Project design document form

(Version 10.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	51 MW wind power project of ONGC at Surajbari, Gujarat in India
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	Document Version: 6
Completion date of the PDD	10/01/2019
Project participants	M/s Oil and Natural Gas Corporations Ltd.
Host Party	India
Applied methodologies and standardized baselines	Methodology : - ACM0002 “Grid-connected electricity generation from renewable sources” (Version 19.0)
Sectoral scopes linked to the applied methodologies	Sectoral scope(s): 01 : Energy Industries (Renewable / Non – Renewable)
Estimated amount of annual average GHG emission reductions	90,540 tCO_{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The proposed CDM project activity comprises of installation and operation of thirty four numbers of S82-1500 kW Wind turbine Generators (WTGs) having a combined wind power generation capacity of 51 MW at villages Jakhau and Village Budiya in Taluka Abdasa in Surajbari, District Kutch in Gujarat. The project is located in one of the wind rich areas of the country. And the wind capacity utilization factor is estimated at about 22.28% for 1500 kW turbines. The net estimated annual average generation per WTG after all correction (in Lac Units) as per Suzlon's machine ratings is 29.28 Lac Units. The annual estimated power generation out of the project is about 995.52 Lakh units. The annual estimated power generation after accounting for net of wheeling charges as per the Wind Power Policy - 2007 of the Government of Gujarat is about 955.56 Lakh units. The proposed CDM project is a grid-connected renewable source of electricity. The proposed grid connected wind power project would displace the fossil fuel based grid electricity that presently feeds the existing ONGC assets based at Ankleshwar, Kadi, Cambay, Ahmedabad, Gandhar, Mehsana and Vadodara. Power wheeling arrangements for the transfer of electricity from the proposed project to the various ONGC assets are being put in place.

Details of the WTGs installed under the proposed CDM project are provided in Table 1.

Table 1
Details of the WTGs installed under the proposed CDM project

S. No	WTG Capacity (KW)	No. of machines	Machine Make	M/c. locations
1	1500	34	Suzlon	Moti Sindholi, Gujarat

The displacement of grid electricity with renewable (wind based) energy saves on greenhouse gas emissions that would have otherwise been emitted in the baseline scenario. This project activity thereby generates cleaner and more sustainable electricity and displaces the grid electricity.

The project assists in enhancing sustainable development in India as detailed in the following aspects:

Social well-being: The project activity leads to alleviation of poverty by generating additional employment opportunities for the local people of the project area both during the construction phase and the entire lifetime of the project. This would lead to removal of social disparities and therefore, the project is contributing to provision of basic amenities to people leading to improvement in quality of life of people.

Economic well-being: The project activity requires additional investment to be made to set up the wind turbines, including additional infrastructure like approach roads, substations, transport of construction materials, etc. by way of which the project is leading to development of additional sectors, generation of new jobs and avenues of employment for the local people.

Environmental well-being: The project uses natural resource of wind to generate clean and green power. Thus, the impact of the project activity on the state of Gujarat is that there is no degradation of natural resources used for the project. Wind power is an environmentally friendly mode of power generation with no negative impact on human health and leads to reduction of pollution in comparison to the alternative of fossil fuel based power plants.

Technological well-being: The project activity utilises environmentally safe and sound wind power technology that is comparable to the best practices across the world.
The project assists in the sustainable development of the Country, and the State of Gujarat by increasing availability of clean renewable power, reducing dependency on fossil fuels, reducing

local air pollution, providing emission free clean electricity and providing employment to rural youth both during the construction phase and the entire lifetime of the project.

A.2. Location of project activity

>>

A.2.1. Host Party

India

A.2.2. Region / State / Province etc.

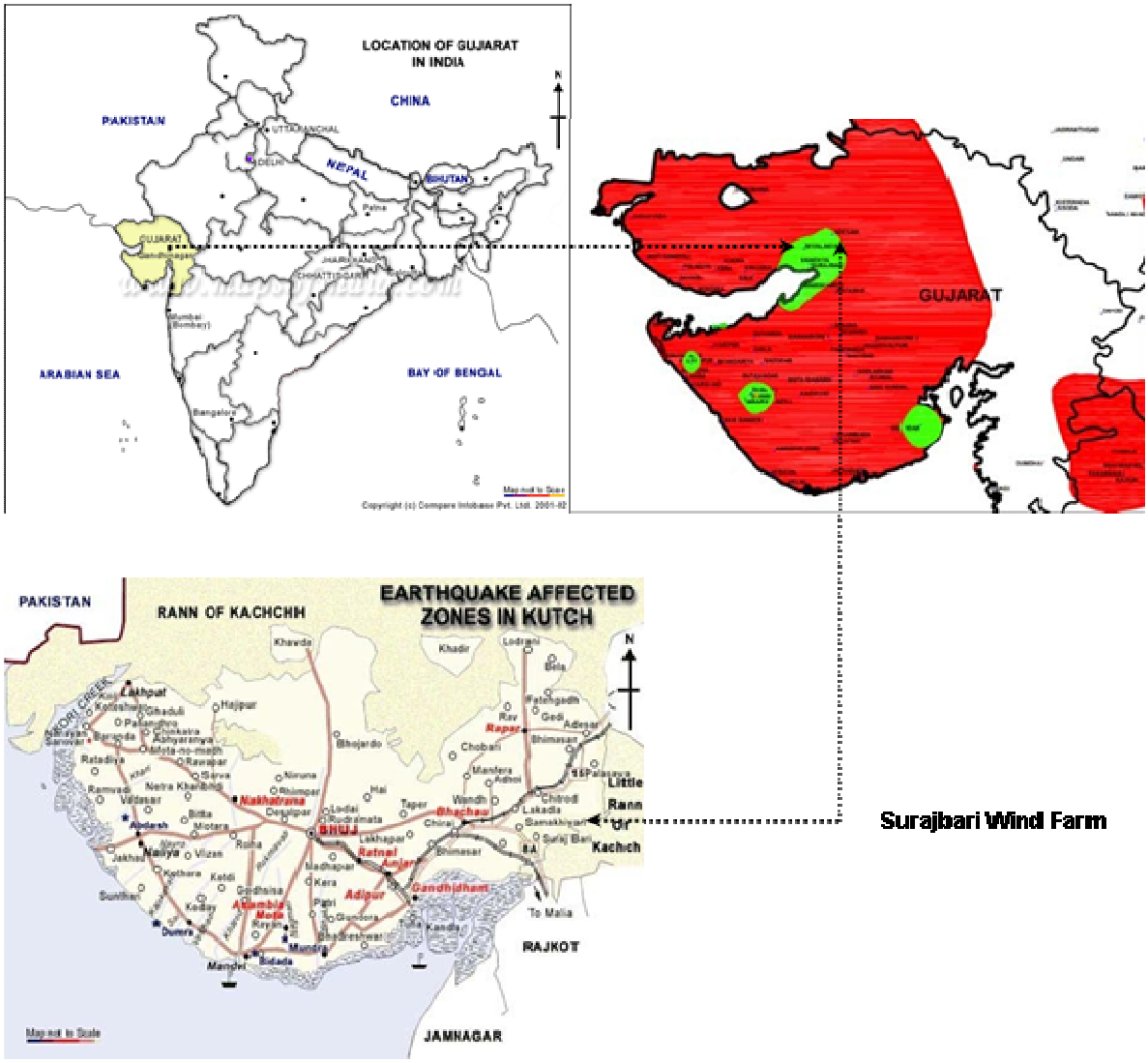
Gujarat

A.2.3. City / Town / Community etc.

The wind turbines are located in the Surajbari creek near the village Jakhau and Village Budiya in Taluka Abdasa in Surajbari.

A.2.4. Physical and Graphical Location

The proposed CDM project activity is located in village Jakhau and village Budiya in Taluka Abdasa, Moti Sindholi, Surajbari , District Kutch, Gujarat State, India. The location map is given below :



Location Map of Moti Sindholi, Surajbari Wind Farm, Gujarat, India

Coordinates of WTGs of proposed 51 MW Wind Power Project at Moti Sindholi (Jakhau) Site

Sl. No.	Location No.	Northing	Easting
1.	M-631	N23Deg 10Min 03.3Sec	E68Deg 43Min 04.7Sec
2.	M-636	N23Deg 09Min 52.1Sec	E68Deg 43Min 36.0Sec
3.	M-637	N23Deg 10Min 32.3Sec	E68Deg 44Min 37.6Sec
4.	M-638	N23Deg 10Min 08.3Sec	E68Deg 44Min 08.3Sec
5.	M-639	N23Deg 09Min 55.9Sec	E68Deg 44Min 16.7Sec
6.	M-707	N23Deg 11Min 39.4Sec	E68Deg 40Min 42.2Sec
7.	M-708	N23Deg 11Min 27.3Sec	E68Deg 40Min 50.5Sec
8.	M-709	N23Deg 11Min 16.5Sec	E68Deg 40Min 59.9Sec
9.	M-710	N23Deg 11Min 02.2Sec	E68Deg 41Min 03.1Sec
10.	M-711	N23Deg 10Min 51.8Sec	E68Deg 41Min 06.6Sec
11.	M-712	N23Deg 10Min 36.8Sec	E68Deg 41Min 13.5Sec
12.	M-713	N23Deg 10Min 24.4Sec	E68Deg 41Min 19.8Sec
13.	M-714	N23Deg 10Min 12.0Sec	E68Deg 41Min 26.9Sec
14.	M-715	N23Deg 09Min 59.5Sec	E68Deg 41Min 33.7Sec
15.	M-716	N23Deg 09Min 47.1Sec	E68Deg 41Min 40.5Sec
16.	M-717	N23Deg 11Min 46.2Sec	E68Deg 41Min 06.6Sec
17.	M-730	N23Deg 11Min 24.7Sec	E68Deg 41Min 14.9Sec
18.	M-731	N23Deg 11Min 12.5Sec	E68Deg 41Min 22.0Sec
19.	M-734	N23Deg 10Min 34.8Sec	E68Deg 41Min 38.6Sec
20.	M-735	N23Deg 10Min 22.6Sec	E68Deg 41Min 46.5Sec
21.	M-736	N23Deg 10Min 10.7Sec	E68Deg 41Min 50.5Sec
22.	M-737	N23Deg 09Min 53.0Sec	E68Deg 42Min 01.8Sec
23.	M-738	N23Deg 10Min 23.0Sec	E68Deg 42Min 46.6Sec
24.	M-739	N23Deg 09Min 35.1Sec	E68Deg 42Min 06.4Sec
25.	M-740	N23Deg 09Min 22.5Sec	E68Deg 42Min 12.7Sec
26.	M-752	N23Deg 11Min 10.4Sec	E68Deg 41Min 46.5Sec
27.	M-753	N23Deg 10Min 57.9Sec	E68Deg 41Min 52.6Sec
28.	M-754	N23Deg 10Min 45.9Sec	E68Deg 42Min 02.5Sec
29.	M-756	N23Deg 10Min 09.9Sec	E68Deg 42Min 26.0Sec
30.	M-757	N23Deg 09Min 45.3Sec	E68Deg 42Min 25.9Sec
31.	M-758	N23Deg 09Min 32.9Sec	E68Deg 42Min 33.4Sec
32.	M-766	N23Deg 11Min 22.7Sec	E68Deg 41Min 38.8Sec
33.	M-767	N23Deg 10Min 39.4Sec	E68Deg 42Min 23.7Sec
34.	M-776	N23Deg 10Min 40.3Sec	E68Deg 43Min 27.3Sec

All the thirty four wind energy generating turbines have been commissioned as on 29th September 2008. Three machines with a total capacity of 4.5MW got commissioned on April 4, 2008. Seven machines with a total capacity of 10.5 MW got commissioned on 12th June 2008. The remaining twenty four machines with a total installed capacity of 36 MW have been commissioned on 29th September 2008. The three separate commissioning certificates for all these machines have been provided to the validator at the ONGC head office at Dehradun.

A.3. Technologies/measures

>>

The project activity complies with the applicability criteria of the large scale CDM Project activity category. The capacity of the proposed project is 51 MW, which is more than the maximum qualifying capacity of 15 MW. The project activity has been considered as a large scale CDM Project activity and UNFCCC indicative simplified modalities and procedures are applied. The project activity utilizes the wind potential for power generation and exports the generated electricity to grid.

According to large – scale CDM Modalities the project activity falls under the following category: Sectoral Scope: 1 Energy Industries (Renewable / non – Renewable sources) Type I : Renewable Energy Project Category I.D. – Grid Connected Renewable Electricity Generation.

As per the provisions specified, the projects that come under the purview of ACM0002, Version 19.0 (31st Aug, 2018), Sectoral Scope: 01)[1] "comprise of renewable energy generation units , such as photovoltaic, hydro, tidal / wave, wind, geothermal and renewable biomass, that supply electricity to and /or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit."

Technology

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind turbines capture wind's energy with two or three propeller – like blades, which are mounted on a rotor to generate electricity. The turbines sit high atop towers, taking advantage of the stronger and less turbulent wind as the wind blows through the blades of windmill, a pocket of low –pressure forms on the downwind side of the blade. The low-pressure pockets pulls the blade towards it, causing rotor to spin. The rotor turns the shaft that further spins the connected generator. The spinning of this generator produces the required electricity.

Thirty four numbers of 1500 kW Suzlon Wind turbine generator turbines have been installed under the proposed CDM project. The power generated will be fed into power distribution grid of the western region as per the Power Wheeling Agreement between ONGC and the Gujarat Energy Transmission Corporation Ltd. (GETCO) grid system. The proposed CDM project is a grid-connected renewable source of electricity. The proposed grid connected wind power project would displace the fossil fuel based grid electricity that presently feeds the existing ONGC assets based at Ankleshwar, Kadi, Cambay, Ahmedabad, Gandhar, Mehsana and Vadodara.

Details of the energy generated and wheeled from the different Wind Turbines under the proposed CDM project activity and the corresponding locations where the power will be used are provided in Table 2 :

Table 2

Machine wise power wheeling to ONGC assets in Gujarat displacing grid electricity

S.No	WTG Location No.	Percentage of Net Energy to be Wheeled	ONGC Installations where energy will be consumed
1 2	**1** **2**	100% 45%	ONGC, Ankleshwar (GGS IV Paniyadra), Ankleshwar
	2	50%	ONGC-Ankleshwar,At.Post- Ankleshwar
	2	5%	MM-ST, Ankleshwar
	TOTAL	**200%**	
3	**3**	95%	OBG Vanseta, ONGC, Ankleshwar, Bharuch
		5%	GGS Kosamba, Ankleshwar
	TOTAL	**100%**	
4	**4**	64%	ONGC Ltd. Colony and Office at Vadodara

[1] https://cdm.unfccc.int/filestorage/5/8/I/58IAGB7SZUDEO2VN6LYM30K41HFPRQ/EB100_repan06_ACM0002.pdf?t=TGh8cGlhYTRjfDARFHXNmKU1TepWgm5lJ4ea

5 6	**5** **6**	36%	ONGC Ltd Chandkheda (E/S) District Ahmedabad
7	**7**	85%	ONGC, CTF South, Kadi
		15%	Kathana GGS, Cambay
	TOTAL	**100%**	
8	**8**	85%	ONGC (Zalora), OBG. B91, ONGC Colony, Chandkheda, Ahmedabad
		5%	GGS-II, Gandhar
		5%	GGS-VI Kalol, Ahmedabad
		5%	GGS-II, Gandhar
	TOTAL	**100%**	
9	**9**	10%	GGS-Motwan, Ankleshwar
		50%	Ex. Engg (Elect), ONGC, GGS.1, Room No. 8, 1st Floor, Avni Bhavan, ONGC Chandkheda, Ahmedabad
		40%	ONGC, Viraj, GGS,Vill: Vidaj, nani Kadi, Chandkheda
	TOTAL	**100%**	
10	**10**	50%	C.E. (Elect), ONGC, Zalora GGS-II,, Chandkheda, Ahmedabad
		45%	Chief Engg (Elect), ONGC, S.T.Electrical Section, Room No. 8, 1st Floor, Avni Bhavan, ONGC Chandkheda, Ahmedabad
		5%	EPS Jolwa, Gandhar
	TOTAL	**100%**	
11 12	**11** **12**	100% 100%	Chief Engr (Elect), ONGC, 1st Floor, Avni Bhavan, ONGC Chandkheda, Ahmedabad
	TOTAL	**200%**	
13	**13**	50%	Tele Communication Centre, ONGC, Chandkheda, Ahmedabad
		40%	ONGC, GGS.III, Room No. 8, 1st Floor, Avni Bhavan, ONGC Chandkheda, Ahmedabad
		10%	GGS-7, Gandhar
	TOTAL	**100%**	
14 15	**14** **15**	100% 50%	WI-MPH, Ankleshwar

	15	50%	ONGC, 1st Floor, Avni Bhavan, ONGC Chandkheda, Ahmedabad
	TOTAL	**200%**	
16	**16**	70%	ETP Sobasan, Mehsana
		15%	Gandhar, ONGC, Plant Post:-Ankleshwar, Dist: Bharuch
		10%	GGS-II Kalol, Ahmedabad
		5%	EPS Itola, Gandhar
	TOTAL	**100%**	
17	**17**	90%	ETP N. Santhal, Mehsana
		5%	EPS Motera, Ahmedabad
		5%	GGS-IV Kalol, Ahmedabad
	TOTAL	**100%**	
18	**18**	80%	Colony & Offices, Mehsana
		10%	Logg Compl., Mehsana
		10%	GGS-XI Kalol, Ahmedabad
	TOTAL	**100%**	
19	**19**	45%	CTF Sobasan, Mehsana
		35%	GGS-II Limbodara, Ahmedabad
		15%	GGS-I Limbodara, Ahmedabad
		5%	GGAS-VIII Kalol, Ahmedabad
	TOTAL	**100%**	
20	**20**	40%	Lanwa Insitu, Mehsana
		5%	GGS-5 Vagra, Gandhar
		10%	CISF Colony, Gandhar
		15%	EPS Vansetta, Gandhar
	TOTAL	**100%**	
21	**21**	30%	CWS, Vadodara
		15%	WIP Wasna, Ahmedabad
		15%	DTYS and Saij colony, Ahmedabad
		40%	ONGC (CHI), Room No. 8, 1st Floor, Avni Bhavan, ONGC Chandkheda, Ahmedabad
	TOTAL	**100%**	
22	**22**	15%	GGS-V Kalol, Ahmedabad
		50%	NK GGS-CTF,Mehsana
		20%	GGS-VII Kalol, Ahmedabad

		15%	GGS-III Kalol, Ahmedabad
	TOTAL	**100%**	
23	**23**	10%	GGS Wasna , Ahmedabad
		25%	GGS Gamij (New), Ahmedabad
		15%	GGS-I Nawagam, Ahmedabad
		50%	ETP Bechraji, Mehsana
	TOTAL	**100%**	
24	**24**	60%	WTP Zanore, Gandhar
		10%	EPS Dahej, Gandhar
		10%	DSA Mullar, Gandhar
		20%	Mud Plant, Gandhar
	TOTAL	**100%**	
25	**25**	30%	GGS-2, Ankleshwar
		40%	GGS-3, Ankleshwar
		20%	CTF, Ankleshwar
		10%	Kathod WI, Ankleshwar
	TOTAL	**100%**	
26	**26**	35%	NK GGS-I, Mehsana
		35%	NK GGS-II, Mehsana
		20%	GGS-IV Balol, Mehsana
		10%	GGS-II S. Santhal, Mehsana
	TOTAL	**100%**	
27	**27**	50%	GGS CUM CTF N.S., Mehsana
		15%	GGS-II Bech, Mehsana
		15%	GGS-II Lanwa, Mehsana
		20%	GGS-I Sobasan, Mehsana
	TOTAL	**100%**	
28	**28**	40%	EPS Linch, Mehsana
		10%	GGS-I Lanwa, Mehsana
		20%	W/Shop & DSA, Mehsana
		30%	CISF, Mehsana
	TOTAL	**100%**	
29	**29**	20%	GGS-III Balol, Mehsana
		30%	GGS Nandasan, Mehsana

		40%	Office complex, Mehsana
		10%	Sabarmati W/Shop, Ahmedabad
	TOTAL	**100%**	
30	**30**	40%	GGS-IX Kalol, Ahmedabad
		20%	EPS WADU, Ahmedabad
		20%	GGS Paliad, Ahmedabad
		20%	GGS-II Nawagam, Ahmedabad
	TOTAL	**100%**	
31	**31**	30%	GGS Ramol, Ahmedabad
		30%	CTF Kadi, Ahmedabad
		10%	GGS-I Kalol, Ahmedabad
		30%	GGS Nandej, Ahmedabad
	TOTAL	**100%**	
32	**32**	20%	GGS-III Dahej, Gandhar
		20%	GGS-VI Denva, Gandhar
		30%	DSA Gandhar
		30%	W/Shop Campus, Gandhar
	TOTAL	**100%**	
33	**33**	30%	GGS-I Bech, Mehsana
		20%	GGS-III Balol, Mehsana
		20%	GGS-III Bech, Mehsana
		30%	GGS-II Sobasan, Mehsana
	TOTAL	**100%**	
34	**34**	25%	GGS-1Jotana, Mehsana
		25%	GGS-III NK, Mehsana
		25%	ETP Lanwa, Mehsana
		25%	ONGC, ONGC, ANK Town, Ankleshwar-393001
	TOTAL	**100%**	

All of the power wheeling arrangements for the transfer of electricity from the proposed project to the various ONGC assets have been signed.

The displacement of fossil fuel based grid electricity with purely renewable, clean, wind based energy saves on greenhouse gas emissions that would otherwise have been emitted in the baseline scenario. Thus, the base line for the proposed project activity is the grid connected electricity being supplied to the various ONGC locations at Ankleshwar, Kadi, Cambay, Ahmedabad, Gandhar, Mehsana and Vadodara.

The technical specifications of the 1500 kW turbines are provided in Table 3 as follows :

Table 3
Technical specifications of the 1500 kW WTG

1	Nominal Output (KW)	1500
2	Power Regulation	Independent electromechanical pitch system for each blade and via Suzlon-Flexi-Slip-System
3	Cut – in (m/s)	4
4	Cut – out (m/s)	20
5	Survival wind speed (m/s)	52.5
6	Tip speed (m/s)	70 (at rated power)
7	Rotor speed (rpm)	16.30 (at rated power)
8	Hub height (m)	78.5 (including 1m foundation height)
	Rotor	
9	Rotor diameter (m)	82
10	Rotor orientation (upwind/downwind)	Upwind
11	Number of blades	3
	Brake System	
12	Aerodynamics	3 independent systems with blade pitching mechanism
13	Mechanical	Hydraulic disc brake, activated by hydraulic pressure and mechanical rotor lock
14	Yaw system	Slide bearing with gear ring & automatic greasing system along with active electric yaw drive having electric motor with brake, gearbox and pinion
	Generator	
15	Voltage (V)	3 Phase 690 V AC
16	Frequency (Hz)	50
	Tower	
17	Type	Lattice
18	Mast Height (m)	78.5

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (host party)	M/s Oil and Natural Gas Corporation Ltd. (ONGC)	No

A.5. Public funding of project activity

>>
There is no public funding in the proposed CDM project activity.

A.6. History of project activity

>>
A.6.1. The proposed CDM project activity is registered as a CDM project activity with UN reference number as UN2856. This project activity is not included as a component project activity (CPA) in a registered CDM programme of activities (PoA).
A.6.2.
This is a registered CDM project activity whose crediting period has expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

>>
Not Applicable

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

>>
The title of the baseline methodology applicable to the proposed project activity is “Large Scale Consolidated Methodology for Grid-connected electricity generation from renewable sources”.

The title of the monitoring methodology applicable to the proposed project activity is “Consolidated monitoring methodology for zero-emissions grid connected electricity generation from renewable sources”.

Reference: ACM0002, Version 19.0 (31st Aug, 2018), Sectoral Scope: 01

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website

Tools referred as per the methodology:

1. Tool for the demonstration and assessment of additionality
2. Combined tool to identify the baseline scenario and demonstrate additionality
3. Tool to calculate project or leakage CO2 emissions from fossil fuel combustion
4. Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation
5. Tool to calculate the emission factor for an electricity system
6. Tool to determine the remaining lifetime of equipment
7. Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period

B.2. Applicability of methodologies and standardized baselines

>>
The proposed CDM project activity is a grid-connected renewable power generation facility and meets the applicability conditions of the chosen methodology as follows:

Condition in the methodology	Applicability
Applies to grid connected renewable energy power generation project activities that: (a) Install a Green Field Power Plant; (b) Involve a capacity addition to (an) existing plant (s); (c) Involve a retrofit of (an) existing operating plants / units. (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s). The project activity may include	The proposed CDM project activity for verification is an electricity generation project utilizing wind energy to generate electricity. Thus the proposed CDM project activity meets the first applicability condition.

renewable energy power plant/unit of one of the following types : - Hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit	
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity	The project activity involves a wind power plant, therefore this condition is not applicable.
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation	The project activity is a grid connected wind power plant and does not involve hydro power. Therefore, this criteria is not applicable.

(3), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
In the case of integrated hydro power projects, project proponent shall: • Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or • Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from	The project activity is a grid connected wind power plant and does not involve hydro power. Therefore, this criteria is not applicable.

river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	
This methodology is not applicable to : • project activities that involve switching from fossil fuels to renewable energy 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 plants/units.	The proposed CDM project activity is a green field project activity; therefore no fuel switch from fossil fuels to renewable energy at the project site is involved. Thus, the proposed CDM project activity meets this condition for applicability of the methodology. Therefore the criterion is not relevant to the project activity.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	Since the project activity is wind power based power plant under renewable energy, this criteria is not applicable for the project.
Applicability Condition of "Tool to Calculate the emission factor for an electricity system"	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This condition is applicable. OM, BM and CM are estimated using the tool under section B.6.1 for calculating baseline emissions.

Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 1: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project activity is a grid connected wind power project and it does not involve biofuels for power generation. Therefore the criterion is not applicable for the proposed project.

This baseline methodology has been used in conjunction with the approved monitoring methodology ACM0002 (Consolidated monitoring methodology for zero-emissions grid connected electricity generation from renewable sources).

B.3. Project boundary, sources and greenhouse gases (GHGs)

>>

As per baseline methodology of ACM0002 Version 19.0, Sectoral Scope (s) : 01 – "The spatial extent of the project boundary includes the proposed CDM project site and all power plants connected physically to the electricity generation and distribution system that the CDM project power plant is connected to".

The project boundary includes the wind turbine generator, sub-stations, grid at the proposed CDM Project site and all the power plant connected to the electricity generation and distribution system that the CDM power plant is connected to.

In the case of the proposed CDM project, the proposed CDM project activity would be feeding the generated electricity power to the NEWNE grid (as per latest CEA database version 13.0, southern and NEWNE grids are synchronised and become one as single Indian Grid, thus NEWNE grid is a part of current Indian Grid). Thus, all the power generation facilities connected to this grid form the project boundary for the purpose of baseline emission estimation.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown below:

	Source	GHG	Included	Justification / Explanation
Baseline	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 from electricity generation in fossil fuel fired power that is displaced due to the proposed CDM project activity.
		CH_4	No	Not applicable
		N_2O	No	Not applicable
		---		Not applicable
Project activity	Electricity generation from the project activity	CO_2	No	Electricity generation from wind does not lead to emissions of CO2. Any consumption of power for managing the common facilities and utility needs of the project site will be taken care of because the electricity meter will record the net power generated by the wind turbines (power produced by the wind turbines minus power consumed by the plant facility)
		CH_4	No	Electricity generation from wind does not lead to emissions of CH_4
		N_2O	No	Electricity generation from wind does not lead to emissions of N_2O

B.4. Establishment and description of baseline scenario

>>

Updated baseline for the second crediting period in line with the "Assessment of the validity of the original / current baseline and update of the baseline at the renewal of the crediting period." (Version 03.0.1).

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.

The tool stipulates the following steps to be carried out :

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

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

The baseline scenario remains unchanged and is in compliance with all the relevant mandatory national and / or sectoral policies.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was the electricity delivered to the grid by the project that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources to the grid.

This project activity was voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent amount of electricity at grid. Hence, same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewable of the project's crediting period under CDM.

Nevertheless, Indian power sector has grown manifold from 1,713 MW in 1950 to 344718.61 MW as on 30.09.2018[2]. The sector wise details of installed capacity is as follows:

	Thermal				Nuclear	Hydro	RES	Grand Total
Region	Coal	Gas	Diesel	Total				
Northern	51985.20	5781.26	0.00	57766.46	1620.00	19707.77	13012.88	92107.11
Western	70608.62	10806.49	0.00	81415.11	1840.00	7547.50	20725.38	111527.99
Southern	45782.02	6473.66	761.58	53017.26	3320.00	11838.03	35535.49	103710.78
Eastern	27201.64	100.00	0.00	27301.64	0.00	4942.12	1075.85	33319.61
North-East	520.02	1706.05	36.00	2262.07	0.00	1452.00	286.46	4000.53
Islands	0.00	0.00	40.05	40.05	0.00	0.00	12.56	52.61
ALL INDIA	196097.50	24867.46	837.63	221802.59	6780.00	45487.42	70648.61	344718.61

However it is evident from the table that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO_2 emissions in the country by increased use of renewable energy sources. Furthermore, project participants has considered the latest available database (Central Electricity Authority under Ministry of Power, Govt. of India; Power Sector Report – Sept, 2018) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all new circumstances. Hence, new circumstances does not have an impact on the baseline.

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

As explained in step 1.2, the baseline scenario was the electricity import / generation from the power plants connected to the electricity grid. The remaining lifetime is well within the range of end date of 2nd CP. The OEM letter is submitted to the DOE.

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

This step stipulates that "where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM activity. "

[2] http://www.cea.nic.in/reports/monthly/executivesummary/2018/exe_summary-09.pdf

In the context of the present project activity the emission factor has been updated along with the approach used to calculate the emission factor.

Impact of the national and / or sectoral policies and circumstances upon the baseline scenario of the project activity

The Government of India enacted the Electricity Act in the year 2003 to harmonize and rationalize the provisions in the then existing laws. The Act consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. With the Enactment of the act, the then existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PDD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

In addition to the above policies, State Electricity Regulatory Commissions (SERCs) have announced preferential tariffs and Indian Renewable Energy Development Agency (IREDA) provides term loan assistance towards establishing biomass power projects. All these fiscal and financial incentives were in force at the time of completion of the baseline study for the registered PDD of the project activity and still continue to exist.

However, in spite of the financial incentives given by the government to renewable power projects in India, the generation from the low cost must run resources connected to the Indian Grid has not Increased to such an extent that this would lead to more than 50% contribution from the low cost must run resources towards the total generation from the Indian Grid.

The approved consolidated baseline methodology, ACM0002: Grid-connected electricity generation from renewable sources - Version 19.0, has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period.

As referred in the methodology “Tool to calculate the emission factor for an electricity system” (version 7.0) has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

As per the approved consolidated methodology ACM002 Version 19.0, Sectoral Scope(s) : 01, *If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.*

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

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

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source[6] (where available) and made publically available.

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

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.9475	Combined margin CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline CO2 Emission database, version 13.0[3] published by Central Electricity Authority (CEA), Government of India.
$EF_{grid,OM,y}$	0.9726	Operating margin CO2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2014-15, 2015-16, 2016-17) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 13.0[4] published by Central Electricity Authority (CEA), Government of India.
$EF_{grid,BM,y}$	0.8723	Build margin CO2 emission factor for the project electricity system in year y	Sourced from Baseline CO_2 Emission Database, Version 13.0 [5] published by Central Electricity Authority (CEA), Government of India.

B.5. Demonstration of additionality

>>

The timeline for the key activities related to the development of the proposed CDM project are provided in the Table below:

CHRONOLOGY OF ACTIVITIES FOR 51 MW WIND POWER PROJECT OF ONGC IN DISTRICT KUTCH, GUJARAT

S.No	Particulars	Date
1	Tender Invite for turnkey contract on wind power project in Gujarat	30th March 2007
2	Tender invite for consultancy of CDM project	3rd July 2007
3	Internal MOM of ONGC demonstrating CDM decision for the project.	26th Oct 2007
4	Letter of Award to consultants "Deloitte" for the CDM development of wind power project in Gujarat	26th Oct 2007
5	Letter of Award to Suzlon for developing wind power project in Gujarat	6th Nov 2007
6	Contract for providing Land & Infrastructure, as well as Supply of Equipment and Materials	4th Jan 2008

[3] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

[4] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

[5] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

7	Contract for construction including civil works, electrical lines, erection and commissioning	4th Jan 2008
8	GEDA Transfer Permission	24th March 2008
9	WTG Commissioning Certificates	4-April-08/ 12-June-08 / 29-Sept-08
10	Power Wheeling Agreements	27th May 2008
11	Chief Electrical Inspector Inspection Certificates	28th March 08 / 12th, 27th & 30th May 2008 / 10 June 2008
12	Tender invite for validation of CDM project	6th June 2008
13	Public notice in local Newspaper	Kutch Mitra dated 9th August 2008
14	MOM of Local Stakeholder Consultation held at WTG site, District Kutch, Gujarat and attendance sheet	18th August 2008
15	Notification of Award (NOA) of project for validation to DNV	27th Oct 2008
16	Host Country Approval meeting at the NC-DNA in New Delhi	17th November 2008
17	Operations and Maintenance Agreement with Suzlon	28th April, 2009

It may be noted that points 1 through 4 (inclusive) in the above table, demonstrate awareness and serious consideration of CDM, all prior to project start date shown as point 5. The project proponent had undertaken the tendering process and appointed the CDM consultant even before placing the purchase order for the project. The above chronology of events proves beyond doubt the prior consideration of CDM for the project activity and that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation.

The proposed CDM project generates power using wind energy which is a renewable, zero emission source of energy. Baseline considerations for the project are based on approved consolidated baseline methodology ACM 0002. The methodology requires the project proponent to determine the additionality based on 'Tool for the demonstration and assessment of additionality', Version 5.2. The step-wise approach to establish additionality of the project activity has been followed, details of which are provided in the following paragraphs:

Step1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity. The proposed project activity involves implementation of 34 WTGs each having capacity 1500 KW to generate electricity. The wind turbines are connected to the grid and will wheel the power generated via the Western grid and displace the grid electricity presently consumed by the various ONGC asset locations at Ankleshwar, Kadi, Cambay, Ahmedabad, Gandhar, Mehsana and Vadodara. Thus, the proposed CDM project increases the clean power availability in the Western grid. This in turn takes care of the shortfall in the availability of power to the consumers which draw power from the grid. There are alternatives to the proposed CDM project activity which would have met the objective of taking care of the shortfall in the availability of power to the end consumers. The alternatives which were available for the purpose are as follows:

Alternative 1 - The proposed project activity not undertaken as a CDM project activity. Under this alternative the promoters of the proposed project, ONGC would have implemented the project to generate renewable electricity using wind energy with the objective of exporting the same to the Western regional grid thereby displacing equivalent units of power generated by fossil fuel based plants in the grid. Under this alternative there would be no emissions of greenhouse gases. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline scenario. However, there exist barriers to the implementation of the proposed project activity without CDM as explained in step 2 and step 3 below.

Alternative 2 - No project activity: Under this alternative, no new facilities will be created to take care of the shortfall in the availability of power and the additional power requirements will be met by the power plants connected to the Western grid.

Alternative 3 – The proposed project activity taken up as another renewable energy project activity:

Keeping the project proponent's commitment to environment friendly generation of clean and pollution free power, it explored the renewable energy avenues available for clean energy production that could be wheeled to the oil producing installations in Gujarat. Under this alternative, the feasibility of hydropower potential in the Gujarat state was assessed. The list of major hydropower projects in the Gujarat state as per CEA data is provided below:

S.No.	Name of Project	Capacity (MW)[6]
1	Kadana, District Panchmahal, River Mahi	240
2	Ukai , District Surat, River Tapti	300
3	Sardar Sarovar – CHPH, River Narmada	250
4	Sardar Sarovar – RBPH, River Narmada	1200
5	Gujarat State Electricity Corporation Ltd. (GSECL) hydropower projects	545
	Total	**2535**

As can be seen, the major river in Gujarat state is the River Narmada and the hydropower potential of this river has been tapped by the Sardar Sarovar Project. The Tapti river has been tapped by the Ukai project and the Mahi river has been tapped by the Kadana project. As the major rivers in Gujarat have already been tapped by these large scale hydropower projects, increasing hydropower growth in Gujarat is not a focus area of the Government of India (as per the CEA data publicly available in CEA website). Due to the unavailability of potential hydropower sites in Gujarat, this alternative could not be pursued by the project proponent.

Under this alternative, the feasibility of using biomass for power generation in the Gujarat state was assessed. As per the MNRE Annual Report at http://mnes.nic.in/annualreport/2006_2007_English/HTML/ch3_pg5.htm, the state wise grid interactive biomass power installed capacity is provided as follows:

State-wise Grid-interactive Biomass Power Installed Capacity (as on 31.12.2006)

S. No.	State	Installed Capacity (in MW)[7]
1.	Andhra Pradesh	301.25
3.	Chhattisgarh	88.5

[6] *Source: http://www.cea.nic.in/hydro/List%20of%20HE%20Stations%20in%20the%20country.pdf (From CEA website)*

4.	Gujarat	0.5
5.	Haryana	6
6.	Karnataka	254.28
7.	Madhya Pradesh	1
8.	Maharashtra	62
10	Punjab	28.0
11	Rajasthan	23.3
12	Tamilnadu	215.5
14	Uttar Pradesh	121.5
	Total	**1101.83**

It is evident from the above table that the installed capacity of biomass power in the state of Gujarat is negligible in comparison to the installed capacity in the country. The biomass potential as per GEDA also does not provide a feasible potential in the state (http://www.geda.org.in/bio/bio_summarybiomass.htm). Because of the lack of potential for developing large scale power projects based on biomass in the state, the project proponent did not pursue the biomass based power generation alternative.

The feasibility of using solar power was assessed in terms of installed capacity and viability. As per the CEA data available at http://www.cea.nic.in/power_sec_reports/Executive_Summary/2007_07/24-30.pdf, the total installed capacity from state, central and private sectors from Renewable Energy Sources in the state of Gujarat is provided as 627.65 MW. The Renewable Energy Sources include SHP=Small Hydro Project, BG=Biomass Gasifier, BP=Biomass Power and U&I=Urban & Industrial Waste Power. There is no reference to grid connected solar power. Thus, there existed no installations of grid connected solar power projects in the state of Gujarat until 31.07.2007.

As per the MNRE, the cost of setting up the solar power is a prohibitive Rs.16 Crore – 20 Crores per MW (http://mnes.nic.in/press-releases/press-release-21042008-2.pdf). Owing to the prohibitive costs associated with setting up the solar power based power plant, the project proponent did not pursue the solar power based model for power generation.

Alternative 4: The proposed project activity is taken up as a fossil fuel based project: The project proponent could have explored setting up of coal based thermal power plants. However, the project proponent has a commitment to take up environment friendly and pollution free energy production. Thus, fossil fuel based power projects were rejected on account of their carbon intensive and polluting nature.

The alternative 2 wherein the equivalent amount of energy would have been produced by the project grid electricity system through its currently running power plants and by new capacity additions (which are mostly thermal) is the most plausible alternative as baseline option for the project. Due to the shortage of power , the power off-takes from the power plants is decided based on capacity availability with a given power plant and availability of transmission and distribution network. Thus, in most of the cases, dispatch of power on merit order basis is not practiced. In absence of the proposed CDM project to generate power using wind energy, it is difficult to justify that equivalent amount of units would have been generated by only the fossil fuel based power plant (as a preferred substitute to the project). Thus, the present generation mix of the grid has been selected as the baseline emission under this alternative.

Outcome of Step 1a:

Of the alternatives (identified above) to the proposed CDM Project, the most realistic and credible scenario to the proposed project activity is the alternative 2 (No project activity) due to the following reasons:

- The proposed project activity cannot be taken up without CDM (as suggested under alternative2) due to the perceived barriers towards such an alternative. The major barrier towards implementation of this alternative is the fact that the project activity is not economically viable without the support of CDM. This has been elaborated in greater detail under investment analysis presented in subsequent paragraphs under Step 2.

- Under alternative 2 to the proposed project activity, the incremental power generated in the wind power project will be generated in the power plants connected to the grid. The configuration of the power plants connected to the grid and their individual contribution in the overall supply of power to the grid may change over a period of time. Under the situation when the power is in short supply, the contribution of an individual power generation unit will depend upon its capacity, availability and the availability of transmission and distribution grid to upload power. Thus the power under this situation is not dispatched in accordance with the principal of merit order dispatch.

Thus, power generation mix of the grid is the most likely baseline scenario for the proposed CDM project activity. The GHG emission in the baseline scenario has been done accordingly.

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

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

All the alternatives to the proposed CDM project identified under step 1a are in compliance with all applicable legal and regulatory requirements in the country as follows:

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

Considering that all the alternatives to the proposed CDM project activity are in compliance with the applicable legal and regulatory requirements, the alternative (no project option and continuation of current practice), wherein the equivalent amount of energy would have been produced by the grid electricity system through its current generation mix of fossil fuel based power, is the chosen baseline scenario which would have happened in the absence of the proposed project activity.

Step 2. Investment analysis

Determine whether the proposed project activity is not:
a) The most economically or financially attractive; or
b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, use the following sub-steps:

Sub-step 2a. Determine appropriate analysis method

Determine whether to apply simple cost analysis, investment comparison analysis or benchmarking analysis (sub step 2b). If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option 1). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III)

The proposed CDM project will lead to generation of power which will be used captively leading to savings in the electricity presently procured from the grid. Thus simple cost analysis (option I) cannot be applied to the proposed CDM project activity.

Amongst the other two options for carrying out the investment analysis, namely the investment comparison analysis (option II) and the benchmark analysis (option III), the benchmark analysis has been adopted. While carrying out the benchmark analysis, the Internal Rate of Return (IRR) on the project has been used. The IRR serves as a benchmark to assess the financial attractiveness of a given investment proposition. The investment analysis carried out assesses if the returns on investment are sufficient for investors to make the initial investment and further bear the associated costs of successfully operating the project activity over the lifetime of the project in general and over the crediting period of the proposed CDM project in particular.

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

An investment analysis of the investment proposition in the proposed CDM project activity was carried out by the project proponent (ONGC) with the Internal Rate of Return (IRR) as the financial indicator. 'Internal Rate of Return' is one of the known financial indicators used by banks, financial institutions, investors and project developers for making investment decisions.

ONGC, being a public sector undertaking, has an established benchmark of 12 % (post tax) as per ONGC Order No. MUM/PAS/PROJ/APPR/RR/2007 dated June 11, 2007. Para 3.1 of the referenced ONGC circular, states: "The target IRR for acceptance of investment proposals (development projects) would now be considered at a minimum rate of 12% (post tax). However, in respect of projects with IRR of less than 12% (post tax), the right to reject such projects would continue to vest with the Corporate Management." The project activity replaces the grid based power generation which is being used by the project proponent in the absence of the project activity. This grid based power is now being replaced by captive power generation by ONGC using wind energy. As captive generation of power for own requirements can be done only by ONGC in this case, thus the use of the internal benchmark is appropriate. The benchmark used by the project proponent is a common benchmark applicable to ONGC development projects and the ONGC Circular No. MUM/PAS/PROJ/APPR/RR/2007 dated June 11, 2007 is submitted as Annexure II to establish this internal benchmark. Thus, the internal benchmark has been applied correctly and in line with the guidance of the CDM Executive Board. The internal benchmark has been applied by the project proponent on other projects also. Such project cases dated 24th November 2008 and 15th June 2007 have been provided as evidence of using the benchmark for acceptance of projects, and project case dated 18th December 2008 is being provided as evidence of use of benchmark for rejection. Tender No L26BC07013 for construction of water injection plant at GGS-I, Nambar, A&AA basin, Jorhat (signed date 18/12/2008 which can be interpreted as date of rejection), point no 2.15, calls to close the present tender and re invite the tender after review and approval of the feasibility of the project as the IRR (actually NPV calculated at a discount factor of 12% which is negative). The cost of the project activity is Rs. 27.9 Crores. As discussed and agreed between the validator and the project proponent, the project proponent is expected to work either the NPV of the current project or the IRR of the rejected project to make it comparable." The NPV has been calculated for the proposed CDM project activity and was found to be negative. The results have been submitted to the validator vide Annexure XXV_IRRSheet. Some examples of projects accepted by ONGC management are: 1. Expenditure Sanction for replacement of 12 OSV's (Rs 736.65) approved on 18/06/07 has an IRR of 16.98%. 2. Re-development of Mumbai High North Phase (Cost Rs 7710.13 Crores, approved on 25/11/2008, IRR is 14.4 %.).

The conservativeness of the internal benchmark of the project proponent at the time of taking decision to go ahead with the project as a CDM project is established, because the State Bank of India's interest rate during that time was higher than 12% at 12.75%. Please see Annexure - XXX that provides the official lending rates of the State Bank of India (SBI) for the time period of October and November 2007, i.e. the time of decision making in favour of the CDM project. Thus, 12% is more conservative than the applicable bank lending rate at the time of decision making for the project.

Thus, the IRR of 12% (post tax) has been used as benchmark for comparison with the IRR of the investment proposition in the proposed CDM project activity.

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):

The internal rate of return for the proposed project activity without CDM revenues was computed for a period of 20 years, corresponding to the lifetime of the 51 MW wind farm based on the considerations as detailed in the section below. The input parameters used for the financial analysis, are reported in the approval note of the 51 MW wind energy project of ONGC dated 25 October 2007[8], submitted to the management of ONGC. This document was provided to the DOE during the validation process. The investment decision of the project activity was taken by the management comprising of the General Manager (Finance & Accounts), the Executive Director (Corporate Finance) and the Director (Finance). The note elaborates in detail the project activity parameters like the total project cost, O&M cost, and the internal rate of return (IRR). The final approval for the project was provided by the Chairman and Managing Director on 26 October 2007, based on the recommendation of the management team.

Table 3: Considerations for calculation of IRR for 34 machines

Considerations	**Value**	**Unit**
Installed Capacity	51	MW
Plant Load Factor	22.28%	
Project Capital Cost	311.62	Crore Rs.
Opex Cost (total)	183.07	Crore Rs.
Debt : Equity Ratio	Debt	0%
	Equity	100%
Emission Reduction Factor		0.89 tCO_2/Ths kWH
Power Tariff		4.66 Rs./ kWh
Life of the project		20 Yrs

For some of the input parameters used in the financial analysis the information from publicly available sources and actual invoices, as required by the Validation & Verification Manual (VVM, Paragraph 109) was made available to the DOE for validation.

Source of information for the input parameters used is shown in the table below:

Input parameter used in financial analysis	**Source of Input Value**	**Source of Input value used by the validator for cross checking**
Project Cost	Project Approval Note	Notification of award of contract to Suzlon dated 6 November 2007 (project starting date).

[8] Appraisal note: "Developing wind energy project at Gujarat as Clean Development Mechanism project" of 25 October 2007 (put up for the approval of the project activity).

O & M Costs	Project Approval Note	O&M contract entered into between ONGC and Suzlon Energy Limited dated 28 April 2009
Cost of 2 ONGC officers for project supervision	Project Approval Note	Revised scales of pay of board and below board level executives in Central Public Sector Enterprises (CPSE), from the official website of Department of Public Sector Enterprises. http://dpe.nic.in/newgl/glch04a23.pdf
GEDA Certification fee and lease rental	Project Approval Note	Notification of award of contract to Suzlon dated 6 November 2007.
Tax benefits: Accelerated depreciation (80%) and Corporate Tax (33.99%)	Project Approval Note	Indian Income Tax Act 1961, Section 32 (Rule 5) Appendix 1 and Section 80-1A, paragraph 2.0.
Plant Load Factor of 22.28%	Project Approval Note	Report of the third party consultant5 engaged by ONGC for evaluation of offers received against open tender call. This is in line with the guidance on PLF, EB 48 Annexure 11 paragraph 3(b), which states that *"The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)".* The estimated PLF as suggested by the consultant was used in the commercial evaluation of the offers received.
4% wheeling charges	Gujarat government wind power policy – 2007	
Tariff	Project Approval Note Electricity bill of ONGC for the month of October 2007.	Electricity bill of ONGC for the month of October 2007.

The equity IRR of the project activity without CDM benefits was found to be 10.59 % which is lower than the equity IRR benchmark of 12% being considered by the project proponent to go ahead with the proposed project.

Hence, it is justifiably concluded that the CDM revenue that the project activity would obtain through sale of the emission reductions, is very crucial to sustain the operations of the project activity.

Sub-step 2d. Sensitivity analysis (only applicable to Options II and III):

A sensitivity analysis has been conducted for the proposed project activity that shows whether the conclusion regarding the financial / economic attractiveness is robust to reasonable variations in the critical assumptions. The IRR for the project without CDM revenues is likely to be impacted by variations in the values of the following critical considerations:

- Capex : Capital expenditure on the project
- Opex: Operating expenses for the project
- Generation: Electricity generated by the project
- Tariff: Power tariff for the project

The variation in the values of other considerations used for computing the IRR is not expected. An analysis of the sensitivity of the equity IRR with variations in the value of these considerations was carried out.

Sensitivity Analysis for proposed project activity

The results of the sensitivity analysis are given in Table 4 below:

Table 4: Sensitivity of Internal Rate of Return (IRR) to critical considerations

S.No.	Parameter	IRR (%)
1	Base Value	10.59
2	Capex + 10%	8.91
3	Capex + 20%	7.49
4	Opex + 10%	10.23
5	Opex + 20%	9.87
6	Generation (-) 10%	8.36
7	Generation (-) 20%	6.01
8	Both Capex & Opex +10%, Generation (-)10%	6.45
9	Both Capex & Opex +20%, Generation (-)20%	2.56
10	Capex – 10%	12.6
11	Opex – 10%	10.94
12	Generation + 10%	12.73
13	Generation + 5%	11.67
14	Tariff + 10%	12.73
15	Tariff + 5%	11.67
16	Tariff – 10%	8.36
17	Tariff – 5%	9.49

As is evident by this sensitivity analysis, even with reasonable variations in the value of the considerations used for the investment analysis, the investment proposition in the proposed CDM project activity remains unattractive in the absence of the CDM benefits. It is the CDM benefits which make the investment proposition in the proposed CDM project activity attractive enough.

In the case of decrease in the Capex by 10%, the project IRR is seen to touch 12.6% that is it crosses the benchmark. However, the decrease in Capex is an unlikely scenario as the Capex figure was picked from the bidder quotation.

In the case of the increase in generation by 10%, the project IRR is 12.73%, i.e. it crosses the benchmark rate of 12%. It is understood that generation from the project is dependent upon several factors like wind velocity, air density, quality, capacity and age of machines, height of hub, and length of the blades, etc. The plant load factor determined for the project activity is based on the estimated generation figures of the machines as determined by the machine supplier and as corrected by the external independent consultant, based on inputs available for the project site. It is therefore expected that the chances of the PLF of the project activity increasing by 10% are highly unlikely. It may be appreciated that the need was felt by the project proponent to appoint an independent consultant to verify the estimated energy generation values provided by different equipment suppliers. The official statement of the independent consultant justifying the estimated energy generation from the machines and thereby the PLF considered for the project activity by the project proponent at the time of decision making has already been provided to the validator as Annexure – XXII. The PLF used in the financial analysis is sourced from the third party (MP Wind farms Limited) assessment of the wind potential in the region. The PLF was also used for evaluating the various offers received by ONGC against the open tender call. During the validation process the DOE was provided with the third party assessment report and the letter informing the

bidders that the estimated PLF will be the basis for the evaluation of the tender. Thus the PLF of the project activity is in line with the guidance on PLF.

The DOE was also provided the details regarding the PLF against the Gujarat Electricity Regulatory Commission (GERC) tariff order on wind energy projects, dated 11 August 2006, which discusses the factors affecting the capacity utilization factor (CUF) and the CUF achieved at various locations in Gujarat. While the Commission report states the maximum CUF achieved at the four sites of Jamnagar Coastal, Jamnagar Inland Patelka, Bhavanagar Sonadar and Surajbari Kutch to be 23.97%, 20.2%, 22.5% and 25.68% respectively. A standard CUF of 23% is stated for all the wind energy projects in Gujarat for tariff calculation. Hence, the selection of the PLF of the project activity of 22.28%, which a) has been estimated by third party consultants, b) has been the basis for the evaluation of the offers and c) the financial analysis, is reasonable.

The energy rate for captive consumption in Gujarat in other ONGC assets considered is Rs.4.05 per unit. In addition, surcharge at 15% is applicable on energy rate. The energy generated from project activity would be wheeled to these assets. The tariff has been fixed by the government and is unlikely to change. In the case of the increase in tariff by 10%, the project IRR comes to 12.73%. However, the chances of tariff increasing by 10% during the lifetime of the project are highly unlikely. As is a known fact in India power tariff is regulated by respective state regulatory commissions (in this case Gujarat State Electricity Regulatory Commission). The tariff by the regulatory authority is fixed considering the policies of the government and a number of factors. As a policy in India, differential power tariff system is followed wherein different types of consumers are charged different price for the power used. Amongst different types of consumers the tariff for industrial consumers like ONGC is the maximum. Considering that the tariff applicable to ONGC is one of the highest and that tariff in India is highly regulated any increase in the tariff is unlikely. Further to this the tariff by the regulatory authorities is based on a number of factors which includes the prime lending rate, the energy price and the fuel prices etc. The minimum acceptable IRR by the project proponent is also based on the very same factors. Though hypothetically there is a possibility of increase in the tariff by regulators due to increase in the cost of capital, fuel prices etc., this will also lead to corresponding increase in the value of minimum acceptable IRR. The tariff considered at the time of IRR calculations were based on the firm prevailing rates being charged by the power supplier. The applicable industrial tariff of INR 4.05 + 15% surcharge for ONGC at the time of decision making has been used in the investment analysis of the project activity. The energy bill for the month of October 2007 from Uttar Gujarat Vij Company Ltd. has been submitted as documentary support for the applicable tariff. As the prices were actual, firm and in force at the time of IRR calculations any possibility of variations in tariff cannot be considered.

Also, the High Tension (HT) industrial consumer tariff for the period from 2002-03 to 2010-11 as per the tariff orders of GERC sourced from their official web site is stated hereunder[9]:

- For the years 2002-03, 2003-04, 2004-05 and 2005-06: INR 4.10
- For the year 2006-07 and 2007-08: INR 4.05
- For the year 2008-09, 2009-10 and 2010-11: INR 4.15

The tariff trend in Gujarat over the period of 9 years from 2002-03 to 2010-11 shows that the increase in tariff for the period is only 1.22%. Since the industrial tariff in Gujarat is one of the highest in India and a number of large scale power plants with better efficiency are due for commissioning in the near future, the tariff increase in future is expected to be small and no significant changes are expected. Based on the assessment of the above mentioned sources, it was considered that the increase in tariff by 10% is unlikely and this is in line with the requirements of executive board EB 41.

[9] *http://www.gercin.org/docs/Orders/Tariff%20Orders/Year%202006/ugvcl.zip,*

http://www.gercin.org/docs/Orders/Tariff%20Orders/Year%202007/Tariff%20order-07_UGVCL.zip,

http://www.gercin.org/docs/Orders/Orders%202008/UGVCL%20Order.pdf

Thus, as explained in the results of the sensitivity analysis study carried out above, it is the CDM benefits which make the investment proposition in the proposed CDM project activity attractive enough for the project proponent to go ahead with the project, as per the existing considerations.

Step 3: Barrier Analysis

In the sensitivity analysis presented above it has been concluded that the proposed CDM project activity is not financially attractive enough without the CDM benefits. Thus no separate barrier analysis for the proposed activity has been carried out.

Step 4: Common practice analysis

The above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region.

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

Provide an analysis of any other activities implemented previously or currently underway that is similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities are not to be included in this analysis. Provide documented evidence and where relevant, quantitative information,

The proposed CDM project activity pertains to generation of captive power using wind energy in the state of Gujarat. In the following paragraphs an account of wind power generation in India in general and wind power generation in the state of Gujarat in particular has been provided.

Table 5 provides details of state wise wind power potential in India. Table 5 also provides the wind power capacity installed in different states as on 31/03/2007:

State wise wind power Potential and Installed Capacity

S. No	State	Gross Potential (MW)	Installed Capacity (MW)
1.	Andhra Pradesh	8275	126.84
2.	Gujarat	9675	1254.835
3.	Karnataka	6620	1030.12
4.	Kerala	875	11.05
5.	Madhya Pradesh	5500	125.84
6.	Maharashtra	3650	1756.38
7.	Orissa	1700	-
8.	Rajasthan	5400	542.095
9.	Tamil Nadu	3050	3847.715
10.	West Bengal	450	1.75
11.	Others	-	1.3
12.	**Total**	**45195**	**8697.925**

Source: http://windpowerindia.com/statstate.html and http://www.windpowerindia.com/statest.html

In India the power generation sector is dominated by fossil fuel based technology. As on 31/03/2008, the total installed capacity of power generation in India was 1,44,130.17 MW. Against this, the installed capacity of wind power in India is 8697.9 MW. Thus only 6 % of the total installed capacity for power generation in India is through wind energy based generation sources. Given

that the gross potential for wind power in India is 45,195 MW, the exploitation of the wind energy based power generation technology is very low.

As can be seen from the table above, the state of Gujarat has the highest gross potential for wind power generation among all the states. However, the installed capacity for wind power generation in the state is much lesser when compared to other states like Tamil Nadu, Maharashtra and Karnataka. Against the potential to generate 9,675 MW of power from wind energy in Gujarat, only 1254.835 MW of wind power has been installed till 31 March 2006 which is about 13% of the gross potential of wind power generation in the state. Thus, there is a huge potential for developing wind power projects in the state of Gujarat.

Sub-step 4b: Discuss any similar options that are occurring:

If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially attractive (e.g., subsidies or other financial flows) or did not face the barriers to which the proposed project activity is subject.

Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

The list of the wind power projects having similar capacity and being established in the state of Gujarat[10] is provided in the following table. As can be seen all these wind power projects with similar size are being implemented considering CDM benefits. This is due to the fact that wind energy based projects are not found financially attractive enough without CDM incentives.

S. No.	Project Name	Location	Capacity (MW)	CDM Status
1.	Wind power project by HZL in Gujarat	Gujarat	88.8	Request for review
2.	22.3 MW Bundled grid connected Wind Power based electricity generation project in Gujarat.	Gujarat	26.25	At Validation
3.	26.25 MW wind electricity generation project of Gujarat NRE Coke Limited at Jamnagar and Kachchh.	Gujarat	22.3	At Validation
4.	Wind power project by PMPL in Gujarat, District Jamnagar and Rajkot by M/s Patnaik Minerals Private Limited	Gujarat	32.5	At Validation
5.	150 MW grid connected Wind Power based electricity generation project in Gujarat	Gujarat	150	At Validation
6.	Wind based renewable energy project in Gujarat	Gujarat	50.4	At Validation
7.	30 MW wind power project at Surajbari, Gujarat in India	Gujarat	30	At Validation
8.	51 MW wind power project of ONGC at Surajbari	Gujarat	51	At Validation
9.	KS Oil Ltd.	Gujarat	30.8	At Validation
10.	24.8 MW Wind Power Project by SREI	Gujarat	24.8	At Validation
11.	Ratnamani Metals and Tubes Ltd.	Gujarat	19	At Validation
12.	Aarvee Denims & Exports Ltd.	Gujarat	18	At Validation
13.	16.875 MW Large Scale Grid Connected Wind Electricity Generation Project by Indian Renewable Energy Foundation	Gujarat	16.87	At Validation
14.	16.5 MW Wind Power Project in Surajbari, Gujarat	Gujarat	16.5	At Validation
15.	Taurian Iron & Steel Co. Pvt. Ltd	Gujarat	16.25	At Validation

As per the above table, all the wind power projects of similar size and capacity are being implemented with CDM benefits in the state of Gujarat. Thus, establishment of such projects without CDM is not a common practice.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

>>

Applied Methodology : ACM0002; Version 19.0, Sectoral Scope 1.0

Base Line Emissions

Baseline emissions 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

[10] Compiled from http://www.cdmpipeline.org/publications/CDMpipeline.xls and http://www.windpowerindia.com/statpriv.html

power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$BE_{y} = EG_{PJ,y} X EF_{grid,CM,y}$

Where **:**

BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

As per methodology combined margin grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' since data is available from an official source.

CO_2 Baseline Database for the Indian Power Sector User Guide Version 13.0 June 2018[11], published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per the "Tool to calculate the emission factor for an electricity system" Version 07.0, EB 100, Annex 4[12], the following steps have been followed.

STEP 1: Identify the relevant electricity systems;
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3: Select a method to determine the operating margin (OM);
STEP 4: Calculate the operating margin emission factor according to the selected method;
STEP 5: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emission factor.

STEP 1: Identify the relevant electricity power systems

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

However since 2007-08 as the four regional grids except the Southern grid has been synchronized, they are now being considered as one and named as NEWNE grid. Since the project supplies electricity to the NEWNE grid, emissions generated due to the electricity generated by the NEWNE grid as per CM calculations will serve as the baseline for this project. As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid, however the data vintage considered for emission factor is considered for NEWNE grid from CEA database version 13 which was latest available at the time of PDD submission for validation.

Table: Geographical scope of the Indian electricity grid

Indian Grid

[11] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

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	Puducherry
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttarakhand				

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

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

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

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

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

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

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

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

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

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

	2010-11	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**
India	**18.4%**	**19.6%**	**16.9%**	**18.6%**	**16.8%**	**15.1%**

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

The "Simple operating margin" has been calculated as per the weighted average emissions (in tCO_2/MWh) of all generating sources serving the system, excluding hydro, geo-thermal, wind, low cost biomass, nuclear and solar generation;

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

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

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

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

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

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

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

Net Generation in Operating Margin (GWh) (excl. Imports)			
	2014-15	2015-16	2016-17
INDIAN Grid	8,08,417	8,71,740	9,16,278

Simple Operating Margin (tCO2/MWh) (incl. Imports)			
	2014-15	2015-16	2016-17
INDIAN Grid	0.99	0.97	0.96

Weighted Generation Operating Margin	
INDIAN Grid	**0.9726**

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

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

Build Margin (tCO_2 / MWh) (not adjusted for imports)	
	2016-17
INDIAN Grid	**0.8723**

(With sample group constituting most recent capacity additions to the grid comprising 20% of the system generation)

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

Combined Margin – The combined margin is the weighted average of the simple operating Margin and the build margin. In particular, for intermittent and non-dispatchable generation types such as wind and solar photovoltaic, the Tool to calculate the emission factor for an electricity system, Version 07.0, EB 100, Annex 4[13], allows to weigh the operating margin and Build margin at 75% and 25%, respectively.

[13] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

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

Calculation of Baseline Emission Factor EF_y

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

$EF_y = W_{OM} * EF_{OM,y} + W_{BM} * EF_{BM,y}$

Where,

W_{OM}	75% weight for wind energy projects
W_{BM}	25% weight for wind energy projects
$EF_{OM,y}$	calculated as described in Steps 3&4 above (tCO_2/MWh)
$EF_{BM,y}$	calculated as described in Steps 5 above (tCO_2/MWh)

Baseline Emission factor (INDIAN Grid) **= 0.75 x 0.9726 + 0.25 x 0.8723**
= 0.9475 tCO_2/MWh

Project Emissions: For most renewable power generation projects activities PEy =0. As per applied methodology only emission associated with the fossil fuel combustion, emission from operation of geo-thermal power plants due to release of non-condensable gases, emission from water reservoir of Hydro should be accounted for the project emission. Since the project activity is a wind power project,

Hence $PE_y = 0$

Leakage Emissions: As per the methodology, Leakage emission is zero.

Emission reduction (ER_y): The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plant by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission.

$ER_y = BE_y - PE_y$

Where,
ER_y = Emission Reduction in tCO_2/year
BE_y = Baseline emission in tCO_2/year
PE_y = Project emissions in tCO_2/year

B.6.2. Data and parameters fixed ex ante

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

Data/Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO2 emission factor in year y
Source of data	Calculated from CEA database, Version 13

Value(s) applied	0.9726
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0[14]" as 3-year generation weighted average using data for the years 2014-2015, 2015-2016 & 2016-17. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 13.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018
Value(s) applied	0.8723
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 06.0" BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 13.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{grid,CM,y}$
Data unit	tCO2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018
Value(s) applied	0.9475
Choice of data or measurement methods and procedures	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 CO2 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 (%) = 75% WBM = Weighting of build margin emissions factor (%) = 25%
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

B.6.3. Ex ante calculation of emission reductions

>>

[14] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

Formula used to calculate the net emission reduction for the project activity is

$ERy = BE_y - PE_y$

Where,

ERy = Emission Reduction in tCO_2/year
BEy = Baseline emission in tCO_2/year
PEy = Project emissions in tCO_2/year

Baseline Emission (BE_Y)

The baseline emissions are the product of electrical energy baseline $EG_{facility,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by an emission factor.

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

Where, $EG_{facility,y}$ = Total quantity of net electricity delivered to the INDIAN grid

Capacity		34 x 1.5 MW
PLF (%) as per 1st CP		22.28%
Total operating hour		8760
Net Generation from the project post accounting the Transmissions loss		95,557
Baseline Emission Factor (tCO2/MWh)	$EF_{grid,CM,y}$	0.9475
Baseline Emissions (tCO2/ year)	$BE_y = EG_{facility,y} * EF_{grid,CM,y}$	90,540
CDM Project Emissions (tCO_2)/Yr.	PE_y	0
Emission Reductions (tCO_2)/Yr.	$ER_y = BE_y - PE_y$	90,540

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Emission reductions (t CO_2e)
Year 1	90,540	0	90,540
Year 2	90,540	0	90,540
Year 3	90,540	0	90,540
Year 4	90,540	0	90,540
Year 5	90,540	0	90,540
Year 6	90,540	0	90,540
Year 7	90,540	0	90,540
Total	633,780	0	633,780
Total number of crediting years- 7 year			
Annual average over the crediting period	90,540	0	90,540

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

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

Data/Parameter	$EG_y = EG_{facility,y}$
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)
Source of data	The receipt of generated electricity uploaded to GETCO grid from the proposed CDM project activity and issued by GETCO
Value(s) applied	95,557
Measurement methods and procedures	Payments to the power producers by the power purchaser are done for the net power supplied to the grid by the power producer. It is determined using the meter installed at the substation that is the point of uploading power to the grid. Suzlon maintains daily records of the electricity generated from each wind turbine. The readings at the main meter at the grid uploading point are jointly noted by GETCO, GEDA and Suzlon officials every month. At the first level, the generation from each WTG is recorded by an energy meter installed near each machine. This meter provides monthly generation data from individual WTGs and the records are maintained on paper and electronically for reference. The joint meter reading (JMR) will be carried out once in a month at Substation end. JMRs are taken at the Substation end by the local electricity utility (GEDA) and representative of Suzlon. The JMR readings can be further broken in to the individual turbine generation with the help of generation data from the Energy meter installed at yard. In case of no generation, the power consumed by the individual WTG is recorded in energy meter installed at yard. Moreover this parameter is also registered at the meter installed at substation end where JMR is taken by Electricity utility. The power generation determined in this manner is net of the transmission & distribution losses within the premises of the wind power project. This also takes into account any consumption of power from the grid within the wind power project premises, for running of the common facilities. The net power uploaded into the grid by the project proponent's wind turbines is reflected in the monthly receipt generated by GETCO in the name of the project proponent. The JMR data will be cross checked with the daily generation data. The daily generation data will be obtained from the CMS log book.
Monitoring frequency	Continuous
QA/QC procedures	Regular maintenance and once in a 3 year calibration of the main and check meter i.e. Sub-station meter is to be carried out as per the established practice. Once in a year calibration will be done for HT yard tri-vector meter.
Purpose of data	The Data / Parameter is required to calculate the baseline emission.
Additional comment	The data will be archived for the entire crediting period plus two years.

B.7.2. Sampling plan

>>

Sampling plan is not required for the given project activity.

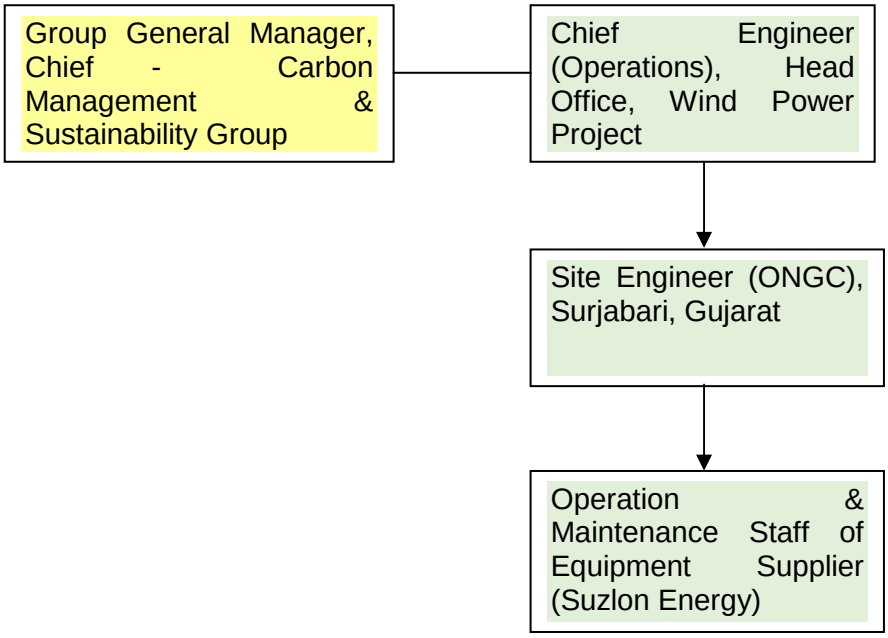
B.7.3. Other elements of monitoring plan

>>

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities and is proposed for grid-connected wind power project being implemented in Andhra Pradesh, India. The monitoring plan, which will be implemented by the project participant describes about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

Organisational Structure for data recording and monitoring:

The authority and responsibility of project management as well as registration, monitoring, measurement and reporting lies with ONGC and O & M staff of Suzlon Energy. ONGC has formulated a Project Team to ensure proper and continuous monitoring of the performance of wind turbines and generation of power. The Chief Engineer (Operations) assisted by a Superintending Engineer, ONGC shall be maintaining the electronic and paper storage, and review of the generation data received from project activity site. The same has been outlined in the organization flowchart as follows:



The O&M personnel are qualified engineers and are trained by Suzlon Energy for operating and ensuring best performance of the WTGs. The general conditions set out for metering, recording, meter readings, meter inspections, test and checking and communication shall be as per the provisions laid out by GETCO.

Under the Operation & Maintenance contract signed by the project proponents with the capital equipment suppliers (Suzlon Energy), the O & M staff of Suzlon Energy shall regularly monitor the measurement of energy and the testing of meters as per the following procedures:

The measurement of energy will be carried out by routine monthly meter reading and resealing shall be arranged by State Electricity Board (SEB) / GETCO authorities and will be witnessed, recorded and signed jointly with Suzlon Energy Ltd. (SEL). SEL shall maintain proper record of joint meter reading measurement book.

Testing of Meters: Authorized officials of SEB/ GETCO may visit metering premises any time for surprise inspection and also for routine testing, calibration (Once in a 3 Year), resealing to check healthiness of metering system. All observations of such visit shall be properly recorded and jointly signed by SEL.

The testing of metering system shall be done at proper interval in accordance with relevant IS / IE Rules / SEB's / GETCO Standards. In case, at any time the O & M Contractor finds any discrepancy in the metering system it shall be immediately informed and also notified in writing to ONGC and SEB / Discom authority within 24 (twenty four) hours requesting for a joint

inspection/investigation of the discrepancy. It would be O & M Contractor's responsibility to sort out the differences and discrepancies, if any, shall not effect the committed generation.

The meters for measuring the electricity generated from the WTGs are as follows:

(a) Individual meters for each WTG machine
(b) Main meter at the uploading substation that connects and transmits electricity generated to the GETCO transmission line.

At the first level, the generation from each WTG is recorded by an energy meter installed near each machine. This meter provides monthly generation data from individual WTGs and the records are maintained on paper and electronically for reference. The individual meters are calibrated periodically i.e. Once in a year.

The joint meter reading (JMR) at Substation end. JMRs are taken at the Substation end by the local electricity utility (GEDA) and representative of Suzlon. The JMR readings can be further broken in to the individual turbine generation with the help of generation data from the Energy meter installed at yard.

In case of no generation, the power consumed by the individual WTG is recorded in energy meter installed at yard. Moreover this parameter is also registered at the meter installed at substation end where JMR is taken by Electricity utility.

Metering and Communication: As per the Gujarat Electricity Regulatory Commission (Open Access in Intra-State Transmission and Distribution) Regulations 2005, Notification No.13 of 2005 dated September 29, 2005, para 18 specifies the installation and use of a special energy meter by the open access user.

The metering protocol is reproduced below:

I. The open access user shall provide ABT compatible Special Energy Meter as Main Meter capable of time differentiated measurements of active energy and voltage differentiated measurement of reactive energy as may be specified by the STU or SLDC which shall be according to the Metering Code as may be specified by Central Electricity Authority based on voltage, point and period of supply and tariff category.

II. Main meters shall always be maintained in good condition and shall be open for inspection by any person authorised by the nodal agency.

III. The concerned licensee may provide check meters of the same specifications as main meters.

IV. The main and check meters shall be periodically tested and calibrated by the concerned licensee in the presence of other party involved. Main and check meters shall be sealed by both parties. Defective meter shall be replaced immediately.

V. Reading of main and check meters shall be taken periodically at appointed day and hour by authorized officer of the concerned licensee, the generator and the open access user or his representative, as the case may be. Meter reading shall be communicated to SLDC, the open access user and the generating company or trader, as the case may be, by the licensee, within 12 hours of meter reading.

VI. Readings of the check meters shall be considered when main meters are found to be defective or stopped. Both the main meter and check meter shall be tested for accuracy if difference between the readings of main and check meters vis-à-vis main meter reading

exceed twice the percentage errors permissible for relevant accuracy class. The meter found defective shall be replaced immediately.

VII. If during the test checks or otherwise, both the main meters and the corresponding check meters are found to be beyond permissible limits of error as per the IS specifications, both the meters shall be immediately calibrated and the correction applied to the generation of energy registered by the main meter to arrive at the correct generation of energy registered by the main meter to arrive at the correct generation of energy for billing purposes for the period of the month up to the time of such test check. Billing for the period thereafter until the next monthly meter reading shall be as per the calibrated main meter.

VIII. If an open access user requires the licensee to provide main meter it shall provide security to the licensee and shall pay for its rent. The meter shall be maintained by the licensee.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>

The date of completion of the application of the consolidated monitoring methodology ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", to the proposed CDM project activity study is 05/02/2009.

C.2. Expected operational lifetime of project activity

>>

The expected operational lifetime of the project activity is 20 years.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>

Renewable crediting period of 7 years 00 months have been opted for the project activity. This is the second crediting period of the project activity.

C.3.2. Start date of crediting period

>>

01/03/2017- Start date of 2nd CP

C.3.3. Duration of crediting period

>>

07 Years 00 Months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

Wind power is one of the cleanest sources of renewable energy, with no associated emissions and waste products. In India, wind power projects do not require an Environmental Impact Assessment.

D.2. Environmental impact assessment

>>

As per the notification from MoEF dated September 14, 200635 and its amendment notification S.O.-3067(E) dated 1/12/2009, the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed project activity type as it involves wind

power generation. Hence the proposed project activity does not require any Environmental impact analysis. Project activity has no significant emissions. Hence no environmental impact analysis was conducted.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>

The impacts to the local stake-holders and the environment were deliberated during the "Stake-Holder Consultation Meeting" held at the Jakhau site of the Wind Power Project set-up by ONGC, on 18th August 2008.

The following stake-holders were identified to have been impacted by the CDM project activity;

- Local resident villagers, farmers and land owners
- Civic Bodies / Statutory Authorities
- Internal employees of the Project Proponent from Finance, Technical Services, Power Generation, Operations & Maintenance, as well as other relevant departments.
- Technology Supplier / OEM supplier for the Wind Turbine Generators (WTG)

Accordingly, invitations for the stakeholder meeting were sent to all stakeholders by publishing a notice in a widely circulated local newspaper.

The agenda of the meeting was as follows;

- Discussion on general environment and social concerns.
- Discussions on initiatives being undertaken by ONGC to address the wellbeing of the environment and the community.
- Discussion on proposed CDM project to address the issue of climate change/global warming.

The meeting schedule undertaken was;

- Welcome and Introduction – by ONGC
- Introduction to Climate Change and Clean Development Mechanism – by ONGC
- Introduction to the proposed CDM project – by ONGC
- Discussion Forum

E.2. Summary of comments received

>>

The discussion was initiated with general clarifications regarding climate change, the various ways and means to mitigate GHG emissions. The participants, mainly hailing from the extreme interiors of the Village, were majorly unaware about the impacts and effects of global warming / climate change. To facilitate the easy understanding of the same, the participants were shown the Hindi version of the movie "An Inconvenient Truth" by Al Gore which has been issued by GTZ for creating public awareness on the issue of climate change. The participants subsequently were curious about how they can play a part in mitigating GHG emissions, and apply various good practices in their day to day life.

After having enlightened the participants with regards to climate change, comments with regards to the proposed CDM activity were invited from the participants of the meeting on the following lines;

- Impacts to the local residents;
    - Permanent / Temporary change in Land Use.
    - Changes in existing Bio-diversity / Vegetation

- Impact on local economy;
    - Increase in jobs / opportunities
    - Increase in local trade
- Local view on sustainable development
    - Greener and cleaner method of power generation

It was evident from the discussions that the farmers and local residents were happy about the increase in trade activity and development in the region, as a result of the set-up of the project in that region. The direct benefit observed to them was the increase in industrialization of that region, effectively increased number of jobs, also a substantial increase in land prices. The indirect benefits were observed in terms of infrastructural development mainly roads, and the opportunities for lodge, and hotel owners as a result of frequent visits of outsiders.

Two main comments were specifically highlighted during the discussions by the stakeholders. One villager commended upon the development carried out as a result of the CDM activity under consideration and was of the view that this would help overall progress of Jakhau and Kutch, relatively under developed regions in the country. He queried that though the land which was not fit for agriculture was used for the project activity, will the setting up of wind farm projects have detrimental impacts and induce soil erosion in the nearby areas?

Another villager was concerned whether setting up of wind farms would affect the overall wind patterns in the region and in turn affect precipitation? He added that, although there has been no noticeable change in the land and soil quality, local environment, existing bio-diversity and vegetation, he was not sure about the same for the rainfall in the region, which is already scarce. Another main concern was whether setting up of wind farms would dry up the existing water table?

E.3. Consideration of comments received

>>

The main comments raised by the stake-holders were concerned about clarifications with regards to climate change and the impacts of setting up of wind power projects on rainfall and soil patterns. While other apprehensions/queries/issues related to GHG mitigation, Climate Change and Clean Development Mechanism were resolved during the discussion forum, suggestions and comments were well received.

Following is the due account taken for the specific comments received from the local stakeholders:

The Deloitte team as well as the technical expert of Suzlon provided the details on the science of soil erosion and explained that there would not be any detrimental impact or any kind of soil erosion as a result of set-up of the wind power projects.

The second query on changes in wind pattern was clarified by Deloitte and ONGC Project representative and stake-holders were explained that the change in wind and precipitation patterns are an outcome of global warming and climate change, and if nothing is done to mitigate the GHG emissions, then surely there will be impacts on precipitation and wind patterns.

SECTION F. Approval and authorization

>>

Host country approval was accorded by Govt. of India vide letter no.[15] – 4/27/2008-CCC dtd. 17.04.2009 to 51 MW Wind Power Project of ONGC at Surjabari, Gujarat in India.

15 http://cdm.unfccc.int/filestorage/J/Z/3/JZ3KG0C8TXUL26QV5YWMORI14BSANF/LOA%20India%202856.pdf?t=elN8cDlob2ZsfDAYOVia9IqLImEOowcXlce-

Appendix 1. Contact information of project participants

Organization name	Oil and Natural Gas Corporation Ltd. (ONGC)
Country	India
Address	Deendayal Urja Bhawan, Nelson Mandela Marg, Vasant Kunj, New Delhi - 110070
Telephone	011-26753007
Fax	011-26129091
E-mail	chief_cmsg@ongc.co.in
Website	www.ongcindia.com
Contact person	Jai Singh, Executive Director – Chief Carbon Management and Sustainability Group

Appendix 2. Affirmation regarding public funding

No public funding is involved in this project activity. The entire cost of the project has been borne by ONGC.

Appendix 3. Applicability of methodologies and standardized baselines

Refer Section B.1 above

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

Refer Section B.6 of PDD

Appendix 5. Further background information on monitoring plan

Refer Section B.7 of PDD

Appendix 6. Summary report of comments received from local stakeholders

Refer Section E.2 of PDD

Appendix 7. Summary of post-registration changes

Not Applicable

- - - - -

Document information

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision 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; • Make 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).

Version	*Date*	*Description*
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
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document