Project design document form for CDM project activities (Version 05.0)	
PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	**Renewable Wind Power generation for promoting energy security**
Version number of the PDD	3.3
Completion date of the PDD	26/03/2015
Project participant(s)	Gangadhar Narsingdas Agrawal
Host Party	India
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	**ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"** (Version 12.2.0); EB 65
Estimated amount of annual average GHG emission reductions	48,430 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The project activity involves installation of 26 wind mills of various capacities around various states of India, cumulatively producing 25.5 MW. It consists of 7 WTGs of 1.5 MW each in the state of Karnataka, 4 WTGs of 1.5 MW each in Maharashtra and 15 WTGs of 0.6 MW each in the state of Gujarat.

Table 1: WTGs part of the project activity

State	Sl. No.	WTG Location No.	Capacity (MW)
Maharashtra	1	N-131	1.5
	2	N-132	1.5
	3	N-133	1.5
	4	N-23	1.5
Karnataka	1	K-377	1.5
	2	K-378	1.5
	3	K-379	1.5
	4	K-381	1.5
	5	K-375	1.5
	6	K-376	1.5
	7	K-380	1.5
Gujarat	1	VRRB/600/07-08/0736	0.6
	2	VRRB/600/07-08/0737	0.6
	3	VRRB/600/07-08/0738	0.6
	4	VRRB/600/07-08/0739	0.6
	5	VRRB/600/07-08/0740	0.6
	6	VRRB/600/07-08/1147	0.6
	7	VRRB/600/07-08/1149	0.6
	8	VRRB/600/07-08/1148	0.6
	9	VRRB/600/07-08/1150	0.6
	10	VRRB/600/07-08/1151	0.6
	11	VRRB/600/07-08/1178	0.6
	12	VRRB/600/07-08/1174	0.6
	13	VRRB/600/07-08/1175	0.6
	14	VRRB/600/07-08/1176	0.6
	15	VRRB/600/07-08/1177	0.6

The project activity uses wind energy to generate electricity and supplies it to grid. Since no greenhouse gases emissions are involved, the project activity produces clean energy. The project activity reduces greenhouse gas emissions by displacing power from various fossil fuel fired power plants connected to the grid with zero emission power from the project activity.

Prior to start of the project activity, the electricity is supplied to the grid from various generation sources connected to grid dominated by fossil fuel fired power stations. In the absence of the project activity, an equal amount of grid electricity would have come from various grid connected fossil fuel dominated power sources. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.
The project is promoted by Gangadhar Narsingdas Agrawal, hereafter referred to as GNA (HUF). The firm is involved in the business of Mining and Export of Iron Ore as the core area of their business activities. In view of the energy crisis, need of clean, renewable energy and support from Kyoto protocol's CDM, the company decided to get involved in Wind power generation.

This is evident from the fact that till now the GNA (HUF) has got an installed capacity of 11.25 MW[1] in various states of India with the help of CDM revenues.

Table 2: List of WTGs Installed by GNA (HUF)

Location	Site location	District	State	Capacity (MW)
K-45	Ingaladalu	Chitradurga	Karnataka	1.25
K-46	Ingaladalu	Chitradurga	Karnataka	1.25
S-352	Irrukandurai	Tirunelveli	Tamilnadu	1.25
K-80	Jamde	Dhule	Maharashtra	1.25
K-152	Panhaipada	Dhule	Maharashtra	1.25
J-14	Jamde, Sakri	Dhule	Maharashtra	1.25
J-15	Jamde, Sakri	Dhule	Maharashtra	1.25
J-118	Shinbon, Sakri	Dhule	Maharashtra	1.25
J-120	Shinbon, Sakri	Dhule	Maharashtra	1.25
			Total	**11.25**

Annual average emission reduction from project activity will be 48,430 tCO_2e. For 10 years crediting period total emission reduction will be 4,84,300 tCO_2e.
Recognizing the need of clean, renewable energy in an effort to fight climate change and bring energy self-sufficiency across various states, the company has gone for this 25.5 MW project

[1] Bundled 15 MW Wind Power Project in India: http://cdm.unfccc.int/Projects/DB/RWTUV1173341097.6/view

activity spread across various regions of the country expecting financial help through CDM revenues to mitigate various risks involved in the project activity.

Sustainable Development

The sustainable development criteria as defined by the DNA of India encompass social well being, Economic well being, environmental well being, and Technological well being. The contributions of the project activity to these aspects have been detailed below:

Social Well Being:

India is currently facing a huge energy crisis which is evident from the fact that the energy shortage in India has increased from 7.1% in 2003-04 to 9.9%[2] in 2007-08 where as the peak shortage has increased from 11.2% to 16.6% during the same period. The project activity will help to narrow this gap. Further, the project activity helps in alleviation of poverty by generating employment opportunities for both skilled & unskilled workers in the region.

Economic Well Being:

Transport of WTGs and related equipments, land development, civil works, installation, commissioning and operation of these WTGs will involve lot of skilled and unskilled workers of all levels and thus is a source of employment generation.

Environmental Well Being:

In India power sector is primarily fossil fuel based (especially coal). The project activity will replace such sources and thus help in reduction greenhouse gases emissions and other pollutants such as SOx & NOx.

Technological Well Being:

Initiatives like these by business houses will provide impetus to the technology providers to come up with more efficient technologies which will again promote investment in this sector.

A.2. Location of project activity

A.2.1. Host Party

>>
India

A.2.2. Region/State/Province etc.

>>
States of Maharashtra, Karnataka, Gujarat

Table 3: Project Activity Location, States

Sl. No.	State	No. of WTGs	Capacity of each WTG (MW)	Total Capacity (MW)
1.	Maharashtra	4	1.5	6 MW

[2] Report published by Central Electricity Authority in Sept 2008 “Power Scenarior at a Glance” , Page no.4

2.	Karnataka	7	1.5	10.5 MW
3.	Gujarat	15	0.6	9 MW

A.2.3. City/Town/Community etc.

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Table 4: Project Activity Location, District

SN	Location No.	State	District	Taluk	Village
1	N-131 N-132 N-133 N-23	Maharashtra	Sangli	Kawathemahakal	Nagaj (Dhalgaon)
2	K-377 K-378 K-379 K-381 K-375 K-376 K-380	Karnataka	Bellary	Huvinahadagali	Thimmalapur & Navali
3	VRRB/600/07-08/736 VRRB/600/07-08/737 VRRB/600/07-08/738 VRRB/600/07-08/739 VRRB/600/07-08/740 VRRB/600/07-08/1147 VRRB/600/07-08/1148 VRRB/600/07-08/1149 VRRB/600/07-08/1150 VRRB/600/07-08/1151 VRRB/600/07-08/1174 VRRB/600/07-08/1175 VRRB/600/07-08/1176 VRRB/600/07-08/1177 VRRB/600/07-08/1178	Gujarat	Kutch	Bhachhau	Kumbhariya

A.2.4. Physical/Geographical location

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The Latitude and Longitude of the physical location of the project activity for unique identification is given in the table below:

Table 5: Details of physical location

WTG No.	State	District	Latitude	Longitude
N-131 N-132 N-133 N-23	Maharashtra	Sangli	17° 09' 29.4" N 17° 09' 44.7" N 17° 09' 39.2" N 17° 12' 00.4" N	74° 55' 10.6" E 74° 55' 00.9" E 74° 54' 34.9" E 74° 57' 03.6" E
K-377	Karnataka	Bellary	15° 01' 09.0" N	75° 51' 14.2" E

K-378 K-379 K-381 K-375 K-376 K-380			15° 01' 03.2" N 15° 00' 56.3" N 15° 00' 50.9" N 15° 00' 43.8" N 15° 00' 38.3" N 15° 00' 33.0" N	75° 51' 21.4" E 75° 51' 28.0" E 75° 51' 35.0" E 75° 51' 40.1" E 75° 51' 47.0" E 75° 51' 53.2" E
VRRB/600/07-08/736 VRRB/600/07-08/737 VRRB/600/07-08/738 VRRB/600/07-08/739 VRRB/600/07-08/740 VRRB/600/07-08/1147 VRRB/600/07-08/1148 VRRB/600/07-08/1149 VRRB/600/07-08/1150 VRRB/600/07-08/1151 VRRB/600/07-08/1174 VRRB/600/07-08/1175 VRRB/600/07-08/1176 VRRB/600/07-08/1177 VRRB/600/07-08/1178	Gujarat	Kutch	23° 19' 32.9" N 23° 17' 30.5" N 23° 17' 32.2" N 23° 17' 49.8" N 23° 18' 24" N 23° 18' 34.7" N 23° 19' 16.9" N 23° 19' 5.5" N 23°19' 31.6" N 23° 18' 54.8" N 23° 19' 40.1" N 23° 19' 57" N 23° 20' 29" N 23° 19' 19.3" N 23° 20' 3.1" N	70° 41' 51.4" E 70° 40' 19.4" E 70° 40' 3.6" E 70° 39' 36.9" E 70° 39' 57.3" E 70° 39' 56.4" E 70° 42' 14.2" E 70° 40' 45.9" E 70° 42' 12.4" E 70° 39' 42.4" E 70° 41' 47.8" E 70° 42' 22.3" E 70° 41' 58.7" E 70° 42' 1" E 70° 42' 41.9" E

Figure 1: Project Activity Location, States[3]

[3] http://www.mapsofindia.com/maps/india/india-political-map.htm

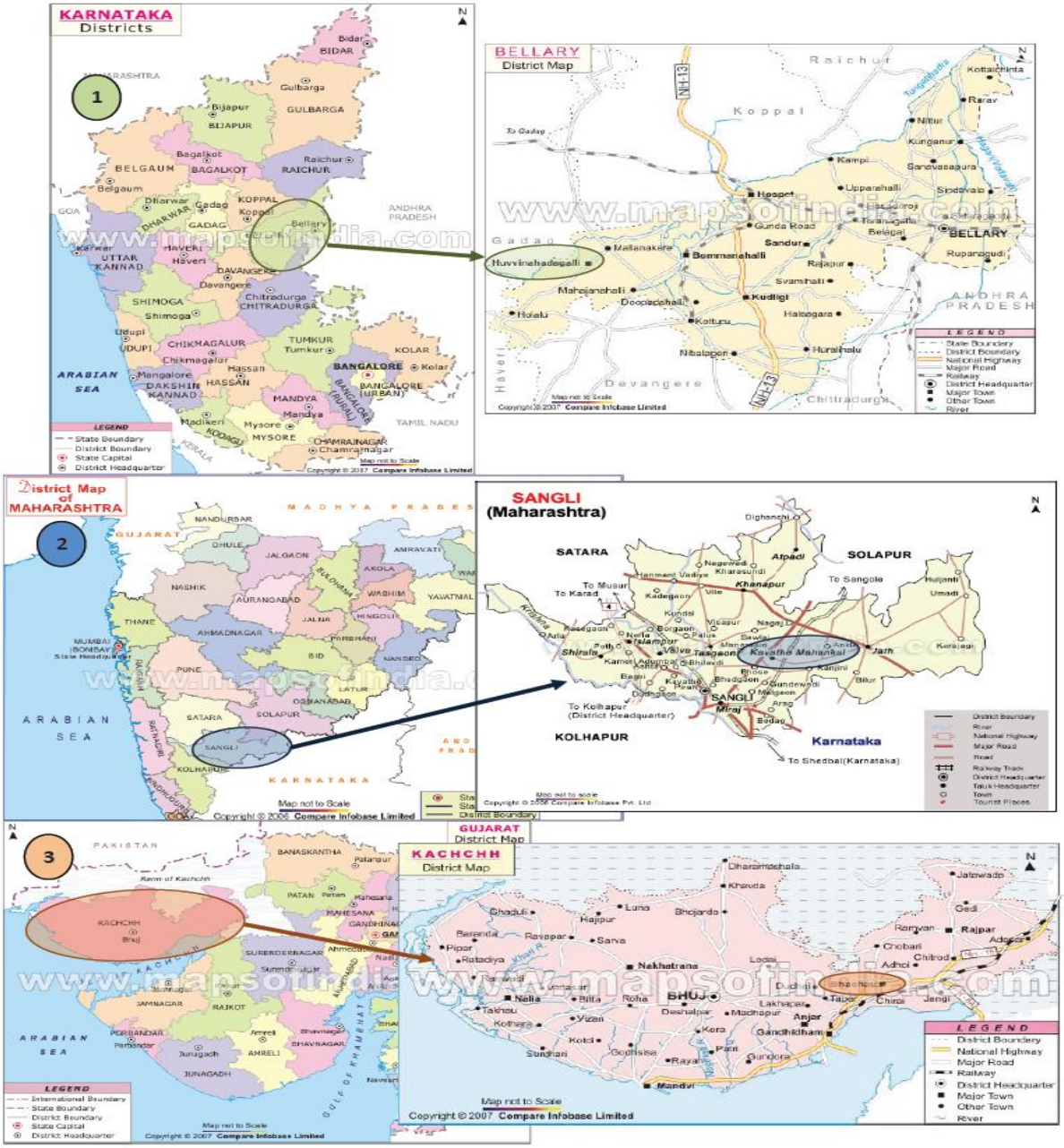

Figure 2: Project Activity Location, District[4]

[4] Available on www.mapsofindia.com

A.3. Technologies and/or measures

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The project activity comprises of 26 WTGs which will cumulatively produce 25.5 MW. Out of these, 11 WTGs have been supplied by Suzlon Energy Ltd. and are of 1.5 MW each (4 in Maharashtra and 7 in Karnataka). The rest 15 WTGs have been supplied by Vestas RRB and are of 0.6 MW each which are in the state of Gujarat. Wind energy based power generation is a clean technology since there are no GHG emissions associated with the electricity generation. The technology in the project activity is environmentally safe and sound

In the absence of the project activity, the equivalent power would be generated in the existing and new upcoming power generation plants of the connected grid. As explained in section B.4 the connected grid has a major share of fossil fuel based power generating stations, which is reflected in the high combined margin. This would have resulted in emission of greenhouse gas namely CO_2.

The technical specifications of the WTGs installed in the project activity are as follows:

Table 6: Technical details of WTGs[5]

RRB Vestas WTGs (0.6 MW)	
Particulars	**Details**
Overall Data	
Cut in wind in speed	4 m/s
Cut-out wind speed	25 m/s
Survival Wind Speed	70 m/s
Tip Speed	64 m/s
Rotor Speed	26.2 rpm
Hub Height	50 m
Nacelle Tilt angle	5^{o}
Generator	
Type	Single Wounded Asynchronous
Rated Power Output	600 kW
Voltage	690 V
Revolutions	1527 rpm
Frequency	50 Hz
Gear box	
Type	Planetary / Helical
Gear ratio	1:58.2
No of Steps	3
Tower	
Type	Lattice
Material	Steel
Sections	6/9
Nacelle Cover	Fibre Glass Reinforced Polymer
Rotor	
No of Blades	3

[5] http://www.rrbenergy.com/PSSpecification.asp

Diameter	47m
Swept Area	1735 m^2
Power Regulation	Pitch Regulated
Brake Systems	
Aerodynamics	Full feathering of blade
Mechanical	Disc brake
Yaw System	Slewing system with gear motors yawing
Controls	Microprocessor based

Table 7: Technical details of WTGs

Suzlon WTGs (1.5 MW)	
Particulars	**Details**
Rotor Diameter	82 m
Installed electrical output	1500 kW
Cut-in wind speed	4 m/s
Cut-out wind speed	20 m/s
Rotor swept area	5281 m^2
Rotational speed	15.6/18.4 rpm
Rotor material	Fibre glass/Epoxy
Regulation	Pitch/Suzlon Flexislip System
Generator	Asynchronous generator, 4 poles
Rated Output	1500 kW
Rotational speed	1511 rpm
Operational voltage	690 V
Frequency	50 Hz
Gear box	3 stage gear box, 1 planetary and 2 helical
Gear ratio	1:95.09
Nominal Load	1650 kW
Type of cooking	Oil cooling system
Yaw drive system	4 active electrical yaw motors
Yaw bearing	Polyamide slide bearing
Safety system	
Aerodynamic break	3 times independent pitch regulation
Mechanical break	Spring powered disc break, hydraulically released fail safe
Control unit	Microprocessor controlled, indicating actual operating conditions, UPS backup system
Design standards	As per GL/IEC

As per the State Electricity Regulatory Commission's (SERC) orders for various states, the applicable plant load factors are 20% for the state of Maharashtra[6], 23% for the state of Gujarat[7] and 26.5% for the state of Karnataka[8].

[6] Maharashtra Electricity Regulatory Commission (MERC) tariff order dated 24th Nov 2003; http://www.mercindia.org.in/pdf/Detail_Wind_Energy_Order.pdf

[7] Gujarat Electricity Regulatory Commission (GERC) tariff order dated 11th August 2006 http://www.geda.org.in/pdf/wind_final_order.pdf

GNA has entered into power purchase agreements with the respective state electricity boards for sale of power.

In the state of Maharashtra the electricity will be supplied to Maharashtra State Electricity Distribution Company Limited (MSEDCL) grid at common metering point at feeder no. 5, at Ghantnandre sub-station. This is a 220/33 KV substation.

Tower wise electricity generation is measured using WTG controller at the project site. Electricity exported to grid is measured using MSEDCL meter installed on uploading station (220 KV / 33 KV Ghatnandre Sub-Station, this reading is taken monthly by joint team of Operation and Maintenance (O&M) team at wind farm and MSEDCL personnel. The accuracy of MSEDCL meter used for Joint Meter Readings has an accuracy class of 0.2s.

MSEDCL issues monthly certificate for actual power exported by various WTGs in the wind farm, This reading is derived using above meters. Reading recorded in this certificate would be used for estimation of actual estimations.

In Karnataka, evacuation will be done to the Karnataka Power Transmission Company Limited (KPTCL) grid at 66 KV sub-station at Hirehadagali through 66 KV lines from Gujanur substation.

The wind machines supply power to KPTCL grid at common metering point, at 33/66 KV substation at Gujanur. Actual power generated by wind mill is measured using transformer yard meter at the project site. Both main meter and check meter are installed. Net electricity exported to grid by the wind farm is measured using KPTCL meters installed at HT end of the 33/66 KV substation at Gujanur. Both main meter and check meter are installed. Both of these are joint meter readings and are taken on monthly basis in the presence of Bangalore Electricity Supply Company Limited (BESCOM) and representative of the project proponent (Operation and maintenance personnel). The accuracy class of the above meters is 0.2s. Based on this, BESCOM will issue certificate for share of net electricity exported by the wind mills to the grid.

Similarly, in Gujarat, evacuation will be done by 33kV grid line to 66 kV capacity Chandrodi site sub-station at Chandrodi. The Chandrodi site substation is connected to Gujarat Energy Transmission Corporation Limited's (GETCO's) Shivalakha substation.

The generated power is stepped up to 33KV at the Project Site and further stepped up to 66KV at the Chandrodi sub station (Sending Station). The Chandrodi site sub station is connected to GETCO's (Gujarat Energy Transmission Corporation Limited) Shivlakha Sub station. Net electricity exported to grid by the wind farm is measured using GETCO meters installed at HT end of the 33/66 KV substation at Chandrodi. This is the joint meter reading and is taken monthly in the presence of GETCO, GEDA and O & M personnel. The accuracy class of GETCO meters is 0.2s. Tower wise generation for WTGs in the wind farm will be measured by various transformer yard meters at the project site. The accuracy class of transformer yard meters is 0.5s. This is done on a daily basis and a monthly compilation is sent to GEDA.
Monthly share of electricity certificate is prorated by GEDA based on actual generation of various WTGs and the net total electricity supplied by the Wind Farm. Reading recorded in this

[8] Karnataka Electricity Regulatory Commission (KERC) tariff order dated 18th Jan 2005; www.kerc.org/

certificate for the WTGs in the project activity would be used for actual estimations. This value can be cross verified with the actual invoices presented to GUVNL. Calibration of WTG meters and substation meter will be carried on at least once in five years basis.

The project activity uses wind energy to generate electricity and supplies it to grid. There is no technology transfer to the Host Party.

The average lifetime of equipment as per industry standards as considered by various SERC tariff orders is 20 years

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	Gangadhar Narsingdas Agrawal (Private Entity)	No

A.5. Public funding of project activity

>>
No public funding is available for the project activity from annex 1 countries.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

>>
ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.2.0); EB 65

Project activity also refers to the following tools-

- **Tool for the demonstration and assessment of additionality** (Version 06.0.0); EB65
- **Tool to calculate the emission factor for an electricity system**, (Version 02.2.1), EB 63

B.2. Applicability of methodology and standardized baseline

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Table 8: Justification of the choice and applicability of the methodology to the project activity

Sl. No.	Applicability Condition	Status in the Project activity
1.	The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The project activity is the installation of new Wind Turbine Generators. The power generated from WTGs is exported to the respective connected regional grids.
2.	In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	The project activity is installation of **new** WTGs. Therefore this criterion is not applicable to the project activity.
3.	In case of hydro power plants, one of the following conditions must apply: o The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or o The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; or o The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2. • The project activity results in new single or multiple reservoirs and the	The project activity is wind energy based power generation. This criterion is not applicable to the project activity.

	power density of each reservoir as per the definitions given in the Project Emissions section, is greater than 4 W/m^2. In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 all the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2. • Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant; • Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; • Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 w/m^2, is lower than 15 MW; • Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m2 is less than 10% of the total installed capacity of the project activity from multiple reservoirs.	
4.	Methodology is not applicable to the following: • 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. • Biomass fired power power plants • Hydro power plants that result in new reservoirs or in the increase in	There were no fossil fuel based power plants at the project site. The project activity involves the installation of **new** WTGs. The project activity doesn't fall under any of these categories.

	existing reservoirs where the power density of the power plant is less than 4W/m2	
5.	In the case of retrofits, 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, i.e. 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 project activity is a Greenfield project, therefore this applicability criterion is not applicable to the project activity.

B.3. Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project scenario	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable to the project activity
		CH_4	No	Not applicable to the project activity
		N_2O	No	Not applicable to the project activity
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not applicable to the project activity
		CH_4	No	Not applicable to the project activity
		N_2O	No	Not applicable to the project activity
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable to the project activity
		CH_4	No	Not applicable to the project activity
		N_2O	No	Not applicable to the project activity

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[9]. The schematic diagram of the project boundary is provided in figures below:

[9] Refer to Appendix 3 for Indian grid system

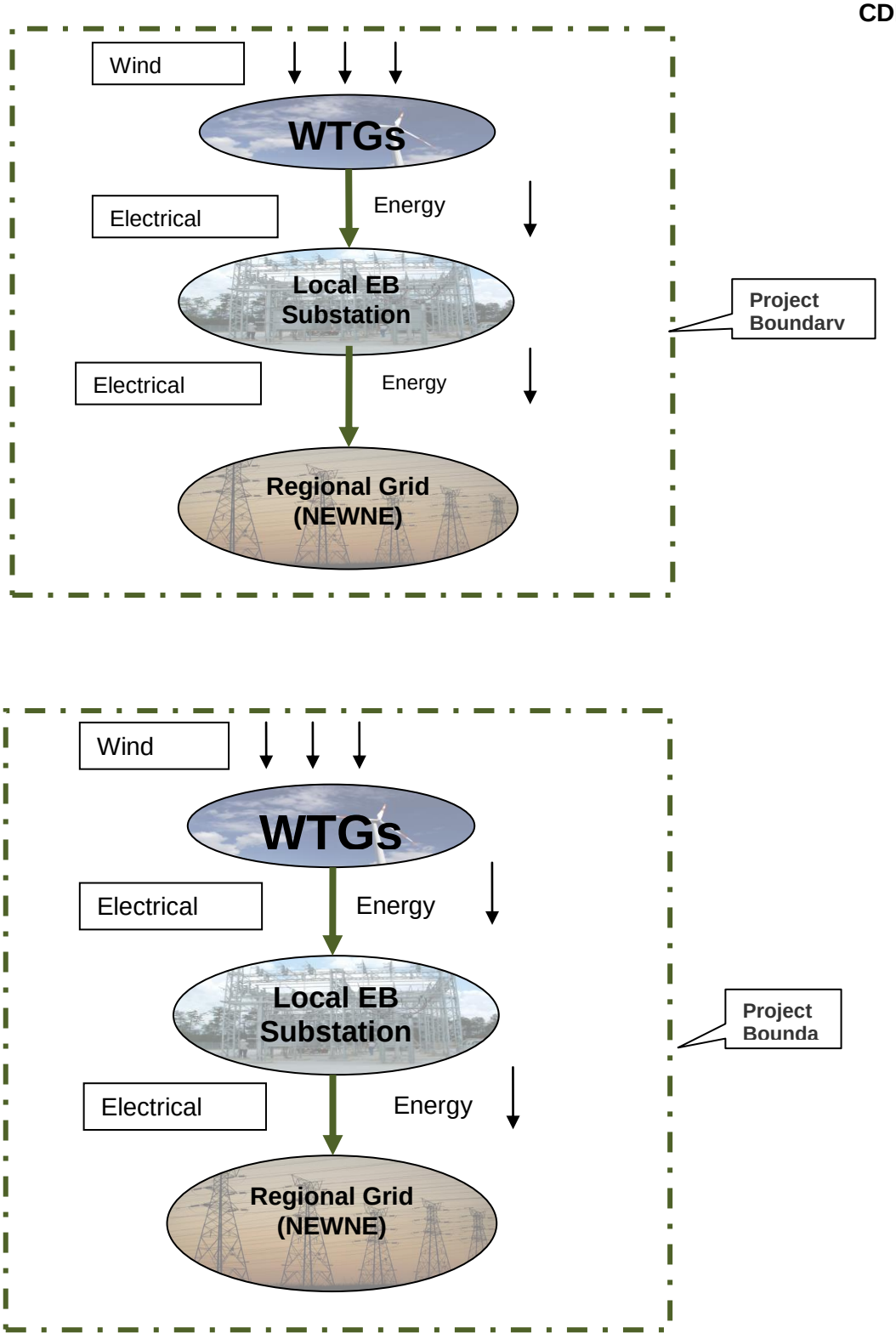

Figure 3: Project Boundary (Gujarat)

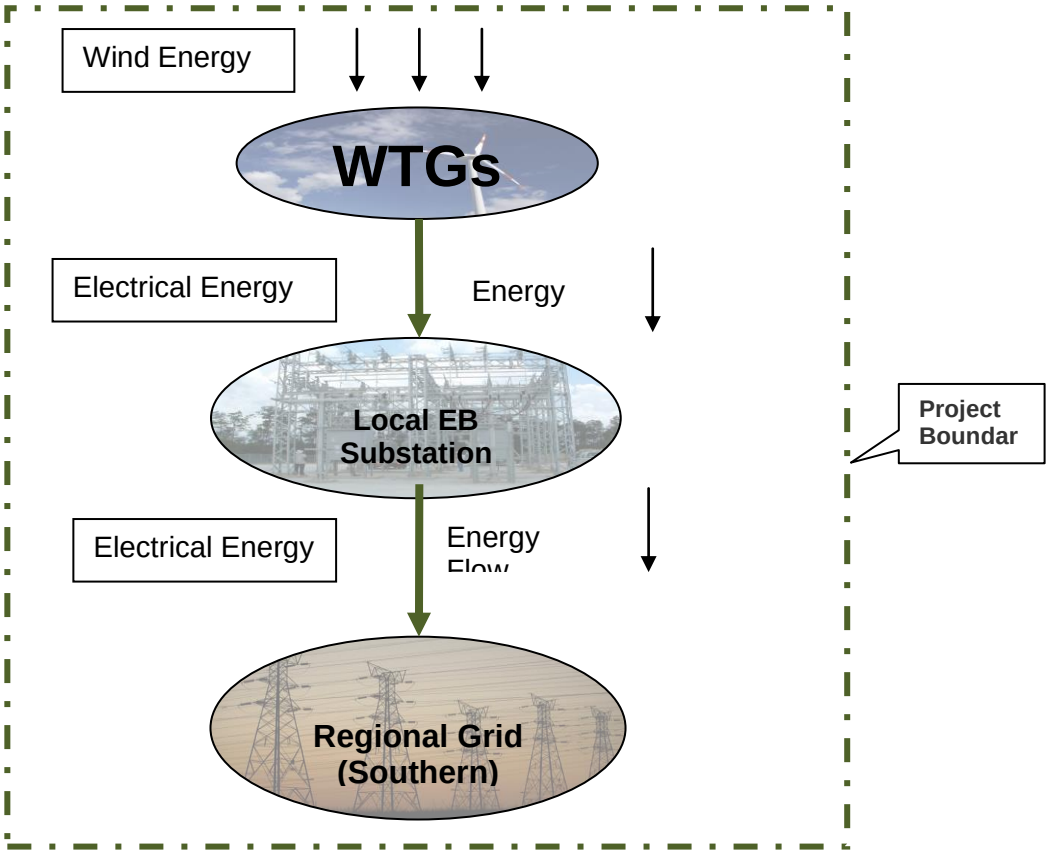

Figure 4: Project Boundary (Karnataka)

B.4. Establishment and description of baseline scenario

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Identification of the baseline scenario

The project activity involves installation of new Wind Turbine Generators and not capacity addition to existing grid connected renewable power plant/unit. Hence, according to the methodology ACM0002, the baseline scenario for the project activity 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"

B.5. Demonstration of additionality

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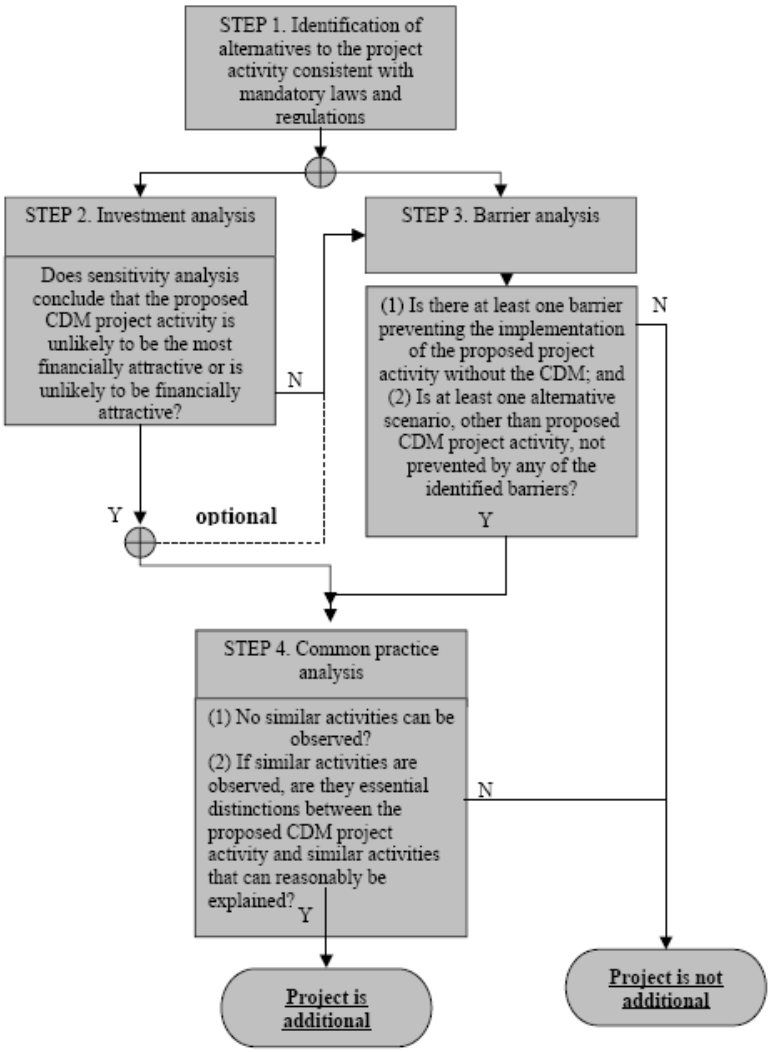
Additionality of the project activity is determined based on **Tool for the demonstration and assessment of additionality** (version 06.0.0 EB65)

This document provides a step-wise approach to demonstrate and assess additionality of the project activity as shown in the flowchart given below.



These steps include:

1. Identification of alternatives to the project activity;
2. Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible;
3. Barriers analysis;
4. Common practice analysis

The Steps are summarized in following sections -

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

The proposed project activity is installation of 26 WTGs of various capacities (1.5MW and 0.6MW) in various states of India (Maharashtra, Karnataka, Gujarat) making a cumulative capacity of 25.5MW. The power generated in the WTGs of the project activity shall be supplied to connected electricity grids. In the absence of the power generating in WTGs of project, same power would be generated in existing and forthcoming power stations. These grid connected power stations are dominated by fossil fuel fired ones and hence the displacement by project activity power, the emission reductions take effect.

There are only two alternatives to project activity,

Option 1:

The proposed project activity is undertaken without being registered as a CDM project activity. This option cannot be considered as the most plausible baseline option because of the barriers outlined

further in the section.

Option 2:
No project activity undertaken and equivalent amount of electricity would have been generated by existing and future additions to the respective grids (Southern and NEWNE grids of India) dominated by fossil fuel based power stations. This has been considered as the most plausible baseline option as it faces no barriers and is also the continuation of the current practice.

Sub-step 1b. Consistency with mandatory laws and regulations:
Both the above listed options are consistent with the applicable legal and regulatory requirements and are qualified for the further steps of additionality tool.

Step 2: Investment analysis
This step requires to determine whether the proposed project activity is the economically or financially less attractive without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, the following sub-steps are used:

Sub-step 2a: Determine appropriate analysis method
Since the project activity shall generate financial income from the sale of power to the grid, Option I (simple cost analysis) is ruled out and Option II (Investment comparison analysis) or Option III (Benchmark analysis) is applied.

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

As per Para 19 of "Guidance on the Assessment of Investment Analysis, Version 05, EB 62, Annex 5", a benchmark approach is suited to circumstances where the baseline doesn't require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest. The baseline of the project activity is the *no project activity*, in which case equivalent amount of energy would be generated by grid electricity system through its currently operating power plants and by new capacity addition (which are mostly thermal), i.e., *status quo*. Therefore selection of benchmark analysis is in conformity with the above mentioned guidance.

Selection of financial indicator:

Investment Analysis of the project activity is carried out to ascertain financial viability of the project without the revenue from the sale of certified emission reductions. To analyse the financial attractiveness of the project Internal Rate of Return on Project (Project IRR) has been chosen as the financial indicator.
The project IRR is one of the most commonly used tools to assess the feasibility and viability of the projects. As the project is funded by both debt and equity, project IRR is considered an appropriate financial indicator for demonstrating the additionality of the project.

Selection of benchmark:

As per the **Guidance on the Assessment of Investment Analysis, Version 05, EB 62, Annex 5,** *Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. The para 13 of the guidance also suggests that in cases where the project can be developed by an entity other than the project participant, the benchmark should be based on publicly available sources which can be validated by DOE. It further states that such benchmarks may include local lending and borrowing rates, equity indices or benchmarks determined by relevant national authorities.*

In accordance with para 15 of the guidance, If the benchmark is based on parameters that are standard in the market, the cost of equity should be determined either by: (a) selecting the values provided in Appendix A; or by (b) calculating the cost of equity using best financial practices, based

on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors. The values in the table in Appendix A may also be used, as a simple default option, if a company internal benchmark is used.

PP has chosen option b) to calculate the cost of equity.

The benchmark is estimated using both generic parameters as specified above in the guidelines and also considering project specific parameters. For conservativeness, the minimum of the two (i.e. benchmark calculated by considering generic parameters (14.08%) and by considering project specific parameters (13.88%)) is considered as the benchmark.

As in the project activity, Project IRR has been chosen as the financial indicator, weighted average costs of capital (WACC) is the suitable benchmark.

Estimation of benchmark:

As discussed above, Weighted Average Cost of Capital (WACC) is used as the benchmark for Project IRR. WACC is calculated using below mentioned formula -

WACC = (Equity %) x (Cost of Equity) + (Debt %) x (Cost of Debt) * (1 - Tax)

Cost of Debt is taken as the interest rate on loan taken from various banks. Cost of equity is estimated based on Capital Asset Pricing Model (CAPM), which is well accepted methodology for estimating of cost of equity or expected return on equity. As per CAPM, cost of equity investment is the return of risk free security plus beta times the difference between market return and risk free return. As per the model cost of equity shall be estimated as below -

Required Return on Equity / Cost of Equity = Risk free return + Beta x (Market Return – Risk Free Return)

Risk Free Return:

Reserve Bank of India provides information on Weighted Average Yield on Market Loans, which is actually risk free return.

Market Return and risk premium:

Equity indices are indicator of expected market return. With a view to eliminate the unsystematic risk associated with the projects totally, index containing 500 companies has been taken to represent the market return. Selection of BSE 500 represent a more robust and efficient face of the market.

Beta:

Project participant estimated equity beta values for a number of power companies in India. Equity beta measures the risk that can not be eliminated in a systematic, well balanced and diversified portfolio. However, the measured equity beta for a particular company relates to the unique capital structure of that firm and that a change in the capital structure will change the degree of financial risk borne by the equity holders and hence the equity beta. A common practice to allow equity betas to be compared across firms with different capital structures is to adjust the estimated equity beta into the equivalent asset beta (which is the equity beta that would apply if the assets were financed wholly with equity) using the following formula:

Asset beta = Equity beta / [1+ (1- Tax) x (debt / equity)]

Table 9: Cost of Equity

Parameter	Details	Remarks
Risk free rate of return	7.34%	Central Government market Loans (2005-06) http://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/72295.pdf
Market risk premium	17.24%	Calculated based upon Market return (Estimated from Market Index BSE 500

		http://www.bseindia.com/stockinfo/indices.aspx for period 1999 -06 and using CAGR method) and Risk free rate of return
Beta	0.87	Average beta value for a number of power companies in India calculated based upon historical stock prices (http://www.bseindia.com/stockinfo/stockprc.aspx) [11], leverage and applicable tax rates (From Companies balance sheets)

As per para 18 of the guideline, for the WACC computation using generic parameters, then the typical debt/equity finance structure i.e. 70/30 observed in the wind power is used, which is evident from the table below.

Table 10: WACC (Generic Parameters)

Parameter	Details	Remarks
Debt rate	11.9%	Average PLR of various banks at time of decision making[12]
Debt	70.00 %	Various tariff Orders[13]
Equity	30.00 %	Various tariff Orders[16]
Tax rate	11.22 %	MAT rate of 2006-07 http://exim.indiamart.com/budget-2006-07/
WACC	**14.08 %**	

Table 11: WACC (Project Specific Parameters)

Parameter	Details	Remarks
Debt rate	12%	Actual Debt Rate, Minimum of (12%, 13% taken in the project). This is conservative.
Debt	58.69%	Actual debt component in the project activity
Equity	41.31%	Actual equity component in the project activity
Tax rate	33.66%	HUF (MAT rate not applicable)
WACC	**13.88%**	

As discussed above, the Benchmark for the project activity is taken as the minimum of the WACC estimated based on generic and project specific parameters. This works out to be **13.88%.** This is conservative.

[10] Excel sheet provided for the same
[11] Excel sheet provided for the same
[12] http://www.thehindubusinessline.com/2006/08/25/stories/2006082503210600.htm
http://www.thehindubusinessline.com/2006/08/13/stories/2006081303080100.htm
http://www.hindu.com/2006/05/04/stories/2006050403561801.htm
http://www.blonnet.com/2006/03/15/stories/2006031504570100.htm
http://www.blonnet.com/2006/03/17/stories/2006031703790600.htm
[13] Maharashtra Electricity Regulatory Commission (MERC) tariff order dated 24th Nov 2003; http://www.mercindia.org.in/pdf/Detail_Wind_Energy_Order.pdf
[13] Gujarat Electricity Regulatory Commission (GERC) tariff order dated 11th August 2006 http://www.geda.org.in/pdf/wind_final_order.pdf
[13] Karnataka Electricity Regulatory Commission (KERC) tariff order dated 18th Jan 2005; www.kerc.org/

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

The financial barrier perceived by the project proponent is due to the poor return on investment and instability in returns due to uncertainty of achievable capacity utilization factor. Wind energy projects are less preferred projects also due to high capital costs involved. Capacity Utilization factor is defined as effective available generation time as a percentage and is dependent on various factors namely grid availability, machine availability, maintenance down-time and wind availability. To check the financial viability of the project activity, Project IRR is selected as the deciding criterion.

Project IRR in the project activity has been calculated based on the following data/ information:

Table 12: Data for computation of project IRR

Particulars	Details	Source
Maharashtra		
Project Cost	Rs 3,504 lakhs[14]	Purchase Orders to WTG suppliers
O & M Cost	Free for first 2 years From 3rd to 8th year: Rs 14..0 Lakhs / WTG per annum with 5% escalation	Purchase Orders to WTG suppliers Contract to be reviewed after 8th yr.
Tariff	Rs 3.50/ kWh	MERC tariff order. Same value is reflected in Power Purchase Agreement (PPA) with Maharashtra State Electricity Distribution Company Limited (MSEDCL)
Escalation in tariff	Rs 0.15 each succeeding year	MERC tariff order. Same value is reflected in Power Purchase Agreement (PPA) with Maharashtra State Electricity Distribution Company Limited (MSEDCL)
Interest rate on term loan	12%	Loan documents with The Saraswat Co-operative Bank
Loan Repayment period	72 months	Loan documents with The Saraswat Co-operative Bank
CUF	20.0%	To confirm with Annex 11 of EB 48, analysis has been done on the basis of CUF provided to the bank for loan sanctioning which is the same as the MERC order value.
Wheeling Charges	0%	Power being sold to the grid, hence no wheeling charges applicable
Karnataka		
Project Cost	Rs 6,448 lakhs	Purchase Orders to WTG supplier
O & M Cost	Free for initial 1 yr For 2nd to 6th year: Rs 15.5 Lakhs / WTG	Purchase Orders to WTG supplier

[14] 1 million = 10 lakhs

	with 5% annual escalation from 3rd yr.	
Tariff	Rs 3.40	KERC tariff order. Same value is reflected in Power Purchase Agreement (PPA) with BESCOM
Escalation in tariff	Rs 0.0	KERC tariff order. Same value is reflected in Power Purchase Agreement (PPA) with BESCOM
Interest rate on term loan	12%	Loan documents with The Saraswat Co-operative Bank
Loan Repayment period	72 months	Loan documents with The Saraswat Co-operative Bank
CUF	26.5%	To confirm with Annex 11 of EB 48, analysis has been done on the basis of CUF provided to the bank for loan sanctioning which is the same as the KERC order value.
Auxiliary Consumption	0.5%	KERC order[15]
Wheeling Charges	0%	Power being sold to the grid
Gujarat		
Project Cost	Rs 4,650 lakhs	Purchase Orders to WTG supplier
O & M Cost	Free for first 4 years From 5th year: Rs 6 Lakhs/WTG per annum with 5% escalation from 7th year	Purchase Orders to WTG supplier
Tariff	Rs 3.37/ kWh	GERC tariff order. Same value is reflected in Power Purchase Agreement (PPA) with Gujarat State Electricity Board
Escalation in tariff	No escalation	Power Purchase Agreement (PPA) with Gujarat State Electricity Board
Interest rate on term loan	12%	Loan documents with Axis Bank
Loan Repayment period	84 months	Loan Documents with Axis Bank
CUF	23.0%	To confirm with Annex 11 of EB 48, analysis has been done on the basis of CUF provided to the bank for loan sanctioning which is the same as the GERC order value.
Wheeling Charges	0%	Power being sold to the grid

The Project IRR in the project activity is found to be 9.64%[16] which is much below the benchmark of 13.88%, and hence is not a financially attractive option for the project proponent. This clearly means that under normal circumstances (without CDM benefits) the project would not have happened and is not a business-as-usual scenario.

[15] Page No. 17, KERC tariff Order dated 18th Jan 2005; www.kerc.org/

[16] Excel sheet provided for the financial analysis

Sub-step 2d: Sensitivity analysis

Further, to show the robustness of the financial analysis, a sensitivity analysis is carried out. As required by para 20, Annex 05 EB 62 *"Guidance on the assessment of investment analysis"* only those parameters that constitute more than 20% of either total project costs or total project revenues are subjected to reasonable variation. The critical parameters thus identified are capital cost, Operation and Maintenance (O&M) expenses, Capacity Utilization Factor (CUF) and tariff rate.

The project cost is based on the figures provided by technology supplier and there is very low probability of cost deviation from the assumed one as the project is up and running and project cost cannot change now. Actual cost incurred on the project can be provided now. O&M costs are fixed for specific number of years beyond which these may vary and hence sensitivity analysis has been carried out on change in O&M cost.

CUF is another critical parameter which may change and have an impact on the financials of the project activity. This is because the CUF for wind power is dependent on various external factors such as wind resource available at a particular location, grid availability etc which are beyond project proponents. Similarly tariff rate in the state of Maharashtra is fixed for 13 years beyond which it may change. Similarly tariff rate in the state of Karnataka is fixed for 10 years beyond which it may change. Sensitivity analysis is carried out on all these parameters. For Gujarat, tariff is fixed for 20 years and hence this is exempted from sensitivity analysis.

Table 13: Results of sensitivity analysis

Factor	**Change % from base value**	**Project IRR**	Remarks
Tariff Rate (Maharashtra)*	+10%	9.71%	*Below Benchmark*
	-10%	9.57%	*Below Benchmark*
Tariff Rate (Karnataka)**	+10%	9.88%	*Below Benchmark*
	-10%	9.39%	*Below Benchmark*
CUF***	+10%	11.54%	*Highly Unlikely as discussed; Also the project IRR is still below Benchmark*
	-10%	7.55%	*Below Benchmark*
O&M Cost	+10%	7.81%	*Below Benchmark*
	-10%	10.34%	
Project Cost****	+10%	8.09%	Not possible as the project is up and running and project cost cannot change now. Actual cost incurred on the project can be provided now
	-10%	11.42%	Not possible as the project is up and running and project cost cannot change now. Actual cost incurred on the project can be provided now

*Tariff for Maharashtra fixed for 13 years as per PPA, therefore sensitivity carried out from 14th year

**Tariff for Karnataka is fixed for 10 years, therefore sensitivity carried out from 11th year

***Justification that +10% variation in CUF is highly unlikely is provided below

****Not possible since Purchase Orders have been raised with the technology supplier for the project activity and project cost is firmed up, it is unlikely for the project cost to change now.

Justification that +10% variation in CUF is highly unlikely:

As discussed above, CUF for wind power is dependent on various externalities which are beyond project proponent's control. Due to number of external uncertain parameters, any of which may drastically impact the power generation, it is highly unlikely that the actual generation will go beyond and maintain steady high values above what is suggested by SERC PLF in various states. This is evident from the following tabulated data which shows the performance of the wind turbines of an earlier project by GNA, all of which were commissioned by August 2006 and thus have 2-3 years of operating data.

Table 14: Performance of GNA 11.25 MW wind machines (Registered CDM Project) spread across various states[17]

	2005-06	2006-07	2007-08
% Power sent to grid as compared to expected by SERC orders	92.58%	103.90%	61.84%

As is evident from the above table, it doesn't seem likely that the GNA's 25.5 MW wind project will consistently outperform generation expected by SERC order for its full operation of 20 years by a margin as high as 10%. It is noteworthy to highlight that the impacts of de-aerating would further decrease the actual generation achieved in later years.

The above analysis is further corroborated by the actual generation data of wind turbines of GNA 25.5 MW project which have completed 1 year of operation. The actual power generation achieved is -7.47%[18] less than what was expected as per SERC orders.

Table 15: Performance of wind turbines of GNA 25.5 MW project which have completed 1 year of operation

WTG Code	SERC prescribed CUF	CUF as per Actual generation at Controller and considering electrical losses	% actual power sent to grid (after considering electrical losses) more/ less as compared to SERC prescribed CUF
N131,N132,N133	20.00%	20.93%	4.65%
N23	20.00%	19.85%	-0.77%
Gujarat (GNA 01,02,03)	23.00%	14.11%	-38.66%
Overall			**-7.47%**

The above analysis clearly shows that a +10% variation in base CUF would be highly unlikely. Clearly the results of the above sensitivity analysis show the robustness of the investment barrier described above and confirms that the project activity is not a financially attractive option for the project proponent even when the change in CUF is considered to be positive

Step 3: Barrier analysis

Barrier analysis hasn't been carried out for the project activity.

[17] Excel Sheet Provided; Only those machines included which had full year of operation in the corresponding fiscal

[18] Excel Sheet Provided; Only those machines included which have completed one year of operation

Step 4: Common practice analysis

Step 4: Common practice analysis

Annex 21 of EB 65, the Tool for the demonstration and Assessment of Additionality, version 06[19] has been used for performing the common practice analysis for the project activity. As per the same, the identification of projects and further analysis has been done in the following step wise manner:

As per para 47 of EB 65, Annex 21, and the following steps have been applied to prove that the proposed project activity is not a common practice within the applicable geographical area. The applicable geographical area has been defined as the host country, India as default as defined in para 5 of the tool.

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

As the proposed project activity is of 25.5 MW capacity, the applicable output range for the identification of projects is 12.75 MW to 38.25 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_{all}*. Registered CDM project activities shall not be included in this step.*

For the analysis all the power plants in the host country India have been considered for the common practice analysis. All the available projects are filtered based on the same applicable output range of 12.75 MW to 38.25 MW, based on which, thermal, hydro, biomass & wind projects and others have been considered for the analysis. After filtering, registered CDM projects are also excluded from the same and N_{all} is arrived at.

Following is the result of this analysis[20]:

Technology Area	Total projects	All projects in applicable cap range	Projects excluding CDM projects in applicable cap range, $N_{(all)}$	$N_{(diff)}$
Thermal	647	100	100	100
Hydro	783	208	208	208
Wind*	392	36	22	14
Nuclear	17	0	0	0
Solar	1	0	0	0
Biomass	159	72	72	72
Tidal-Mechanical &Thermal	2	0	0	0
Geothermal	0	0	0	0
Total	**2001**	**416**	**402**	**394**

[19] http://cdm.unfccc.int/filestorage/9/A/G/9AGSVUJ4HP731N0DRL8CYF5EXTBZKQ/eb65_repan21.pdf?t=WkN8bTAxYWs3fDBb6airgk3DcsbyRmEjkvxM

[20] Details of data collated and analysis done are provided to DOE for validation.

It can be seen that N_{all} = *Thermal projects*[21]*+ Hydro Projects*[22]*+ Wind Projects*[23]*+Biomass projects*[24]*+Nuclear projects*[25]*+ Solar projects*[26]*+ Geothermal & Tidal projects*[27]

=100+208+22+72+0+0+0+0
=402

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}.

From the above identified number of projects above, those projects which employ **"different technologies",** as per the clauses prescribed in the para 4 of the guidelines, have been excluded and the number of such projects has been identified as N_{diff}.

All the thermal & the hydropower projects are different from the project activity (a wind based project) as they use different *Energy source/fuel* (point (i), para 4 of the guideline). Also, small scale wind power projects which fall out of this range are excluded. Therefore,

N_{diff}*= Thermal projects + Hydropower projects + Biomass projects+ small scale wind power projects*

=100+208+72+14
=394

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*

F= 1-(394/402)
=0.02

Step 5: The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} *is greater than 3.*

As the factor F has been calculated to be 0.02 (less than 0.2), the proposed project activity is not a common practice.

Sub-step 4b: Discuss any similar Options that are occurring:
There are no similar options identified as per the explanation provided in sub-step 4a.

Thus, because the similar activities cannot be observed, Sub-steps 4a and 4b are assumed to be satisfied and the proposed project activity is considered **additional**.

CDM Consideration:

a) As per the EB Guidelines 62, Annex 13 on the Demonstration and Assessment ***of prior consideration of the CDM***[28], "the project activities with a start date after August 2008, the project participant must inform a Host party DNA and the UNFCCC Secretariat in writing of the commencement of the project activity and of their intension to seek CDM status. Such Notification must be made within six months of the project activity starting date."

[21] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
[22] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
[23] Source, Wind Power Directory, dated August,2009
[24] http://www.mnre.gov.in/annualreport/2007_2008_English/Chapter%205/chapter%205_1.htm
[25] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
[26] http://www.mnre.gov.in/annualreport/2010_11_English/Chapter%206/chapter%206.htm
[27] http://www.eai.in/ref/ae/oce/oce.html
[28] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid04.pdf

b) The project participant must indicate awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project. Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a CDM project activity.

a) The project participant must indicate, by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. Evidence to support this should include, inter alia, ***contracts with consultants for CDM/PDD/methodology services****, draft versions of PDDs and underlying documents such as letters of authorization, and if available, letters of intent, Emission Reduction Purchase Agreements(ERPA) term sheets, ERPAs or other documentation related to the potential sale of theCERs (including correspondence with multilateral financial institutions or carbon funds),* ***evidence of agreements or negotiations with a DOE for validation services****, submission of a new methodology or requests for clarification or revision of existing methodologies to the CDM Executive Board, publication in newspaper, interviews with DNA, earlier correspondence on the project with the DNA or the UNFCCC secretariat.*

GNA was well aware of the CDM benefits prior to start of the project activity. The group already had an installed capacity of 15 MW[29] in wind power generation which was under CDM registration process. The company was very optimistic about it getting registered as a CDM Project Activity which eventually happened and therefore they decided and resolved in a *Board Meeting dated 28th Oct 2006* to further invest into renewable wind energy sector with the help of CER Revenues.

To promote energy security across various states the company decided to make an investment spread across various states. The chronology of events of the project activity is shown below:

Table 16: Chronology of Events in the project activity

Event	Date	Remarks
Board Resolution on project activity	**28/10/2006**	**Decision making**
Minutes of meeting with technology suppliers	02/11/2006 03/11/2006	
First Purchase order (Placed for 4 Nos. of WTG's in the state of Maharashtra)	**07/11/2006**	**Start date**
Letter from technology supplier regarding delay in project execution	**11/06/2007**	
Purchase order for WTG's in Gujarat	05/07/2007	10 Nos. of WTG
Engagement of CDM Consultant	**17/07/2007**	**This is completed within 2 years from the project start date.**
Minutes of meeting with CDM Consultant	**26/07/2007**	
Loan Sanction from Axis Bank for WTGs in Gujarat	28/09/2007	For WTGs in the state of Gujarat
Purchase order for WTG's in Karnataka	30/11/2007	7 Nos. of WTG
Purchase order for WTG's in Gujarat	05/12/2007	5 Nos. of WTG
Power Purchase Agreement for WTGs in Gujarat	07/12/2007	5 Nos. of WTG
Commissioning completed for WTGs in Maharashtra	29/01/2008	
Loan sanction from The Saraswat Co-operative Bank.	08/03/2008	For WTGs in the state of Maharashtra, Karnataka

[29] 11.25 MW by GNA (HUF) and 3.75 MW by Ferromar Shipping Private Limited (FSPL)

Power Purchase Agreement for WTGs in Maharashtra	21/04/2008	3 Nos. of WTG
Commissioning completed for WTGs in Karnataka	07/05/2008	
Power Purchase Agreement for WTG in Maharashtra	13/05/2008	1 Nos. of WTG
Commissioning completed for WTGs in Gujarat	31/05/2008	
Power Purchase Agreement for WTGs in Karnataka	18/06/2008	7 Nos. of WTG
Newspaper publication for stakeholder consultation in Karnataka, & Maharashtra	**23/07/2008**	**This was done within 2 years from the project start date**
Receiving of DOE Proposals	**28/07/2008**	**This was started within 2 years from the project start date**
Newspaper publication for stakeholder consultation in Gujarat	**08/08/2008**	**This was started within 2 years from the project start date**
DOE engagement for project activity validation	**12/08/2008**	**This was completed within 2 years from the project start date**
Power Purchase Agreement for WTGs in the state of Gujarat	30/08/2008	10 Nos. of WTG

The tool further suggests that *Assessment of real and continuing actions shall be validated by the DOE and the validation should focus on real documented evidence as indicated in paragraph 6 (b), including an assessment by the DOE of the authenticity of the evidence. In validating proposed CDM project activities where:*

There is less than 2 years of a gap between the documented evidence the DOE shall conclude that continuing and real actions were taken to secure CDM status for the project activity;

The chronology clearly demonstrates as per the above mentioned guideline that continuing and real action were taken to secure CDM status for the project in parallel with its implementation as indicated by various crucial steps the project proponent has taken to secure CDM status which includes, inter alia, engagement of CDM consultants, publishing Newspaper advertisement, Finalization of DOE all within 2 years of start date or even the board decision to proceed with the project activity.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

>>
According to the methodology, emission reductions are calculated based as described below:

$$ER_y = BE_y - PE_y$$

Where,
ER_y = Emission reductions in year y (tCO_2e/yr)
BE_y = Baseline emissions in year y (tCO_2e/yr)
PE_y = Project emissions in year y (tCO_2e/yr)

Baseline Emissions:

Baseline emission include only CO_2 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:

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

Where:

BE_y = Baseline emissions in year *y* (tCO2/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" (tCO2/MWh)

The project activity is the is the installation of Greenfield renewable energy power plants, therefore as per methodology $EG_{PJ,y}$ is calculated as follows:

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

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)

The Combined Margin is the result of a weighted average of two emission factors pertaining to the electricity system: the operating margin (OM) and the build margin (BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.

In accordance with the "Tool to calculate the emission factor for an electricity system",Version 02.2.1, EB 63, Annex 19 combined margin CO2 emission factor for grid connected power generation is calculated stepwise as below:

STEP1. Identify the relevant electricity systems.

The electricity generated from the proposed project activity will be supplied to three state electricity boards which are parts of the Southern and NEWNE[30] Grids of India. For more details of grid system in India, please refer to Appendix 3.

Table 17: Relevant Regional Grids for the Project Activity

Sl. No.	State	Capacity	Regional Grid
1.	Karnataka	10.5 MW	Southern
2.	Maharashtra	6 MW	NEWNE
3.	Gujarat	9 MW	NEWNE

[30] Northern, Eastern, Western and North-Eastern Grid

The details of the generation mix, Operating Margin (OM), Build Margin (BM) and Combined Margin (CM) is publicly available from Central Electricity Authority of India.

STEP2. Choose whether to include off-grid power plants in the project electricity system (optional).

To calculate the operating margin and build margin emission factor only grid power plants are included in the calculation

STEP3. 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:

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

As per the tool, any of the four methods can be used. For the project activity, simple OM method has been chosen to calculate the operating margin emission factor ($EF_{grid,OM,y}$). However 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.

Following table analyses whether simple OM can be used in the project case or not:

Table 18: Percentage of low-cost/must run sources in Southern Grid

Generation source	2003-04	2004-05[31]	2005-06	2006-07	2007-08	Average (last five years)
Southern grid						
Net Generation (GWh)	128372.685	134675.841153	138328.55195	152205.95195	157315.02977	142179.6
% of Low cost/ Must run sources	16.17%	21.61%	27.00%	28.31%	27.08%	24.03%

Table 19: % of low-cost/must run sources in NEWNE grid

Generation source	2003-04	2004-05	2005-06	2006-07	2007-08	Average (last five years)
NEWNE grid						
Net Generation (GWh)	389,003	413,746	437,877	465,361	496,119	440421
% of Low cost/ Must run sources	15..97	17.21	17.95	18.45	19.04	18.16

The above tables clearly show that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) is much lesser than 50% of the total generation. Thus, Simple OM method can be used for calculating the emission factor.

Further as per the tool 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

[31] Net generation and % of low cost/must run sources for the year of 2003-04 and 2004-05 has been taken from "Baseline carbon dioxide database", version-03 published by Central Electricity Authority. http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

period is required. For grid power plants, use 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.

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.

For the project activity Ex-ante option has been chosen, therefore operating margin emission factor is estimated using 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.

STEP4. Calculate the operating margin emission factor according to the selected method.
In India, the Central Electricity Authority (CEA) has provided the data for estimation of the baseline emission factor for the power sector. This data is the most authentic information available in the public domain.

Table 20: Operating Margin Southern Grid

Year	2005-06	2006-07	2007-08	Generation Weighted Average
Operating Margin (tCO_2/MWh)	1.01	1.00	0.99	0.9982
Net Generation in Operating Margin	100,978	109,116	114,702	

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 4.0

Table 21: Operating Margin NEWNE Grid

Year	2005-06	2006-07	2007-08	Generation Weighted Average
Operating Margin (tCO_2/MWh)	1.02	1.01	1.00	1.0086
Net Generation in Operating Margin (GWh)	359,271	379,471	401,642	

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 4.0

STEP 5. Calculate the build margin (BM) emission factor.

As per the tool, 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.

For the project activity project proponent has chosen Option 1

The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available.

Table 22: Build Margin Southern Grid

Year	2007-08
Build Margin (tCO_2/MWh)	0.7133

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 4.0

Table 23: Build Margin NEWNE Grid

Year	2007-08
Build Margin (tCO_2/MWh)	0.5977

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 4.0

STEP6. Calculate the combined margin (CM) emissions factor.

As per the tool, The calculation of the combined margin (CM) emission factor (EFgrid,CM,y) is based on one of the following methods:
(a) Weighted average CM; or
(b) Simplified CM.

The weighted average CM method (option A) has been used for the computation of combined margin (CM) emissions factor.

The combined margin emissions factor is calculated as follows:

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

Where:
$EF_{grid,BM,y}$: Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$: Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}: Weighting of operating margin emissions factor (%)
w_{BM}: Weighting of build margin emissions factor (%)

In case of wind power generation project w_{OM} = 0.75 and w_{BM} = 0.25

Table 24: Southern Grid Emission factor (Combined Margin)

Particulars	Details	Source
Operating Margin (tCO_2/MWh)	0.9982	CEA
Build Margin (tCO_2/MWh)	0.7133	CEA
Combined Margin (tCO_2/MWh)	0.9269	Weighted Average

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 4.0

Table 25: NEWNE Grid Emission factor (Combined Margin)

Particulars	Details	Source
Operating Margin (tCO_2/MWh)	1.0086	CEA
Build Margin (tCO_2/MWh)	0.5977	CEA
Combined Margin (tCO_2/MWh)	0.9059	Weighted Average

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 4.0

Project emissions
The project activity uses wind power to generate electricity; hence there are no greenhouse gas emissions from the project activity

$PE_y = 0$

Leakage
As per methodology no leakage emissions are considered.

B.6.2. Data and parameters fixed ex ante

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

Data / Parameter	**$EF_{SR,OM,y}$**
Unit	tCO_2/MWh
Description	Operating Margin of the Southern Grid of India
Source of data	CO_2 Baseline Database for the Indian Power Sector, Version 4.0, published by Central Electricity Authority, Ministry of Power, Government of India This is available at http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip
Value(s) applied	0.9982
Choice of data or Measurement methods and procedures	CO_2 Baseline Database for the Indian Power Sector, Version 4.0, published by CEA is consistent with the Tool to calculate the emission factor for an electricity system published by CDM Executive Board
Purpose of data	Calculation of Baseline emissions
Additional comment	-

Data / Parameter	**$EF_{SR,BM,y}$**
Unit	tCO_2/MWh
Description	Build Margin of the Southern Grid of India
Source of data	Central Electricity Authority of India (CEA): CO_2 Baseline Database, Version 4.0 http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip
Value(s) applied	0.7133
Choice of data or Measurement methods and procedures	CO_2 Baseline Database for the Indian Power Sector, Version 4.0, published by CEA is consistent with the Tool to calculate the emission factor for an electricity system published by CDM Executive Board
Purpose of data	Calculation of Baseline emissions
Additional comment	-

Data / Parameter	**$EF_{NEWNE,OM,y}$**
Unit	tCO_2/MWh
Description	Operating Margin of the NEWNE Grid of India

Source of data	CO_2 Baseline Database for the Indian Power Sector, Version 4.0, published by Central Electricity Authority, Ministry of Power, Government of India This is available at http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip
Value(s) applied	1.0086
Choice of data or Measurement methods and procedures	CO_2 Baseline Database for the Indian Power Sector, Version 4.0, published by CEA is consistent with the Tool to calculate the emission factor for an electricity system published by CDM Executive Board
Purpose of data	Calculation of Baseline emissions
Additional comment	

Data / Parameter	**$EF_{NEWNE,BM,y}$**
Unit	tCO_2/MWh
Description	Build Margin of the NEWNE Grid of India
Source of data	Central Electricity Authority of India (CEA): CO_2 Baseline Database, Version 4.0 http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver4.zip
Value(s) applied	0.5977
Choice of data or Measurement methods and procedures	CO_2 Baseline Database for the Indian Power Sector, Version 4.0, published by CEA is consistent with the Tool to calculate the emission factor for an electricity system published by CDM Executive Board
Purpose of data	Calculation of Baseline emissions
Additional comment	

B.6.3. Ex ante calculation of emission reductions

>>

Calculation of Emission factor:

$EF_{grid,CM,y} = EF_{grid,OM,y} * 0.75 + EF_{grid,BM,y} * 0.25$

For NEWNE Grid (Gujarat and Maharashtra):

$EF_{NEWNE,CM,y}$ = 1.0086 * 0.75 + 0.5977 * 0.25
= 0.9059 tCO_2/MWh

For Southern Grid (Karnataka):

$EF_{SR,CM,y}$ = 0.9982 * 0.75 + 0.7133 * 0.25
= 0.9269 tCO_2/MWh

Electricity generated by the project activity:

Maharashtra:

EG_{ym} = Installed Capacity *CUF * Number of operational hours
= 6 MW * 20% * 365*24 hrs
= 10512 MWh

Gujarat:

EG_{yg} = Installed Capacity * CUF * Number of operational hours

= 9 MW * 23% * 365*24 hrs
= 18133 MWh

Karnataka:
EG_{yk} = Installed Capacity * CUF * Number of operational hours
= 10.5 MW (1-0.5%[32]) * 26.5% * 8760 hrs
= 24253 MWh

Calculation of Baseline Emissions:
$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$

Maharashtra:
BE_{ym} = 10512 MWh * 0.9059 tCO_2/MWh
= 9523 tCO_2e
Gujarat:
BE_{yg} = 18133 MWh * 0.9059 tCO_2/MWh
= 16427 tCO_2e

Karnataka:
BE_{yk} = 24253 MWh * 0.9269 tCO_2/MWh
= 22481 tCO_2e

Therefore, Emission Reductions:

Maharashtra:
ER_{ym} = 9523 tCO_2e

Gujarat:
ER_{yg} = 16427 tCO_2e

Karnataka
ER_{yk} = 22481tCO_2e

Hence,

Total Emission Reductions for the project activity,
ER_y = ER_{ym} + ER_{yg} + ER_{yk}
= (9523+16427+22481) tCO_2e
= 48430 tCO_2e

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2012-13	48430	0	0	48430
2013-14	48430	0	0	48430
2014-15	48430	0	0	48430
2015-16	48430	0	0	48430
2016-17	48430	0	0	48430
2017-18	48430	0	0	48430

[32] Auxiliary Consumption: Page No. 17, KERC tariff order dated 18th Jan 2005; www.kerc.org/

2018-19	48430	0	0	48430
2019-20	48430	0	0	48430
2020-21	48430	0	0	48430
2021-22	48430	0	0	48430
Total	**484300**	**0**	**0**	**484300**
Total number of crediting years	10			
Annual average over the crediting period	48430	0	0	48430

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	**EG_{ym}**
Unit	MWh
Description	Quantity of net electricity supplied by the WTGs in Maharashtra associated with the project activity to the grid in year y
Source of data	Certificate for share of electricity for power exported by the project activity WTGs issued by Maharashtra State Electricity Dist. Co. Ltd. (MSEDCL)
Value(s) applied	10512
Measurement methods and procedures	The value of $EG_{y.m}$ reported in these monthly share of electricity certificates for WTGs in the project activity at Sangli (Location no. N-131, N-132, N-133, N-23) are calculated values. Monthly share of electricity is apportioned by the MSEDCL based on the individual WTG generation and the total electricity supplied by the wind farm. WTG wise electricity generation is measured using WTG controller at the project site. Net Electricity exported to grid by the wind farm is measured using MSEDCL meter installed at sub-station. The meter is a tri-vector meter which records both import and export. This reading is taken monthly by joint team of Operation and Maintenance (O&M) team at the wind farm and MSEDCL personnel. The accuracy of MSEDCL meter used for Joint Meter Readings is 0.2. The WTG controller data is recorded by O&M team and communicated to MSEDCL
Monitoring frequency	Continuous monitoring with monthly recording
QA/QC procedures	Calibration of the MSEDCL meter would be carried out at least once in five years. Net electricity exported by the project activity can be cross verified with the actual invoices presented to MSEDCL
Purpose of data	Calculation of Baseline emissions
Additional comment	The period of storage of data will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Data / Parameter	**EG_{yg}**
Unit	MWh

Description	Quantity of net electricity supplied by the WTGs in Gujarat associated with the project activity to the grid in year y
Source of data	Certificate for share of electricity for power exported by Wind Farm at Chandrodi issued by Gujarat Energy Development Agency (GEDA)
Value(s) applied	18133
Measurement methods and procedures	Actual energy supplied by WTGs each month is calculated by Gujarat Energy Development Agency. GEDA issues a certificate for the share of electricity generated every month. Monthly share of electricity certificate is apportioned by GEDA based on actual generation of various WTGs and the net total electricity supplied by the Wind Farm. Actual power generated by various WTGs is measured using transformer yard meter at the project site. The accuracy class of WTG meter is 0.5s. These are monitored on daily basis and a compilation of this data is sent to GEDA every month. Net electricity exported to grid by the wind farm is measured using GETCO meters installed at HT end of the 33/66 KV substation at Chandrodi. This is the joint meter reading and is taken in the presence of GETCO, GEDA and O & M personnel. Accuracy class of GETCO meters is 0.2s. Based on this GEDA issues certificate for share of electricity generated by various power producers.
Monitoring frequency	Continuous monitoring with monthly recording
QA/QC procedures	This value can be cross verified with the actual invoices presented to GUVNL. Calibration of GETCO meter will be carried out on at least 5 year basis[33].
Purpose of data	Calculation of Baseline emissions
Additional comment	The period of storage of data will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Data / Parameter	**EG_{yk}**
Unit	MWh
Description	Quantity of net electricity supplied by the WTGs in Karnataka associated with the project activity to the grid in year y
Source of data	Certificate for the net electricity exported to the grid by the WTGs associated with the project activity issued by Bangalore Electricity Supply Company Limited (BESCOM)
Value(s) applied	24253

[33] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

Measurement methods and procedures	Actual energy supplied by WTGs each month is estimated by BESCOM. BESCOM issues a certificate for the share of electricity generated every month. Monthly share of electricity certificate is apportioned based on actual generation of WTGs and the net total electricity supplied by the Wind Farm Actual power generated by wind mill is measured using transformer yard meters at the project site. Both main meter and check meter are installed. Net electricity exported to grid by the wind farm is measured using KPTCL meters installed at HT end of the 33/66 KV substation at Gujanur. Both main meter and check meter are installed. Both of these are joint meter readings and are taken on monthly basis in the presence of KPTCL/BESCOM and representative of the project proponent (Operation and maintenance personnel). The accuracy class of the above meters is 0.2s. Based on this BESCOM will issue certificate for share of net electricity exported by the wind mills to the grid.
Monitoring frequency	Continuous monitoring with monthly recording
QA/QC procedures	This value can be cross verified with the actual invoices presented to Bangalore Electricity Supply Company Limited (BESCOM). Calibration of BESCOM meter will be carried out on at least once in five years.
Purpose of data	Calculation of Baseline emissions
Additional comment	The period of storage of data will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

B.7.2. Sampling plan

>>

The project proponent has engaged various experienced O&M service providers for the management of the WTGs. O&M team will be responsible for preventive maintenance, handling emergency situations and improvement measures.

Maharashtra

Operation and Maintenance contract for the WTGs in Maharashtra have been awarded to Suzlon Energy Ltd for the management of WTGs. O & M team will be responsible for preventive maintenance, handling emergency situations and improvement measures.

Metering & Monitoring:

The WTGs supply power to MSEDCL Grid at common metering point, at 220/33KV Ghatnandre Sub-Station. Actual electricity supplied by WTGs each month is monitored by MSEDCL. Monthly share of electricity is prorated by the state electricity board based on the individual WTG generation and the total electricity supplied by the wind farm.

Tower wise electricity generation is measured using WTG controller at the project site. Electricity exported to grid is measured using MSEDCL meter installed on uploading station (220 KV / 33 KV Ghatnandre Sub-Station, this reading is taken monthly by joint team of Operation and Maintenance (O&M) team at wind farm and MSEDCL personnel.

MSEDCL issues monthly certificate for actual power exported by various WTGs in the wind farm. This reading is derived using above meters. Reading recorded in this certificate for the WTGs in the project activity would be used for actual estimations. This reading can be cross verified with the actual invoices presented to MSEDCL. Calibration of the substation meter will be carried on at least once in five year basis.

If main mater and check meter are found faulty, energy generation is monitored in accordance with procedures described in PPA as follows

If during testing both the Main and Check meter are found within the permissible limit of error i.e. 0.5%, the energy computation will be as per the Main meter. If during test, any of the main meters is found to be within the permissible limits of error but the corresponding check meter is beyond the permissible limit, the energy computation will be as per the Main meter. The check meter shall be calibrated immediately.

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 the permissible limits of error, then the energy computation for the month test check shall be in accordance with check meter. The main meter shall be calibrated immediately and the energy for the period thereafter shall be as per the calibrated main meter.

If during any of the monthly meter readings, the variation between the main meter and the check meter is more than 0.5%, all the meters shall be re-tested and calibrated immediately by MSEDCL. The correction required as per result of the testing will be applied to the generation and consumption of energy for the period from last meter reading to the time of such test checks. Energy for the periods thereafter shall be in accordance with the calibrated main meter

Data storage and Archiving:
The energy credit document will be kept at safe storage for verification of emission reductions generated from the project activity. Supporting documents such as invoices presented will also be kept in safe storage for later verification by an independent third party. The period of storage will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Gujarat
Operation and Maintenance contract for the wind mills in Gujarat have been awarded to Vestas RRB India Ltd. for the management of WTGs. O & M team will be responsible for preventive maintenance, handling emergency situations and improvement measures.

Metering & Monitoring:
The generated power is stepped up to 33KV at the Project Site and further stepped up to 66KV at the Chandrodi sub station (Sending Station). The Chandrodi site sub station is connected to GETCO's (Gujarat Energy Transmission Corporation Limited) Shivlakha Sub station. Net electricity exported to grid by the wind farm is measured using GETCO meters installed at HT end of the 33/66 KV substation at Chandrodi. This is the joint meter reading and is taken monthly in the presence of GETCO, GEDA and O & M personnel. Tower wise generation for WTGs in the wind farm will be measured by various transformer yard meters at the project site. This is done on a daily basis and a monthly compilation is sent to GEDA.

Monthly share of electricity certificate is prorated by GEDA based on actual generation of various WTGs and the net total electricity supplied by the Wind Farm. Reading recorded in this certificate for the WTGs in the project activity would be used for actual estimations. This value can be cross verified with the actual invoices presented to GUVNL. Calibration of substation meter will be carried on 5 year basis[34].

If main mater and check meter are found faulty, energy generation is monitored in accordance with procedures described in PPA as follows.

In case, both the main meters and check meter are found to be beyond permissible limit of error, both the meters shall be calibrated immediately and the correction applicable to main meter shall be applied to the energy registered by the main meter at the correct energy for the purpose of

[34] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

energy account/billing for the actual period during which inaccurate measurements were made, if such period can be determined or, if not readily determinable, shall be the shorter of.

a. the period since the immediately preceding test of the relevant main meter, (OR)
b. one hundred and eighty (180) days immediately preceding the test at which the relevant Main meter was determined to be defective or inaccurate.

Data storage and Archiving:
The energy credit document will be kept at safe storage for verification of emission reductions generated from the project activity. Supporting documents such as actual invoices presented to GUVNL will also be kept in safe storage for later verification by an independent third party. The period of storage will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Karnataka

Operation and Maintenance contract for the wind mills in Karnataka have been awarded to Suzlon Energy Ltd for the management of WTGs. O & M team will be responsible for preventive maintenance, handling emergency situations and improvement measures.

Metering & Monitoring:

The wind machines supply power to KPTCL grid at common metering point, at 33/66 KV substation at Gujanur. Actual energy supplied by wind mills each month is estimated by KPTCL. KPTCL will issue a certificate for the share of electricity generated every month. Monthly share of electricity certificate is prorated by KPTCL based on actual generation of wind mills and the net total electricity supplied by the Wind Farm

Metering equipment shall be electronic trivector meters. The metering equipment shall be maintained in accordance with electricity standards. Actual power generated by wind mills is measured using transformer yard meter at the project site. Both main meter and check meter are installed. Net electricity exported to grid by the wind farm is measured using meters installed at HT end of the 33/66 KV substation at Gujanur. Both main meter and check meter are installed. Both of these are joint meter readings and are taken on monthly basis in the presence of KPTCL/BESCOM and representative of the project proponent (Operation and maintenance personnel).

Based on this BESCOM will issue certificate for share of net electricity exported by the wind mills to the grid. Reading recorded in this certificate for the WTGs in the project activity would be used for actual estimations. This reading can be cross verified with the actual invoices presented to BESCOM. Calibration of substation meter will be carried on at least once in five years basis.

If main mater and check meter are found faulty, energy generation is monitored in accordance with procedures described in PPA as follows:

Main meter and check meter shall be tested for every year with reference to a portable standard meter. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters. If both the 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 meter. Records of calibration certificates will be maintained for verification. Hence, high quality is ensured with the above parameters. Sales records will be used and kept for checking the consistency of the recorded data.

The monthly Invoice for each billing is in accordance with the below mentioned equation as detailed in the Power Purchase Agreement

DE= X1-(X1*Z%)

Where
DE is the delivered energy pertaining to the project.
X1 is the reading of the energy meter installed at the project site.
Z is the percentage transmission line loss incurred in the transmission line between the project and the receiving station and shall be

$$Z=\left\{\frac{(X1+X2+X3+X4+-----)-Y}{(X1+X2+X3+X4+-----)}\right\}*100$$

Where
Y is the reading of the bulk energy meter installed on the 66 KV side of the receiving station.
X1,X2, X3, X4 etc., are the readings of the energy meters installed at various individual windmill power projects being developed/proposed to be set up in the area and connected to the receiving station.

Data storage and Archiving:
The energy credit document will be kept at safe storage for verification of emission reductions generated from the project activity. Supporting documents such as invoices presented to BESCOM will also be kept in safe storage for later verification by an independent third party. The period of storage will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

For details on organization structure please refer to Appendix 5.

B.7.3. Other elements of monitoring plan

>>
Not applicable

B.7.4. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Date of completion of baseline study: 30/11/2008

Person responsible for baseline study:

Anirudh Agrawal
Gangadhar Narsingdas Agrawal (Also a project participant)

Anand Bhavan, Station Road, Margao – 403 601
Tel: (0832) 2704131/32/33
Fax No: 2730372, E-mail: gna@sancharnet.in

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
07/11/2006 (Purchase Orders for first set of WTGs in the state of Maharashtra)

C.1.2. Expected operational lifetime of project activity

>>
20 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Fixed

C.2.2. Start date of crediting period

>>
01/04/2012 or from the date of request for registration whichever is earlier

C.2.3. Length of crediting period

10 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
WTGs do not use any fuel for power generation. Thus there is no question of any kind of pollution associated with it. According to, Environmental Impact Assessment Notification-2006, Para 2[35], establishment and operation of wind mills is not included in the industries/activities which need an EIA in India. This is because of the established fact that no negative impacts are associated with wind mills.

D.2. Environmental impact assessment

>>
Environmental impacts are not considered significant by the project participants.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
Following stakeholders were identified for the project activity:

1. District authorities
2. Local Community
3. Local Gram Panchayat
4. State Electricity Boards

The project activity has obtained all necessary approvals for setting up the power plants and meets all regulatory requirements as mandated by Government agencies.

[35] http://envfor.nic.in/legis/eia/so1533.pdf

Letters are sent to the various district and village authorities informing them about the power project and inviting their views on the same. Meetings are also held with the local communities where they are informed about the project activity and their queries addressed to their satisfaction. Meeting is held on 10th Sept 2008 in the state of Gujarat, on 7th Nov 2008 in the state of Karnataka, on 12th Nov 2008 in the state of Maharashtra. Further, views about project activity are invited from the stakeholders by publishing an advertisement in the local newspapers on 23rd July 2008 in the state of Karnataka & Maharashtra and on 08th August 2008 in the state of Gujarat.

E.2. Summary of comments received

>>

Benefits of the windmills power project in the form of generation of employment opportunities, positive impact on the environment by reduction of greenhouse gas emissions and bridging the supply demand gap in the face of power deficit scenario is deeply acknowledge by the stakeholders.

E.3. Report on consideration of comments received

>>

No adverse comments received on project activity from any of the stakeholder's consulted

SECTION F. Approval and authorization

>>

The approval letter from the host country is available at the time of submission of PDD to the validating DOE.

Below link provide the details of approval letter

https://cdm.unfccc.int/filestorage/9/A/G/9AGTLJDPF3U0MWS7C5IBVOHXZ8YRK4/5553%20HCA.pdf?t=cW18bmQ3cDF2fDBnpc0joJe6RB8x131jJRf7

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Gangadhar Narsingdas Agrawal
Street/P.O. Box	Anand Bhavan
Building	Station Road
City	Margao
State/Region	Goa
Postcode	403601
Country	India
Telephone	+91-832-2704131
Fax	
E-mail	info@agrawalgroupgoa.com
Website	-
Contact person	
Title	Managing Director
Salutation	Mr.
Last name	Agrawal
Middle name	-
First name	Anirudh
Department	Director
Mobile	+91 9822984256
Direct fax	
Direct tel.	+91-832-2704131
Personal e-mail	info@agrawalgroupgoa.com

Appendix 2. Affirmation regarding public funding

No public funding available for the project activity.

Appendix 3. Applicability of methodology and standardized baseline

Indian Grid System[36]:

Historically, the Indian power system was divided into five independent regional grids, namely Northern, Eastern, Western, Southern, and North-Eastern. Each grid covered several states (see Table 2). **Since August 2006, however, all regional grids except the Southern Grid have been integrated and are operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids will be treated as a single grid and is being named as NEWNE grid in this document from FY 2007-08 onwards for the purpose of this CO2 Baseline Database. The Southern grid has also been planned to be synchronously operated with rest of all Indian Grid by early 12th Plan (2012-2017). Presently Southern grid is connected with Western and Eastern grid through HVDC link and HVDC back to back systems.** Power generation and supply within the regional grid 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. Each state meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. Moreover, there are also electricity transfers between regional grids, and small exchanges in the form of cross border imports and exports (e.g. from Bhutan).

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

Figure 5: Geographical scope of the two electricity grids

Hence, for calculation of emission factor of project activity spread across various states, following grids have been taken into account:

[36] Central Electricity Authority, CO_2 Baseline Database for the Indian Power Sector, Version 4.0; http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm

Table 26: Relevant grids for the project activity

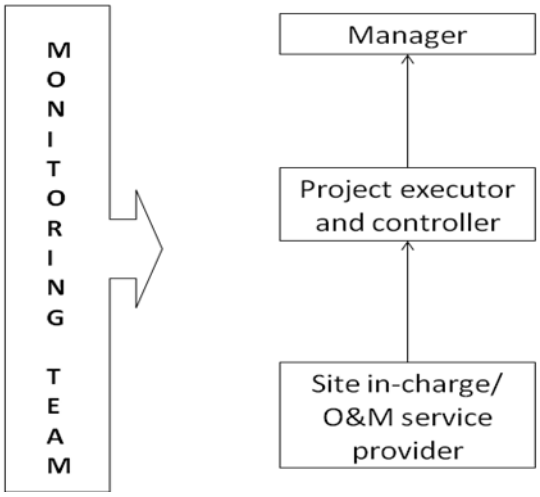
Sl. No.	State	Capacity	Regional Grid
1.	Karnataka	10.5 MW	Southern
2.	Maharashtra	6 MW	NEWNE
3.	Gujarat	9 MW	NEWNE

Appendix 4. Further background information on ex ante calculation of emission reductions

Not Applicable

Appendix 5. Further background information on monitoring plan

Organizational Structure & Responsibilities:



The project activity is operated and managed by the PP with the help of site in-charge (personnel appointed by PP) and site O&M contractor (personnel appointed by supplier of WTG/PP). For the accurate execution of the project activity a project team has been constructed. The wind power project abides and will abide by all regulatory and statutory requirements as prescribed under the state and central laws and regulations. The project team is delegated with the responsibility to monitor and document the electricity generated and also safe keeping of the recorded data.

The electricity being generated is monitored at each wind mill/common metering point as per the provision in the site using calibrated energy meters of which is installed and owned by respective State electricity boards. This meter records the electricity generated on a continuous basis.

Every month officials of the respective electricity board visits each metering point in the presence of site in-charge and the meter reading is taken recorded. The electricity generation invoice which is obtained from the grid is then cross-checked with the data recorded by meter to avoid any differences. The energy meter is inspected and sealed on behalf of the Electricity Board and the PP and is not interfered with by either party except in the presence of the other party or its accredited representatives.

The project team is also responsible for calculation of actual creditable emission reduction in the most transparent and relevant manner. All the monitoring data is stored/will be recorded and kept under safe custody. In case of the faulty meters it will be changed immediately and the necessary correction in the electricity generation will be adjusted in agreement with the state electricity board.

Designation	Responsibilities
Manager Wind Projects	Holds complete control over monitoring aspects pertaining to the project
Project Executor and Controller	• Recording • Verification • Storage of Data
Site Incharge	• Operation, Monitoring and Verification of Data • Data Recording

	• Storage of data
Operation and Maintenance service provider	• Operation and Maintenance • Storage of data • Data Recording

Appendix 6. Summary of post registration changes

The following changes have been made in the registered PDD. The details about where the changes are incorporated in the revised PDD (post registration) with reference to registered PDD is given in the table below. The revised PDD in VVS is being submitted for approval from EB.

Sl No	Changes done	Reference	
		Registered PDD	Revised PDD
01	Gujarat substation meter calibration frequency changed.	• Section B.7.1	• Section B.7.1
02	Symbol of X1 (reading of the energy meter installed at the Karnataka project site) is corrected in transmission loss calculation formula.	• Section B.7.2	• Section B.7.2

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Document information

Version	*Date*	*Description*
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
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