the time of investment decision and the Tariff Rate as per PPA is same as available at the time of investment decision and is fixed for the entire life of the Project. However, Sensitivity is carried out for +/-10% variation in the tariff. Even then the benchmark is not breached. Hence, there is no probability of variation for the same.

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

Step 3: Barrier analysis

Barrier analysis has not been used.

Step 4: Common practice Analysis

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

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

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

[11] http://cdm.unfccc.int/EB/048/eb48_repan11.pdf

Range	Capacity	Unit
+50%	150	MW
Capacity of the proposed project activity	100	MW
-50%	50	MW

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

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

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

a. As the project is located in Andhra Pradesh state of India, therefore, the applicable geographical area of Andhra Pradesh has been chosen for analysis.
b. The project activity is a green-field wind power project and uses measure (b) *"Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies"*.
   Therefore, all projects applying same measure (b) as the proposed project activity are candidates for similar projects.
c. The energy source used by the project activity is wind. Hence, only wind energy projects have been considered for analysis.
d. The project activity produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.
e. The capacity range of the projects is within the applicable capacity range from 50 MW to 150 MW.

f. The start date of the project activity is 22-Mar-18. As Kyoto Protocol was ratified by India on 26/08/2002[12], therefore projects, which had started commercial operation between 26/08/2002 to 22/03/2018, have been identified.

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

Particulars	No. of Projects	Source
N_{Wind}	4	List of commissioned Wind Power Projects in A P State up to August,2016

Sources: List of commissioned Wind Power Projects in A P State up to August,2016

Refer Common Practice Analysis Excel Sheet for Project Details & Analysis

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

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

Thus $N_{all} = 2$

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

From the projects identified above, those projects which employ "different technologies" have been excluded and the number of such projects has been identified as Ndiff.

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

So, projects in Andhra Pradesh that have been allocated under Solar Park or National Solar Mission or through Bidding process and have PPA with NTPC or SECI can be assumed that such projects are governed by different investment climate. Therefore, these projects come under different investment climate and have been considered under Ndiff

As $N_{all} = 2$; thus $N_{diff} = 0$

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

[12] http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php

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

As N_{all} =2 thus, N_{all}-N_{diff} = 2; is less than 3

Outcome of Step 5:

As,

i. F = 1; is more than 0.2
ii. N_{all}-N_{diff} = 2; is less than 3

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

3.6 Methodology Deviations

There is no methodology deviation.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

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:

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

Where:

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

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

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

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

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

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

Where:

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

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

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

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

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

Therefore,

For 100 MW (total project capacity)

$EG_{PJ,y}$= 205,860

For 40 MW (already commissioned)

$EG_{PJ,y}$= 82,344 MWh

II. Calculation of $\boldsymbol{EF_{grid,CM,y}}$

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

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

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

The methodology provides following approaches for emission factor calculations:

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

OR

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

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' since data is available from an official source i.e.

CO2 Baseline Database for the Indian Power Sector, Version 14, December 2018 , published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per the "Tool to calculate the emission factor for an electricity system" Version 07.0, EB 100, Annex 4, the following steps have been followed.

STEP 1: Identify the relevant electricity systems;

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

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

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

STEP 5: Calculate the build margin (BM) emission factor;

STEP 6: Calculate the combined margin (CM) emission factor.

STEP 1: Identify the relevant electricity power systems

The tool defines that "for determining the electricity emission factors, identify the relevant electricity system. Similarly, identify any connected electricity systems". It also states that "If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used". Keeping this into consideration, the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids viz. Northern, Eastern, Western, North-eastern and Southern. However, all the 5 zones have now been synchronized and called as Indian Grid.

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

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

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

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

The Project Participant has chosen only grid power plants in the calculation.

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

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

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

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

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

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

Data Source: Central Electricity Authority (CEA) database Version 14, Dec'2018

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

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

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

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

OR

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

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

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

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

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

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

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2015-16	**2016-17**	**2017-18**
Indian Grid	0.9655	0.9636	0.9543

Weighted Generation Operating Margin	
Indian Grid	**0.9610**

STEP 5: Calculate the build margin emission factor (EFgrid,BM,y)

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

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

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

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

Build Margin (tCO_2/MWh) (not adjusted for imports)	
	2017-18
Indian Grid	**0.8644**

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

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

wOM = 0.5 and wBM = 0.5 for the first crediting period, and

wOM = 0.25 and wBM = 0.75 for the second and third crediting period,

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

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

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

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

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

Where,

w_{OM}	75% weight of operating margin emissions factor (%)
w_{BM}	25% weight of operating margin emissions factor (%)
$EF_{grid,OM,y}$	Build margin CO_2 emission factor of a particular grid in year y; calculated as described in Steps 3&4 above (tCO_2/MWh)

$EF_{grid,BM,y}$	Build margin CO_2 emission factor of a particular grid in year y; calculated as described in Steps 5 above (tCO_2/MWh)

Baseline Emission factor (Indian Grid)

$EF_{Grid,CM,y}$ = 0.75*0.9610 + 0.25*0.8644

= 0.9368 tC02/MW

Therefore, Baseline Emissions:

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

For total project capacity 100MW,

BE_y= 205,860 x 0.9368 = 192,849 tC02

For already commissioned capacity 40 MW,

BE_y= 82,344 x 0.9368 = 77,139 tC02.

4.2 Project Emissions

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

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (t CO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (t CO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (t CO_2e/yr)

4.3 Leakage

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

4.4 Estimated Net GHG Emission Reductions and Removals

As per para 61 of ACM0002 version16; Emission Reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

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

PE_y = Project emissions in year *y* (t CO_2e/yr)

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

$$ER_y = BE_y - PE_y$$

For total capacity 100MW

ER_y = 192,849– 0 =192,849 tCO_2

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
22-03-2018 to 21-03-2019	192,849	0	0	192,849
22-03-2019 to 21-03-2020	192,849	0	0	192,849
22-03-2020 to 21-03-2021	192,849	0	0	192,849
22-03-2021 to 21-03-2022	192,849	0	0	192,849
22-03-2022 to 21-03-2023	192,849	0	0	192,849
22-03-2023 to 21-03-2024	192,849	0	0	192,849
22-03-2024 to 21-03-2025	192,849	0	0	192,849
22-03-2025 to 21-03-2026	192,849	0	0	192,849
22-03-2026 to 21-03-2027	192,849	0	0	192,849
22-03-2027 to 21-03-2028	192,849	0	0	192,849
Total	**1,928,490**	0	0	**1,928,490**

For commissioned capacity 40 MW,

ER_y = 77,139– 0 = 77,139 tCO2

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
22-03-2018 to 21-03-2019	77,139	0	0	77,139
22-03-2019 to 21-03-2020	77,139	0	0	77,139
22-03-2020 to 21-03-2021	77,139	0	0	77,139
22-03-2021 to 21-03-2022	77,139	0	0	77,139
22-03-2022 to 21-03-2023	77,139	0	0	77,139
22-03-2023 to 21-03-2024	77,139	0	0	77,139
22-03-2024 to 21-03-2025	77,139	0	0	77,139
22-03-2025 to 21-03-2026	77,139	0	0	77,139
22-03-2026 to 21-03-2027	77,139	0	0	77,139
22-03-2027 to 21-03-2028	77,139	0	0	77,139
Total	771,390	0	0	771,390

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018[13]
Value applied:	0.9610 (Indian Grid)
Justification of choice of data or description of	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0.0" as 3-year generation weighted

[13] http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf

measurement methods and procedures applied	average using data for the years 2015-16, 2016-17 & 2017-18. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 14.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018
Value applied:	0.8644 (Indian Grid)
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0.0" as 3-year generation weighted average using data for the year 2017-18. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 14.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018
Value applied:	0.9368 (Indian Grid)
Justification of choice of data or description of	The combined margin emissions factor is calculated as follows:

measurement methods and procedures applied	$EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid, BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh) $EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

5.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh
Description	Electricity supplied to Grid
Source of data	Certificate for share of electricity generated by the wind farm
Description of measurement methods and procedures applied	Net electricity generated will be calculated at the main meter connected to the Grid Substation. The procedures for metering will be as per the provisions of the power purchase agreement. The WEGs of a single customer (individual PPS) at a particular site are connected to a to a feeder that ultimately leads to the main meter at the substation maintained by O&M team. Data monitoring takes place at the metering yard and Main meter at the substation. The electricity metered at the main meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the individual WTGs. The emission reduction calculations are done on the basis of the Main meter reading (net electricity exported to the grid) after deducting imports from the grid as mentioned in the share certificate issued on monthly basis. The electricity measurements at main meter are continuous and recorded on monthly basis.

Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied:	205,860 MWh (for 100 MW) 82,344 MWh (for 40 MW
Monitoring equipment	Electricity Meters of 0.2s Class
QA/QC procedures applied	Calibration of all the meters will be undertaken at required intervals and faulty meters will be duly replaced immediately based on CEA guidelines which specifies calibration once in 5 years. The data will be cross checked with sales receipts.
Purpose of data	Calculation of Baseline emissions
Calculation method	N/A
Comments	The data will be archived electronically for two years after the end of the last crediting period or the last issuance of VERs for this project activity, whichever occurs later

5.3 Monitoring Plan

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

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

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

1. Purpose - The purpose of monitoring the project is to assess the annual emission reductions in tonnes of CO2 that the project activity has achieved.
2. Data to be reported - $EG_{PJ,y}$ in MWh and periodical calibrations of monitoring equipment's.
3. Monitoring times and periods - The data will be monitored on a continuous basis but will be recorded on a monthly basis with the energy meters installed at the site.
4. Data Accuracy - Metering Arrangement of the Power Purchase Agreement (PPA) the metering arrangement including its installation, testing, maintenance and collection transportation and processing of data required for energy exchange shall be governed as per the notification/ directives issued/or to be issued by Central Electricity Regulatory Commission and as per relevant provisions contained in IEGC as amended from time to time. The Central

Electricity Authority (CEA) notification regarding Installation and Operation of meters regulations, 2006, says that meters are required to be tested once in 5 years (refer clause 18 of the guideline). Thus, the meters recording the electricity exported will be calibrated at least once 5 years.

5. Emission Reduction Calculation Approach - The emission reductions are calculated as a product of the net electricity generated from the project activity and the combined margin emission factor. The calculation approach is explained in detail under section 3 of this document.

6. Approach to be followed in following cases:

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

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$EG_{BL,y}$
Data unit	kWh
Description	Quantity of Net Electricity supplied to the grid
Value applied:	118,477
Comments	The meter will be calibrated as per APTRANSCO norms. Sales invoices and other records are used for cross verification to ensure consistency.

6.2 Baseline Emissions

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

Where

BE_y = Baseline Emissions in year y (t CO2)

$EG_{BI,y}$ = Quantity of net electricity supplied to the grid as a result of the

implementation of the CDM project activity in year y (MWh)

$EF_{CO,grid,y}$ = CO2 emission factor of the grid in year y (t CO2/MWh)

BEy = 110,988 tCO2

6.3 Project Emissions

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

6.4 Leakage

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

6.5 Net GHG Emission Reductions and Removals

The total emission reduction achieved in current monitoring period is

ERy = BEy – PEy – LEy

For non-AFOLU projects, use the following table:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 2018	54,996	0	0	54,996
Year 2019	55,992	0	0	55,992
Total	110,988	0	0	110,988

The break down details are provided in the ER sheet however, there was no major break down during the monitoring period. Further, the comparison for estimated emission reductions as per validated VCS PD and actual observed are detailed below. The emission reductions are lower than the estimated value.

Parameters	tCO2e
Estimated Annual Emission Reduction per year for 100 MW	192,849

Estimated Annual Emission Reduction per year for 40 MW (already commissioned)	77,139
Estimated Emission Reductions for the monitoring period for 100 MW (561 days)	296,406
Estimated Emission Reductions for the monitoring period for 40 MW (561 days)	118,562
Actual Emission reductions achieved in monitoring period	110,988
Percentage of variation when compared with estimated ERs	-6.39%

APPENDIX 1: CALIBRATION DETAILS

Guttaseema Wind Energy Company Private Ltd.					
Main	Check	Stand By	Calibration Date	Due Date of calibration	Accuracy Class
18035458	1803560	1803561	16.03.2018, 26.02.2019	25.02.2024	0.2S

Vayuputra Energy Private Ltd.					
Main	Check	Stand By	Calibration Date	Due Date of calibration	Accuracy Class
17250994	18035463	18035464	16.03.2018, 26.02.2019	25.02.2024	0.2S