Project design document form for
CDM project activities
(Version 05.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Wind power project in Rajasthan, India
Version number of the PDD	05.2310
Completion date of the PDD	1405914/0802304/20142015
Project participant(s)	Ratedi Wind Power Private Limited (*previously known as IL&FS Wind Power Limited*)
Host Party	India
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	**Sectoral Scope**: 01 Energy Industries (renewable/ non-renewable sources) **Methodology**: ACM0002, v13.0.0 Consolidated baseline methodology for grid-connected electricity generation from renewable sources
Estimated amount of annual average GHG emission reductions	47,732 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

Brief Summary of the Project

The objective of the proposed project activity is to set up a wind farm of 26.4 MW in Jaisalmer district in the state of Rajasthan, India. A total of 33 Wind Electric Generators (WEGs) of 800 kW capacities each is installed at the site. The project would help in reducing greenhouse gas emissions and provide clean renewable power to the NEWNE regional grid.
The project belongs to the Sectoral Scope 1 'Energy industries (renewable / non-renewable sources)' and is a Renewable energy (wind) project.

Scenario Existing Prior to Start of the Implementation of the Project Activity

Since the project activity is a Greenfield project, no energy generation units existed at the project activity site in the pre-project scenario.

Baseline Scenario

In the absence of the project activity, the equivalent amount of electricity injected to the NEWNE grid would have been generated in the fossil fuel mixed (current and future additions of) NEWNE grid of India.

Project Scenario and the Technology employed

The project activity consists of 33 nos. of Enercon make 0.8 MW WEGs totaling to a capacity of 26.4 MW. The WEG generates 3-phase power at 400V, which is stepped up to 33 KV.

These WEGs are based on gearless technology, which helps in eliminating mechanical losses. It also combines the variable speed with variable pitch and hence increases the conversion efficiency. This technology is well established and running successfully at various sites in India.

Contribution to reduction in GHG emissions by the proposed project activity

With the implementation of the proposed project activity, the electricity generated from wind turbines is supplied to the NEWNE regional grid which is dominated by fossil fuel based power plants there by reducing an equivalent amount of GHG emission, associated with thermal energy generating sources of the NEWNE grid. The project will, thus, help in bridging the demand supply gap[1] by using wind as a source of generating electrical energy. The project will reduce 47,732 tCO_2e CERs annually and a total of 477,320 tCO_2e CERs for the chosen crediting period.

Contribution of project activity to sustainable development

Proposed CDM project activity has the following sustainable development aspects:

1. Social well being
   - The project activity provides direct and indirect job opportunities to the local population during construction of the project as well as during operation stage. Employment generation would help poverty alleviation in the local community and bring about reduction in the disparity of income.
   - The infrastructure development for the purpose of the project activity would benefit the local community. For instance, roads constructed for connecting the project sites would be used by the villagers.
2. Economic well being
   - The generation of electricity by the project activity will improve availability of electricity to the State grid and also provide more opportunities for setting up of industries in the region.

[1] Demand-Supply Gap: The energy and peak shortage in the country during the period April 2010–February 2011 was recorded to be 8.6% and 10.3%. Available at: http://www.pib.nic.in/newsite/erelease.aspx?relid=70956

3. Environmental well being
   - ➲ The wind energy based electricity generation is a renewable energy and replaces fossil fuel based electricity generation, thereby helping in conservation of fossil fuel resources and mitigation of GHG emissions.
4. Technological well being
   - ➲ Wind electric generators deployed in the project activity are from well-known international manufacturer; the technology is proven and ensures efficient and safe operation of the project activity

A.2. Location of project activity

A.2.1. Host Party

>>

India

A.2.2. Region/State/Province etc.

>>

State : Rajasthan

A.2.3. City/Town/Community etc.

>>

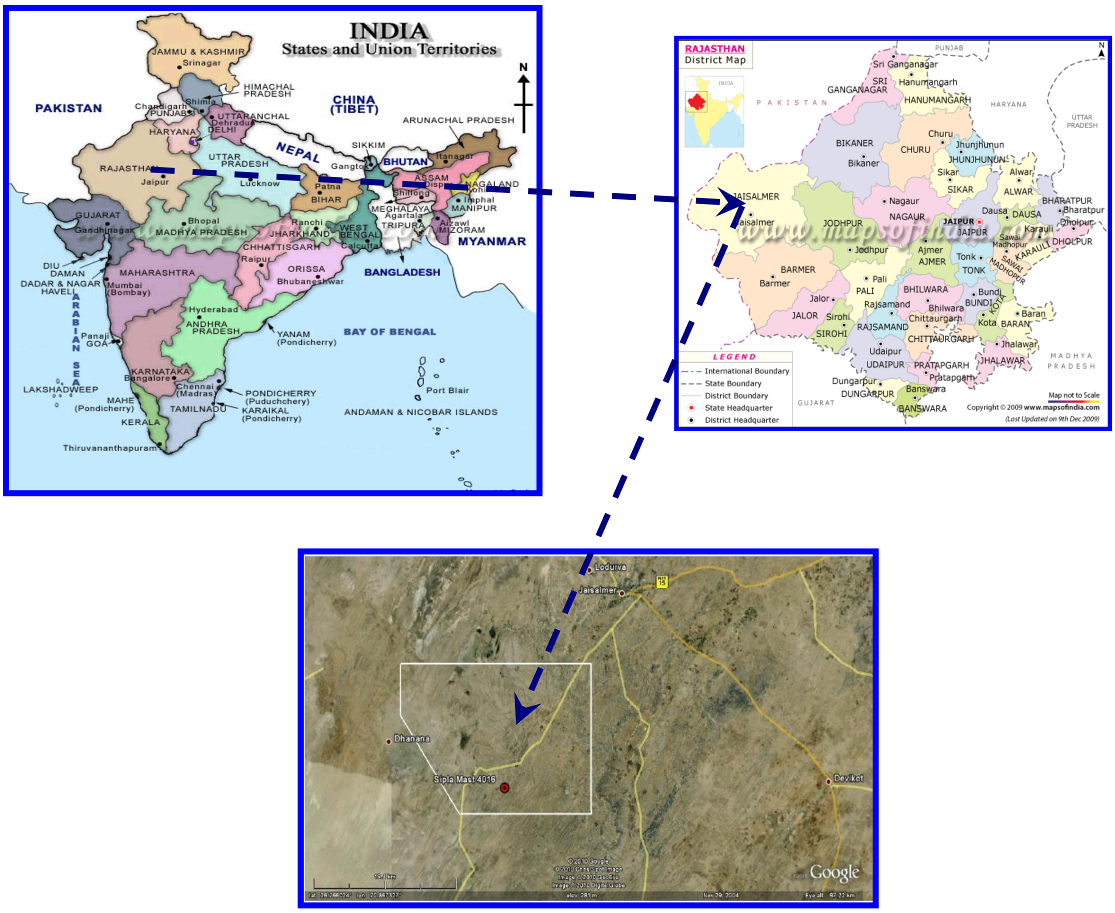
Village : Sipla, Pithla, Kotri, Senag, Satta, Jajiya

District : Jaisalmer

A.2.4. Physical/Geographical location

>>

WEGs have been installed in district Jaisalmer of Rajasthan, India. Jaisalmer is the nearest airport to the site. The project consists of 33 WEGs of 800 kW capacities each. The details of their geo-coordinates have been added as Appendix 8.



A.3. Technologies and/or measures

>>

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind blowing at high speeds has a considerable amount of kinetic energy. When this kinetic energy passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity.

The proposed project activity involves installation of 33 WEGs of 800 KW capacity each, i.e. total installed capacity of 26.4 MW and PLF of 21.66%. The WEGs are of Enercon's E-53 model, with newly designed blades, type tested and approved by the Ministry of New and Renewable Energy (MNRE)[2].All manufacturing units, training academy, corporate office, projects and service sites of Enercon India Limited (EIL) are ISO 9001 certified[3].

The specifications of the WEGs installed at each of the sites are specified below:

Parameter	Description
Turbine Model	Enercon E-53
Rated Power	800 kW
Rotor Diameter	53 m
Hub Height	75 m (Concrete)
Turbine type	Direct driven, horizontal axis wind turbine with variable rotor speed
Power Regulation	Independent pitch system for each blade
Cut-in wind speed	3 m/s
Rated wind speed	12.6 m/s
Cut-out wind speed	28m/s (with Enercon storm control)
50 Year Extreme wind speed	57 m/s
Rated rotational speed	29 rpm
Operating range rotational speed	11-29.5 rpm
Orientation	Upwind
Number of blades	3
Blade Material	Fibre Glass Epoxy reinforced
Gear box type	Gear less
Generator type	Synchronous type
Braking	Aerodynamic
Output voltage	400 V
Yaw system	Active yawning with 4 electric yaw drives with brake motor
Tower	74 m (Concrete)
Turbine Life	20 Years

The electricity generated by the project activity is being supplied to the regional grid, i.e. NEWNE grid. The major contributor of electricity to the regional grids is fossil fuel based thermal power plants. Fossil fuel based electricity generation contributes to GHG emissions of Carbon Dioxide into the atmosphere. The project activity is a wind electricity generation which is a clean source of energy. In addition to contributing to the electricity generation to the state of Rajasthan, the project activity also helps to displace electricity generated from fossil fuel based thermal power plants into the grid thereby reducing GHG emissions. Prior to the project activity the same amount of electricity would be supplied from the connected grid system.
The pre-project scenario has already been discussed in the Section A.1.

The Baseline scenario, *i.e.,* the scenario in the absence of project activity, the equivalent amount of electricity supplied by this component would have been generated in the fossil fuel mixed power

[2] http://www.cwet.tn.nic.in/Docu/RLMM_List_01_2011.pdf
[3] http://www.enerconindia.net/background-note.jsp

plants connected to NEWNE grid of India Emission reductions will be claimed based on the net electrical energy that is supplied to grid. The metering of the electricity generated would be done at the Substation location using the appropriate metering devices. The detailed monitoring plan is at section B.7.3.

The project activity is wind electricity generation which is renewable source of energy and therefore is an environmentally safe technology.

Technology Transfer:
The project activity does not involve any technology transfer.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	**Private entity**: Ratedi Wind Power Private Limited (*previously known as IL&FS Wind Power Limited*)	No

A.5. Public funding of project activity

>>
No public funding and no ODA from a country listed in Annex 1, is involved in this project activity.

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

B.1. Reference of methodology and standardized baseline

>>
"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"; ACM0002, Version 13.0.0 which uses the following methodological tools:

- "Tool to calculate the emission factor for an electricity system", v02.2.1
- "Tool for the demonstration and assessment of additionality", v06.1.0

B.2. Applicability of methodology and standardized baseline

>>
The project meets all applicability criteria as set out in the approved methodology, ACM0002, v13.0.0; Tool to calculate the emission factor for an electricity system, v02.2.1 and Tool for the demonstration and assessment of additionality, v06.1.0 as described below:

Applicability conditions under ACM0002, v13.0.0	Eligibility Status
This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (green field plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The proposed project activity involves option (a) i.e. installing a new power plant at a site where no renewable power plant was operated prior to implementation of the project activity (green field project). Hence, this applicability condition is satisfied.
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/ unit of one of the following types: hydro	The project activity is installation of a new wind power plant; satisfying the applicability condition.

power plant/ unit (either with a run-of-river reservoir or an accumulated 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 or replacements, the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum reference period and the implementation of the project activity.	This condition is not applicable as the project activity is installation of a new wind power plant and does not involve capacity addition, retrofit or replacement of a power unit.
In case of hydro power plants, one of the following conditions must apply : ➲ The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or ➲ The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or ➲ The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The proposed project activity involves installation of a wind power plant; hence this condition is not applicable.
The methodology is not applicable to the following: ➲ Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; ➲ Biomass fired power plants; ➲ Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than $4W/m^2$.	The proposed project is installation of a new wind based power plant; hence this condition is not applicable.
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 after the implementation of the project activity all of the following conditions must apply: ➲ The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2; ➲ All reservoirs and hydro power plants are located at the same river and were designed together to function as an integrated project that collectively constitutes the generation capacity of the	The proposed project is installation of a new wind based power plant; hence this condition is not applicable.

combined power plant; ➲ The water flow between the multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; ➲ The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 W/m^2, is lower than 15 MW; ➲ The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs	
The methodology is not applicable to the following: ➲ Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; ➲ Biomass fired power plants; ➲ A hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.	The proposed project is installation of a new wind based power plant, hence this methodology is applicable to the project activity.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is 'the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.	The project activity a Greenfield project and does not involve retrofits, replacements or capacity additions and hence this condition is not applicable
Applicability conditions under Tools **Tool to calculate the emission factor for an electricity system, v02.2.1**	**Project activity is eligible since:**
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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	The wind power project results in supply of electricity to the grid that would have been provided by conventional power units in the absence of the project activity. Thus meeting the applicability criteria.
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, the conditions specified in "Annex 2 - Procedures related to off-grid power generation should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10%	The project activity involves supply of electricity to the grid and the emission factor for the NEWNE grid is calculated only for grid power plants. Therefore, this applicability criterion is satisfied.

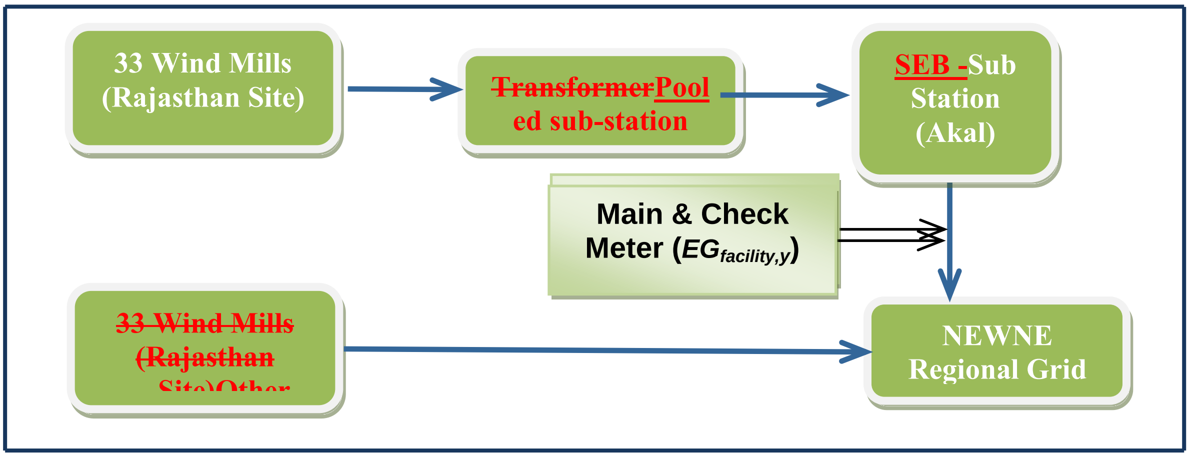
of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10% of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	
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 electricity system is within the geographical boundary of India with exports and import to neighbouring countries which does not include Annex I countries. Hence the applicability criterion is met.
Tool for the demonstration and assessment of additionality, v06.1.0	**Project activity is eligible since:**
This tool provides for a step-wise approach to demonstrate and assess additionality. These Steps include: a) Identification of alternatives to the project activity b) Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible; c) Barriers analysis; and d) Common practice analysis;	The step-wise approach has been undertaken to demonstrate and assess additionality of the project activity (Section B.5).
Based on the information about activities similar to the proposed project activity, the common practice analysis is to complement and reinforce the investment and/or barriers analysis. The Steps are summarized in flow-chart on page 2 of this document.	Common practice analysis has been carried out to complement and reinforce the investment analysis (Section B.5).
The document provides a general framework for demonstrating and assessing additionality and is applicable to a wide range of project types. Some project types may require adjustments to this general framework.	The project activity follows the framework laid down in the document for demonstrating and assessing the additionality.
This tool does not replace the need for the baseline methodology to provide a step-wise approach to identify the baseline scenario. Project participants that propose new baseline methodologies shall ensure consistency between the determination of additionality of a project activity and the determination of a baseline scenario. Project participants can also use the .Combined tool to identify the baseline scenario and demonstrate additionality, which provides a procedure for baseline scenario identification as well as additionality demonstration.	The baseline methodology ACM0002 v13.0.0 is separately applied to the project activity for identifying the baseline scenario.

B.3. Project boundary

According to the Approved consolidated baseline and monitoring methodology ACM0002, v13.0.0, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

Tool to calculate the emission factor for an electricity system, v02.2.1, states that Grid/project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. The project activity evacuates power to the integrated NEWNE regional grid.

A diagrammatic presentation of the project boundary has been given below:



The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	In the baseline scenario the electricity would have been sourced from the NEWNE grid which in turn would be connected to fossil fuel fired power plants which emit CO_2.
		CH_4	No	No Methane emissions are expected.
		N_2O	No	No Nitrous Oxide emissions are expected.
Project scenario	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not Applicable. The project activity is installation of new wind power plant. Therefore, this activity is not applicable
		CH_4	No	Not applicable
		N_2O	No	Not applicable
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not Applicable. The project activity is installation of new wind power plant. Therefore, this activity is not applicable
		CH_4	No	Not applicable

		N_2O	No	Not applicable
	For hydro power, emissions of CH_4 from the reservoir	CO_2	No	Not Applicable. The project activity is installation of new wind power plant. Therefore, this activity is not applicable
		CH_4	No	Not applicable
		N_2O	No	Not applicable
	Greenfield wind energy conversion system	CO_2	No	The project activity does not result into generation of GHG emissions.
		CH_4	No	No Methane emissions are expected.
		N_2O	No	No Nitrous Oxide emissions are expected.

B.4. Establishment and description of baseline scenario

>>

As the project activity involves installation of a new grid-connected renewable energy power plant/unit and is not a modification/retrofit of an existing plant/unit, the baseline scenario, as per the Approved consolidated baseline and monitoring methodology ACM0002, Version 13.0.0, 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".

National policies relevant to the project activity

The project participant has invested in this wind power project activity voluntarily and has not done so because of any mandate or regulation.

Power projects in India (conventional and renewable) are governed by the Electricity Act (EA), 2003, prior to which there were no specific provisions that would promote renewable sources of energy. The EA, 2003, applicable environmental regulations and all policy support for grid interactive renewable power[7] promotes additional generation of electricity from renewable sources of energy and does not restrict or empower any authority to restrict the choice of fuel or the technology employed.

The EA, 2003 enacted by Government of India on June 10, 2003 has repealed the three acts which were in existence namely (i) The Indian Electricity Act 1910 (ii) The Electricity (Supply) Act, 1948 and (iii) The Electricity Regulatory Commissions Act, 1998. The EA, 2003 was enacted to harmonize and rationalize the provisions in the existing laws in India; it consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. The EA, 2003 was in force at the time of completion of the baseline study for the PDD.

Section 5.12.2 of the EA 2003 provides that co-generation and generation of electricity from nonconventional sources would be promoted by the State Electricity Regulatory Commissions (SERCs) by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Such percentage for purchase of power from nonconventional sources should be made applicable for tariff determination; the act empowered the State

Electricity Regulatory Commissions to specify the terms & conditions for the determination of tariffs in their respective area.

As specified in the EA 2003, the appropriate commission, in this case the Rajasthan Electricity Regulatory Commission (RERC) (as the project activity is located in the state of Rajasthan, the corresponding state regulatory commission is the RERC), shall ensure the promotion of co-generation and generation of electricity from renewable sources of energy while determining tariff and shall promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person.

The data published by planning commission of CEA committee for capacity addition in the Eleventh Plan (2007-12) clearly projects the dominance of the thermal sector based power projects8. The data is presented in the table below[4]:

S. No.	Source	Central	State	Private	Total
1	Hydro	8654	3482	3491	15627
2	Thermal	24840	23301	11552	59693
3	Nuclear	3380	-	-	3380
	Total	**36874**	**26783**	**15043**	**78700**

This scenario and projections indicate that the government favours the fossil fuel based electricity generation. There are no national policies or circumstances that mandate the renewable energy based electricity generation.

The key parameters and data sources used for *ex-ante* calculations are given as follows:

Parameter	Value	Source	
		Ex-ante	***Ex-post***
$EG_{facility,y}$ – Quantity of net electricity generation supplied by the project plant to the grid in year *y* (MWh)	50,094	PO (for rated capacity), PLF reports from third party engineering company	JMR Statement in conjunction with Share certificate
$EF_{grid,OM,y}$ Operating Margin CO_2Emission Factor of NEWNE Regional Grid (tCO_2/MWh)	0.98422	"CO_2 Baseline Database for Indian Power Sector" v7.0 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India	
$EF_{grid,BM,y}$ Build Margin CO_2Emission Factor of NEWNE Regional Grid (tCO_2/MWh)	0.85878	"CO_2 Baseline Database for Indian Power Sector" v7.0 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India.	
$EF_{grid,CM,y}$ Combined Margin CO_2Emission Factor of NEWNE Regional Grid (tCO_2/MWh)	0.95286	"CO_2 Baseline Database for Indian Power Sector" v7.0 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India.	

B.5. Demonstration of additionality

>>

According to the approved consolidated methodology ACM0002, v13.3.0, the proposed project activity uses latest version of the "Tool for the demonstration and assessment of additionality" v06.1.0, to determine the additionality.

[4]http://www.cea.nic.in/reports/powersystems/nep2012/generation_12.pdf (Table 2.1)

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
While identifying the alternatives to the project activity, ACM0002, v13.0.0 directs to use Step 1 of latest additionality tool.

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

According to the methodology, the realistic and credible alternatives for the project activity to be analysed include:
(a) The proposed project activity undertaken without being registered as a CDM project activity;
(b) Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g., cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;
(c) If applicable, continuation of the current situation (no project activity or other alternatives undertaken).

Outcome of Step 1a: Of the above three alternatives, Alternative (a) and (c) stand out to be the most plausible baseline scenarios, since in the absence of project activity, the current situation would have continued, *i.e.* power generation from existing thermal power plants using fossil fuels and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system.

Sub-step 1b: Consistency with Mandatory Laws and Regulations

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

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

Outcome of Step 1b: The above identified realistic and credible alternative scenarios to the project activity are in compliance with all mandatory legislation and regulations, taking into account the enforcement in the host country and EB decisions on national and/or sectoral policies and regulations.

Step 2: Investment Analysis

Sub-step2a: Determine appropriate analysis method

According to the “Tool for the demonstration and assessment of additionality”(version 06.1.0) there are three options for the execution of the investment analysis.

Option I: Simple cost analysis (the CDM project activity generates no financial or economic benefits other than CDM related income)
Option II: Investment comparison analysis [the relevant financial indicator (IRR, NPV) is determined and compared], or
Option III: Benchmark analysis (the relevant financial indicator, such as IRR, is compared to a benchmark)

The project will generate revenues from energy sale and also from credits of emissions reduction, therefore Option I is not applicable. Option II also does not apply since, there is no comparable

investment alternative available to the project proponent. The most appropriate financial analysis method is therefore Option III: the benchmark analysis, where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country. This option is also in line with the paragraph 19 of "Guidelines on the Assessment of Investment Analysis" v05 - if *the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.*

Sub-step2b: Option III. Apply benchmark analysis

The project developer has chosen equity IRR to demonstrate the additionality, which is in accordance with Guidelines on the assessment of investment analysis v05, EB 62 Annex 05, as provided in the "Tool for demonstration and assessment of additionality".

The project developer is a limited company and is primarily concerned with the return on equity and associated risks in the investments. Hence, in order to analyze the financial viability of the project activity, the financial indicator that has been used is the post-tax equity IRR of the project activity

As per paragraph 12 of Guidelines on assessment of investment analysis, v05 where the equity IRR is chosen as the financial indicator, required/expected returns on equity are appropriate benchmark.

According to the "Tool for the demonstration and assessment of additionality", discount rates and benchmarks may be derived from government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type. Expected Return on Equity has been arrived at using the Capital Asset Pricing Model (CAPM). In estimating the expected return on equity, official publicly available financial data has been used to arrive at beta value and market risk premium for the project type.

Formula Applied:

Return on Equity = Risk-free rate of return + (Beta × Market Risk Premium)

Risk-free rate of return: The redemption yield on Government of India securities for 20 year maturity period is taken as the risk-free rate of return. As per the Reserve Bank of India publication[5], the yield for the same is **8.46%.**

Market risk premium: In CAPM, the risk premium is estimated as the difference between the market return and the risk-free rate of return.

The stock index, BSE-200 has been taken to calculate the market return. The market return has been arrived at based on the annual average return of listed securities in the BSE-200.The market return is computed to be **16.30%.** Hence, the market risk premium works out to be **7.84%.**

Beta value: The beta is determined to be **0.962**, by referring to the beta values of publicly listed companies that are engaged in similar types of business.
As the project activity type is power generation, beta values have been taken for BSE-200 listed power generation companies (as BSE 200 is a good representation of power sector companies and provides conservative market returns, when compared to other indices), computed through regression using the formula:

Beta = Covariance(R_j, R_m) / Variance R_m

Where:

[5] Available at: http://www.rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=11649

R_j Percentage returns on company's price movements
R_m Percentage returns on index' price movements

For calculating Beta value, the following companies have been considered:

Company Name	Beta Value	
CESC Ltd	1.03	**Average Value = 0.962**
KSK Energy Ventures Ltd.	0.62	
NTPC Ltd.	0.42	
Reliance Infrastructure Ltd.	1.69	
Reliance Power Ltd.	1.05	
Tata Power Ltd.	0.75	
Torrent Power Ltd.	1.18	

The companies considered for beta estimation represent the power sector. The chosen seven companies have power projects in their portfolio, and have been traded on the index for a substantial period.

A period of 2 years (Sep'08 to Sep'10) is considered for beta estimation in order to have a substantial historical data for estimation. Monthly returns on stock were chosen to reduce the non-trading bias significantly. A longer estimation period is unadvisable as the firms' risk characteristics change over the time period

The market risk premium has been multiplied by beta to take into account the project specific risk. Based on the above, the return on equity for the project has been computed as **16.00%**.

Sub-step2c: Calculation and comparison of financial indicators

The equity IRR has been computed based on the following assumptions (The assessment year considered is 2011-12):

Parameters	Value	Source
Plant Capacity (33 nos. of WEGs, 0.8 MW capacity each)	26.4 MW	Proposal
Plant Load Factor (PLF) (%)	21.66%	Calculated based on Wind Assessment Report
Cost of Project (Rs. In million)	1498.20	Proposal
Financing Pattern – Equity (%)	25	Management Assumption based on previous experience
Financing Pattern – Debt (%)	75	Management Assumption based on previous experience
Rate of Interest (%)	11	Management Assumption based on previous experience
Working Capital Interest Rate (%)	11	IREDA
Tariff Rate – (Rs./KWh)	3.87	RERC wind tariff order dated 06/08/2010
Book Depreciation – annual rate (%) (90% of the value has been depreciated over project life period of 20 years. 10% has been considered as salvage value.	4.5	Management Assumption based on previous experience
Depreciation as per Income Tax act (WDV basis) (%)	15	Income Tax Act
Corporate tax rate (%)	33.22	Income Tax Act
MAT rate (%)	19.93	Income Tax Act

Tax holiday under section 80-IA	10 years	Income Tax Act
Operation & Maintenance costs per WEG (Rs. in Million)	0.6	Equipment Supplier's Proposal
Yearly escalation in O&M costs (%)	6	Equipment Supplier's Proposal
Insurance cost (as % of project cost)	0.04 %	Management Assumption based on previous experience

The equity IRR for the project without CDM benefit works out to be as follows:

Equity IRR without CDM benefit	Benchmark (Return on Equity)
7.14 %	16.00 %

This clearly indicates that the project activity has lower IRR than the benchmark, so the project activity cannot be considered as financially attractive. The additionality of the project is thus apparent.

Sub-step2d: Sensitivity Analysis

Guidelines on investment analysis require the project developer to subject critical assumptions to reasonable variation to ascertain the robustness of the conclusion drawn, that is, the project is unlikely to be the most financially attractive. As required, a sensitivity analysis has been conducted to measure the impact of changes in the chosen parameters.

The project proponent has chosen four assumptions as critical to the operations of the project namely: Plant Load Factor (PLF), total Project Cost, O&M costs and tariff rate. These factors were subjected to 10% variation on either side to ascertain the impact on the profitability and hence the IRR of the project. The results of the sensitivity analysis are as given below[6]:

Factor	Resultant equity IRR		
	Decrease by 10%	*Base case*	*Increase by 10%*
Generation	4.13 %	7.14 %	10.12 %
Project Cost	10.08 %	7.14 %	4.77 %
O&M Cost	7.65 %	7.14%	6.62 %
Tariff	4.15 %	7.14%	10.06 %

The unlikelihood of occurrence of a scenario where the parameters reach/cross the benchmark value is tabulated as below:

Parameters	Tariff at investment decision	Justification of unlikelihood
Generation	30.1 %	The PLF is based on the Wind Assessment Study carried out for the project activity. Further, an analysis has been carried out, to study the PLF of projects undergoing Verification[7], which suggests that the PLF of the projects of Jaisalmer is less than that considered for the project activity. It is therefore unlikely that the PLF will ever increase more than 30% and IRR of project

[6] ***Actual Scenario w.r.t. tariff:***

The PPA for the project was signed with a revised tariff rate of 4.46 per kWh The equity IRR at this tariff is 11.58 %,. The IRR does not cross benchmark even after considering a sensitivity on PPA signed tariff..

[7]The list of the analyzed projects has been provided to the DOE.

		to breach the benchmark.
Project Cost	-24.3 %	The project cost cannot change as all the purchase orders have been placed and the project related expenses have already been incurred.
O&M Cost	-201 %	The agreement between Enercon and IWPL has been signed at Rs. 0.6 million/year for 10 years, Therefore it is highly unlikely that the O&M cost will decrease.
Tariff	30.1%	As per the PPA signed, the highest tariff rate is Rs. 4.46, which is the most conservative scenario. The PPA has been signed for 20 years and further increase in the tariff is not anticipated. Therefore, it is not likely to reach the benchmark breakeven point.

Outcome of Step 2: It is evident from the above analysis that the equity IRR does not cross the benchmark rate of **16.00 %** even after an increase of 10% in the selected parameters. The project is unlikely to be financially/economically attractive without CDM benefits. The CDM benefits earned will help generate revenue for the project. Therefore, the alternative scenario (c), the most favorable scenario, is additional.

Step 4: Common Practice Analysis

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

As per the tool for "Demonstration and assessment of additionality" Version 06.1.0, the following **Stepwise approach for Common Practice** has been followed for the project activity.

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

The capacity of the project activity is 26.4 MW. The project capacity has been subject to the variation in the range of +/- 50%, the following table depicts the outcome of the variation applied;

-50%	Capacity (in MW)	+50%
13.2 MW	26.4	39.6 MW

For the analysis, the projects falling in the range of 13.2 MW to 39.6 MW capacities have been taken.

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

India has been considered applicable geographical area as a default, for the common practice analysis of project activity. All power plants generating electricity within the capacity range of 13.2 MW to 39.6 MW and having commercial operations date before project activity start date (22/11/2010) have been considered. The power generation plants identified in this step are hydro[11], thermal[8]and wind power projects[9]. The total number of power plants is 392.

[8] CO_2 Baseline Database for Indian Power sector, v7.0
[9] Directory: Indian Wind Power 2011

CDM project activities which have got registered or are under validation have been excluded in this step. The list of the plants identified is provided to the DOE. After excluding the registered and under validation projects the total number of projects, N_{all}= 353

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

In accordance with Guidelines on Common practice Version 1, EB 63, Different technologies are technologies that deliver the same output and differ by at least one of the following

(i) Energy Source/Fuel
(ii) Feed stock
(iii) Size of installation (power capacity)
- Micro
- Small
- Large

(iv) Investment climate in the date of the investment decision, inter alia:
- Access to technology;
- Subsidies or other financial flows;
- Promotional policies
- Legal regulations

(v) Other features, inter alia:
- Unit cost of output

The project activity has been separated from the different technologies on the basis of the following criteria:

Energy Source/fuel: The project activity involves electricity generation from wind. The other project activities identified in Step 2 are hydro and thermal power plants. All these are using water and conventional fuels as energy sources for the generation of electricity respectively. Therefore, all the projects falling under above category, except wind power plants, are considered as plants with different technologies and included under $N_{diff.}$

Number of thermal Power projects	**95**
Number of hydro power projects	211
Total	306

Size of installation: The total number of wind projects is 45. These have been differentiated into large and small scale as:

Wind (Small Scale) Below 15 MW	**16**
Wind (Large Scale) Above 15 MW	31
Wind total	47

Investment climate in the date of the investment decision

The investment decision, taken by the Board, of the project activity has happened on 16/10/2010. The investment decision of the project activity was taken considering Generation Based Incentive (GBI) scheme[10] initiated by Ministry of New & Renewable Energy, Government of India. The scheme is to broaden the investor base and create level playing field for various classes of investors. GBI is applicable for grid interactive wind power projects in India. The GBI scheme came in effect from 17/12/2009. The advent of this scheme had played critical role for project proponent to take decision to go ahead with the implementation of the project.

On the basis of above promotional scheme (GBI), wind power projects with commissioning date prior to 17/12/2009 have also been considered under different technology projects (N_{diff}).

[10] www.mnre.gov.in/gbi-scheme.html; http://www.pib.nic.in/newsite/erelease.aspx?relid=78829

Therefore, the technologies different than the project activity, N_{diff} is calculated as:

Project category	Number of Projects
Thermal	95
Hydro	211
Wind Small Scale	16
Wind Large Scale (Without GBI)	28
Total N_{diff}	**350**

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

.

From step 2 and step 3 following table is arrived at;

N_{all}	**353**
N_{diff}	350
$N_{all}-N_{diff}$	3
$F= (1-N_{diff}/N_{all})$	0.0085

As per the tool, *the proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:*

(a) The factor F is greater than 0.2, and
(b) $N_{all}-N_{diff}$ is greater than 3.

The factor F and $N_{all}-N_{diff}$ is calculated and following values are arrived at;
F = 0.0085; $N_{all}-N_{diff}$ = 3

The value of factor F as calculated in Step 4 is **0.0085** and is less than 0.2 hence the project activity is not a common practice.

The analysis clearly demonstrates that project activity is not a common practice within a sector in the applicable geographical area. Therefore, it can be concluded that the project activity is additional and requires CDM revenues to alleviate the investment barrier to the project activity.

<u>Serious Consideration of CDM and Continued Action to Secure CDM status</u>

As per the Project Standard (Version 1):

For a proposed CDM project activity with a start date before 2 August 2008 and prior to the date of publication of the PDD for global stakeholder consultation, project participants shall demonstrate that the CDM was seriously considered in the decision to implement the proposed project activity. Such demonstration requires the following elements to be satisfied:

(a) Project participants shall provide evidence of their awareness of the CDM prior to the start date of the proposed project activity, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project;
(b) Project participants shall provide evidence that continuing and real actions were taken to secure CDM status for the proposed project activity in parallel with its implementation;
(c) Project participants shall provide an implementation timeline of the proposed CDM project activity. The timeline should include, where applicable, the date when the investment decision was made, the date when construction works started, the date when commissioning started and the date of start-up (e.g. the date when commercial production started). Project

participants shall provide a timeline of events and actions, which have been taken to achieve CDM registration, with description of the evidence used to support these actions.

Serious Consideration of CDM:

The start date for the project activity is 22/11/2010. The project proponent has (as per the Project Standard, v01.0) informed the Indian DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. The form for prior consideration was submitted to the host DNA and UNFCCC on 05/05/2011, which is within six months of the project activity start date.

The project developer has taken parallel action for the implementation of the project and the registration of project as CDM activity.

Sr. No.	Events	Date
1.	Enercon Proposal	16/08/2010
2.	Board Resolution	16/10/2010
3.	Purchase Order for supply of WEGs	22/11/2010
4.	Local Stakeholder Consultation Meeting	29/01/2011
5.	Submission of form for Prior Consideration of CDM to UNFCCC	05/05/2011
6.	Agreement between IWPL and IEISL for CDM consultancy	21/12/2011
7.	Commissioning Dates of WEG Location Numbers	
	109,111,112,116,121,130,506,531,532,533,534,539,551	23/06/2011
	52,65,67,68,255,256,206	29/09/2011
	108,132,133,59,54,605,	07/09/2011
	250,251	12/11/2011
	253,254	24/11/2011
	555,556,557	31/01/2012
8.	Appointment of DOE	07/05/2012
9.	Issuance of Letter of Approval from the host country	22/11/2012

B.6. Emission reductions

B.6.1. Explanation of methodological choices

>>

Estimation of Project Emissions

The project activity involves harnessing of wind energy for electricity generation, which does not involve combustion or generation from fossil fuels. Hence according to ACM0002 v13.0.0, there will be no project emissions in the project activity ($PE_y = 0$).

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

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

Where:

BE_y	Baseline emissions in year y (tCO_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 CO_2 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” v2.2.1 (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

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

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

Where:

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

Baseline emissions (BE_y in tCO_2/yr) due to displacement of grid-electricity is calculated as the product of the Baseline Emissions Factor ($EF_{grid,CM,y}$ in tCO_2/MWh) calculated as described below, times the electricity supplied by the project activity to the grid ($EG_{facility,y}$ in MWh/yr), over the crediting period (from equation 1 and 2).

$$BE_y = EG_{facility,y} \times EF_{grid,CM,y} \quad (3)$$

Where:

BE_y	Baseline emissions in year y (tCO_2/yr)
$EG_{facility,y}$	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)
$EF_{grid,CM,y}$	Combined margin CO_2 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 ”v2.2.1 (tCO_2/MWh)

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

As per the approved methodology, ACM0002 Version 13.0.0, “Tool to calculate emission factor for an electricity system”, v02.2.1 is used to determine the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system by calculating the combined margin emission factor of the electricity system. Following steps are applied to determine the combined margin CO_2 emission factor:

As per approved methodology ACM0002, v13.0.0, the baseline emission factor for a grid system has to be calculated as per “Tool to calculate the emission factor for an electricity system”

According to the “Tool to calculate the emission factor for an electricity system”, project proponent shall apply the following steps:

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 emission factor.
Step 6.Calculate the combined margin (CM) emission factor.

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. Central Electricity Authority (CEA) (which is an official source of Ministry of Power, Government of India) have worked out

baseline emission factors for two grids in India and made them publicly available in the form of "CO_2 Baseline Database for Indian Power sector" dated January 2012, v7.0[11].
The emission factor of the grid for the ex-ante approach is calculated in the following manner:

Step 1: Identify the relevant electricity system

The CEA of the host country has published a delineation of the project electricity system and connected electricity systems. For identification of relevant electric power system of the project activity the data published by the CEA of the host country is used and the project activity falls under the Integrated Northern, Eastern, Western, and North-Eastern (NEWNE) regional grids.

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

The baseline emission factor (including Imports) of NEWNE grid, for the Northern state Rajasthan, published by CEA is considered for calculation of emission reductions due to displacement of electricity in accordance with the "Tool to calculate the emission factor for an electricity system", v02.2.1.

Step 2: Choose whether to include off-grid power plants in the project electricity system

According to the tool, the following two options are available 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

Option II allows the inclusion of off-grid power generation in the grid emission factor, i.e. it aims to reflect that in some countries, off-grid power generation is significant and can be partially displaced by CDM project activities.

In the host country, the electricity grid being considered, i.e. the NEWNE grid is both reliable and stable. Hence the off-grid power generation is not significant. Therefore the project proponent has considered Option I for calculation of operating margin and build margin emission factor.

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

According to the "Tool to calculate the emission factor for an electricity system" Version 02.2.1, the calculation of operating margin ($EF_{grid,OM,y}$) is based on one of the following methods:
a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or

[11] Central Electricity Authority, 2012, Baseline Carbon Dioxide Emissions from Power Sector, Version 7.0 [online] Available at: <http://cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm>

d) Average OM.

Any of the four methods can be used, however the simple OM method (option a) can only be used if low cost/must run resources[12] constitute less than 50% of total grid generation.

Grid	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	18.5 %	19 %	17.4 %	15.9 %	**17.6 %**
South	28.3 %	27.1 %	22.8 %	20.6 %	**21.0 %**
India	**20.9 %**	**21 %**	**18.7 %**	**17.1 %**	**18.4 %**

The data as mentioned in table B5 clearly shows that % of total grid generation by low cost/must run plants for the NEWNE grid is less than 50% of the total generation. Hence, the **Simple Operating Margin** method can be used to calculate operating margin emission factor.

The project proponent choose an *ex-ante* option for calculation of the OM with a 3-year generation weighted average, based on most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emission factor during the crediting period.

Step 4: Calculate the Operating Margin emission factor ($EF_{grid,OM,y}$) according to the selected method

<u>Simple OM method</u>

The OM emission factor under this method is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. The data vintage option selected is the ex-ante approach, where a 3 year average OM is calculated. The most recent three year CEA data published on the emission factor of NEWNE region is considered.

The simple OM may be calculated using:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For calculation of simple OM, option A is chosen because necessary data for the option is available, and option B can only be used if the required data for option A is not available.

Option A - Calculation based on average efficiency and electricity generation of each plant

Under this option, the CEA baseline is derived using the following formulae to calculate simple OM.

$$EF_{grid,OM\ simple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (4)$$

Where:

$EF_{grid,OMsimple,y}$ Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

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

$EF_{EL,m,y}$ CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

[12] Defined as Hydro, geothermal, wind, low cost biomass, nuclear and solar generation plants in the Methodological Tool: "Tool to calculate the emission factor for an electricity system", version 2.2.1

m	All power units serving the grid in year *y* except low-cost/ must-run power units
y	The relevant year as per the data vintage chosen in step 3

Determination of $EF_{EL,m,y}$

For calculation of emission factor of each power unit, the following options have been considered:

Option A1. If for a power unit *m* data on fuel consumption and electricity generation is available
Option A2. If for a power unit *m* only data on electricity generation and the fuel types used is available
Option A3. If for a power unit *m* only data on electricity generation is available

Since data on fuel consumption and electricity generation is available, the emission factor in the CEA database has been determined taking **Option A1**, as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \quad (5)$$

Where:

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power unit *m* year *y* (Mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in the year *y* (tCO_2/GJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in the year *y* (MWh)
m	All power units serving the grid in year *y* except low-cost/ must-run power units
i	All fossil fuel types combusted in power plant/ unit *m* in year *y*
y	The relevant year as per the data vintage chosen in step 3

The calculated value of $EF_{grid,OM,y}$ is 0.98422 tCO_2/MWh

Step 5: Calculate the Build Margin (BM) Emission Factor $EF_{grid,BM,y}$

As per the Tool, in terms of vintage of data, project participants can choose between one of the following two options:

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

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

The value for Build Margin is taken from Central Electricity Authority (CEA) CO_2 baseline database for Indian Power sector, v7.0.[13]

The Build Margin emission factor has been determined using option 1. Also, the sample group of power units m used to calculate the build margin has been determined by CEA CO_2 baseline database version 7 as per the following procedure:

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

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);
(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);
(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Since none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, SET_{sample} has been used to calculate the build margin.

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

$$\mathbf{EF_{grid,BM,y}} = \frac{\sum_m \mathbf{EG_{m,y} \times EF_{EL,m,y}}}{\sum_m \mathbf{EG_{m,y}}} \qquad \mathbf{(6)}$$

Where:

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

The value for $EF_{grid,BM,y}$ is 0.85878 tCO_2/MWh

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

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:
(a) Weighted average CM; or
(b) Simplified CM.

The weighted average CM method (option A) should be used as preferred option.

The simplified CM method (option b) can only be used if:

[13] Central Electricity Authority, 2012, Baseline Carbon Dioxide Emissions from Power Sector, v7.0 available at: http://cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

Since the project activity is not located in a LDC and meets the data requirements for application of step 5, therefore, the weighted average CM method (option A) is used.

The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (7)$$

Where:

$EF_{grid,OM,y}$	Operating margin CO_2emission factor in year y (tCO2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2emission factor in year y (tCO2/MWh)
w_{OM}	Weighting of operating margin emission factor (%)
w_{BM}	Weighting of build margin emission factor (%)

As per the "Tool to calculate emission factor for an electricity system"; Version 02.2.1, for wind power projects, the default weights are as follows: w_{OM} = 0.75 and w_{BM} = 0.25.

The value for $EF_{grid,CM,y}$ is 0.95286 tCO_2/MWh.

Estimation of Leakage Emissions

No leakage emissions are to be accounted under this methodology.

Estimation of Emission Reductions

According to the approved methodology ACM0002, v13.0.0; emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad (8)$$

Where:

ER_y	Emission reductions in year *y* (tCO_2e/yr)
BE_y	Baseline Emissions in year *y* (tCO_2e/yr)
PE_y	Project Emissions in year *y* (tCO_2e/yr)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$EF_{grid,OM,y}$
Unit	tCO_2/MWh
Description	Operating Margin CO_2 Emission Factor of NEWNE Regional Grid
Source of data	"CO_2 Baseline Database for Indian Power Sector" v7.0 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India[14].
Value(s) applied	0.98422
Choice of data or Measurement methods and procedures	Operating Margin Emission Factor has been calculated using the simple OM approach in accordance with ACM0002 and "Tool to calculate the emission factor for an electricity system" v2.2.1. The generation weighted average of simple operating margins of the year 2007-08,2008-09,2009-10 have been used to calculate ex-ante OM.
Purpose of data	For calculation of baseline emissions

[14] CO_2 Baseline Database, January 2012, Version 7.0

Additional comment	-

Data / Parameter	***$EF_{grid,BM,y}$***
Unit	tCO_2/MWh
Description	Build Margin CO_2 Emission Factor of NEWNE Regional Grid
Source of data	“CO_2 Baseline Database for Indian Power Sector” v7.0 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India[15].
Value(s) applied	0.85878
Choice of data or Measurement methods and procedures	Build Margin Emission Factor has been calculated by the Central Electricity Authority in accordance with ACM0002 and “Tool to calculate the emission factor for an electricity system” v2.2.1. The ex-ante value for the year 2009-10 has been used.
Purpose of data	For calculation of baseline emissions
Additional comment	-

Data / Parameter	***$EF_{grid,CM,y}$***
Unit	tCO_2/MWh
Description	Combined Margin CO_2 Emission Factor of NEWNE Regional Grid
Source of data	“CO_2 Baseline Database for Indian Power Sector” v7.0 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India[16].
Value(s) applied	0.95286
Choice of data or Measurement methods and procedures	Combined Margin Emission Factor (***$EF_{grid,CM,y}$***) is calculated ex ante as the weighted average of Operating Margin Emission Factor (***$EF_{grid,OM,y}$***) and Build Margin Emission Factor (***$EF_{grid,BM,y}$***). In case of wind power projects, default weights of 0.75 for ***$EF_{grid,OM,y}$*** and 0.25 for ***$EF_{grid,BM,y}$*** are applicable as per ACM0002, v13.0.0.
Purpose of data	For calculation of baseline emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

>>

In accordance with ACM0002 v13.0.0 and “Tool to calculate the emission factor for an electricity system” v2.2.1, the baseline is calculated using the combined margin approach. The baseline emission factor is calculated in the following steps:

Step 1: Calculation of Operating Margin Emission Factor $EF_{grid,OM,y}$ (*ex-ante*)

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

Simple Operating Margin (tCO_2/MWh) (incl. Imports)	2008-09	2009-10	2010-11
NEWNE	1.00655	0.97774	0.97066

The value for Simple Operating Margin has been calculated in the Appendix 4.

Thus, the final $EF_{grid,OM,y}$ based on three years weighted average is estimated to be **0.98422 tCO_2/MWh**.

Step 2: Calculation of the Build Margin Emission Factor $EF_{grid,BM,y}$ (*ex-ante*)

[15] CO_2 Baseline Database, January 2012, Version 7.0

[16] CO_2 Baseline Database, January 2012, Version 7.0

The build margin has to be calculated by constituting a sample group m from either the 5 most recently built power plants or the power capacity additions in the electricity system that comprise 20% of the system generation (that have been built most recently). The sample group that comprises larger annual generation from either of these has to be chosen. It is observed that the generation from the sample group that comprises 20% of the system generation has larger generation than the 5 most recently built plants. So the Build Margin is calculated from the sample group comprising the most recently additions to the grid that constitute 20% of the system generation.

Build Margin (tCO_2/MWh) (incl. Imports)	2008-09	2009-10	2010-11
NEWNE	0.67548	0.81231	0.85878

The $EF_{grid,BM,y}$ is estimated at **0.85878 tCO_2/MWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

Step 3: Calculation of Baseline Emission Factor

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

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

Where the weights w_{OM} and w_{BM}, are 0.75 and 0.25 respectively, and $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

Baseline Emission factor: 0.95286 tCO_2 /MWh

Step 4: Calculation of Baseline Emissions (BE_y)

According to "Tool to Calculate the Emission Factor for an Electricity System" the baseline emissions is calculated as electricity supplied to the grid multiplied by an emission factor (measured in tCO_2/MWh) calculated in a transparent and conservative manner.

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

Where:

BE_y	Baseline emissions in year *y* (tCO_2/yr)
EG_y	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh)
EF_y	Combined margin CO_2emissions factor grid connected power generation (tCO_2e/MWh)

Therefore,

Baseline Emissions = 50,094 MWh/yr × 0.95286 tCO_2/MWh
= 47,732.57 tCO_2/yr
= 47,732 tCO_2/yr (round down value)

Step 5: Calculation of Emission Reductions (ER_y)

The emission reductions by the project activity during a given year y is the difference between Baseline emissions (BE_y) and project emissions (PE_y).

$$ER_y = BE_y - PE_y$$

Project Emissions by sources of GHGs due to the project activity within the project boundary are zero since wind power is a GHG emission free source of energy.

Therefore, net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis. The project activity results into evacuation of approximately 52.17 Million KWh (based on capacity of project which is 26.4 MW, PLF considered is 21.66%) of renewable power annually to the power deficit NEWNE grid and the annual emissions reductions are equal to **47,732 tCO_2e**.

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2012-13	47,732	0	0	47,732
2013-14	47,732	0	0	47,732
2014-15	47,732	0	0	47,732
2015-16	47,732	0	0	47,732
2016-17	47,732	0	0	47,732
2017-18	47,732	0	0	47,732
2018-19	47,732	0	0	47,732
2019-20	47,732	0	0	47,732
2020-21	47,732	0	0	47,732
2021-22	47,732	0	0	47,732
Total	**477,320**	**0**	**0**	**477,320**
Total number of crediting years	10			
Annual average over the crediting period	**47,732**	**0**	**0**	**47,732**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant to the grid in year *y*
Source of data	The Credit Statement prepared by service provider [Wind World (India) Ltd.] based on Joint Meter Reading (JMR)~~Joint Meter Reading and/or Credit Statement by service provider~~
Value(s) applied	50,094 (for *ex-ante* purpose). The parameter will be monitored *ex-post*.

Measurement methods and procedures	The following parameters shall be measured: ➲ The quantity of electricity supplied by the project plant/unit to the grid; and ➲ The quantity of electricity delivered to the project plant/unit from the grid $EG_{facility,y} = EG_{export,} - EG_{import,}$ The Credit note prepared by the technology supplier is considered to be the source of data. The apportioning method used is described in B.7.3. *Electricity meters*: Metering system for the project activity consists of electronic bidirectional tri-vector meters (one main and one check meter). *Accuracy*: Accuracy of metering system is 0.2s. *Measurement frequency*: Continuous measurement *Calibration frequency*: Annually *Responsible person*: Site in-charge
Monitoring frequency	Continuous measurement and at least Monthly recording
QA/QC procedures	Cross check the measurement results with electricity sale invoices raised by PP. Additionally, PP would use the data represented by $EG_{gross,project}$ as indicative cross-checking mechanism to ensure the conservativeness of data represented by $EG_{facility,y}$.
Purpose of data	Calculation of baseline emissions
Additional comment	The data will be archived on electronic media as well as on paper and will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

~~**Data / Parameter**~~	~~EG_{export}~~
~~**Unit**~~	~~MWh~~
~~**Description**~~	~~Electricity exported to the grid by the project activity~~
~~**Source of data**~~	~~Calculated on the basis of JMR and Panel meters reading at the individual WEG end.~~
~~**Value(s) applied**~~	~~-~~
~~**Measurement methods and procedures**~~	~~Calculated using the formula:~~ ~~$EG_{export} = EG_{gross,project} \times MF_{export}$~~ ~~$MF_{export} = EG_{export,gross} / EG_{gross,windfarm}$~~ ~~$EG_{gross,project} = \sum(\text{Panel meter reading}_{closing} - \text{Panel meter reading}_{opening})$~~
~~**Monitoring frequency**~~	~~Monthly~~
~~**QA/QC procedures**~~	~~Cross check the measurement results with Joint Meter Reading and/or invoices. All the LCS panel meters are auto calibrated. In case of any fault WEG stops automatically and the meter is replaced immediately.~~ ~~The SEB substation meters (check and main) are calibrated annually.~~
~~**Purpose of data**~~	~~Calculation of baseline emissions~~
~~**Additional comment**~~	~~The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.~~

~~**Data / Parameter**~~	~~EG_{import}~~
~~**Unit**~~	~~MWh~~

Description	Electricity imported from the grid by the project activity
Source of data	Calculated on the basis of JMR and Panel meters' reading at the individual WEG end.
Value(s) applied	-
Measurement methods and procedures	Calculated using the formula: $EG_{import} = EG_{gross,project} \times MF_{import}$ $MF_{import} = EG_{import,gross} / EG_{gross,windfarm}$ $EG_{gross,project} = \sum(\text{Panel meter reading}_{closing} - \text{Panel meter reading}_{opening})$
Monitoring frequency	Monthly
QA/QC procedures	Cross check the measurement results with Joint Meter Reading and/or invoices. All the LCS panel meters are auto calibrated. In case of any fault WEG stops automatically and the meter is replaced immediately. The SEB substation meters (check and main) are calibrated annually.
Purpose of data	Calculation of baseline emissions
Additional comment	The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data / Parameter	$EG_{gross,project}$
Unit	MWh
Description	Sum of gross generation readings of panel meter at individual WEGs in the project activity.
Source of data	Panel meters reading of individual WEGs
Value(s) applied	-
Measurement methods and procedures	Difference between Closing Panel Reading and Opening Panel Reading (the net electricity exported) of the WEG
Monitoring frequency	Monthly
QA/QC procedures	Cross check the measurement results with Joint Meter Reading and/or invoices. All the LCS panel meters are auto calibrated. In case of any fault WEG stops automatically and the meter is replaced immediately The SEB substation meters (check and main) are calibrated annually
Purpose of data	Calculation of baseline emissions
Additional comment	The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data / Parameter	$EG_{export,gross}$
Unit	MWh
Description	Electricity exported from the wind farm measured at State Electricity Board substation
Source of data	Joint Meter Reading
Value(s) applied	-
Measurement methods and procedures	Generated at SEB Substation on the basis of main meter reading
Monitoring frequency	Monthly
QA/QC procedures	The SEB substation meters (check and main) are calibrated annually

~~**Purpose of data**~~	~~Calculation of baseline emissions~~
~~**Additional comment**~~	~~The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.~~

~~**Data / Parameter**~~	~~$EG_{import,gross}$~~
~~**Unit**~~	~~MWh~~
~~**Description**~~	~~Electricity imported by the wind farm, from the grid measured at State Electricity Board substation~~
~~**Source of data**~~	~~Joint Meter Reading~~
~~**Value(s) applied**~~	~~-~~
~~**Measurement methods and procedures**~~	~~Generated at SEB substation on the basis of main meter reading~~
~~**Monitoring frequency**~~	~~Monthly~~
~~**QA/QC procedures**~~	~~The SEB substation meters (check and main) are calibrated annually~~
~~**Purpose of data**~~	~~Calculation of baseline emissions~~
~~**Additional comment**~~	~~The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.~~

~~**Data / Parameter**~~	~~$EG_{gross,windfarm}$~~
~~**Unit**~~	~~MWh~~
~~**Description**~~	~~Sum of panel reading (for generation) of all the WEGs connected to the wind farm~~
~~**Source of data**~~	~~Panel readings of all the WEGs in the wind farm~~
~~**Value(s) applied**~~	~~-~~
~~**Measurement methods and procedures**~~	~~Sourced from the Enercon substation, i.e. the total of the wind farm aggregating from each WEG end~~
~~**Monitoring frequency**~~	~~Monthly~~
~~**QA/QC procedures**~~	~~The LCS panel meters are auto calibrated. In case any fault WEG stops automatically and meter is replaced immediately~~
~~**Purpose of data**~~	~~Calculation of baseline emissions~~
~~**Additional comment**~~	~~The data (electricity supplied to the grid) will be archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.~~

B.7.2. Sampling plan

>>

NA

B.7.3. Other elements of monitoring plan

>>

As per the applicable methodology ACM0002, v13.0.0 monitoring is required for electricity generated from the project, and the grid emission factor where the *ex-post* determination of the grid has been chosen. Since, the methodology is based on *ex-ante* determination of the baseline; therefore, the monitoring of the grid emission factor is not required. Thus, the sole parameter for monitoring for the project activity is the quantity of net electricity generation supplied by the project plant to the grid.

<u>General Aspects of Monitoring</u>:

The project proponent has entered into comprehensive Operation & Maintenance contract with Enercon (India) Limited, the supplier of Wind Electric Generators.

The activities of the O&M team comprising of Wind World (India) limited (*previously known as Enercon (India) Ltd.*) will be supervised by the Project Manager, assisted by the necessary technical and other staff. The following will be maintained during operation of the project activities:

i. Monitoring the functioning of the metering arrangements and getting them calibrated as per the State Electricity Board norms or on annual basis, so that the accuracy and reliability levels are maintained.
ii. Periodic onsite inspections to ensure the quality of the data collected by the team and initiate steps in case of any abnormal conditions.
iii. Ensure monthly recording of the generation particulars.
iv. Obtaining and archiving the generation data from the State Electricity Board for aggregation at the required intervals.
v. Verification and reconciliation, if needed, of the generation certificates with the generation data recorded and maintained regularly.
vi. Aggregating the data on net exported energy from the project and providing credit statement to PP. The credit statement will then be forwarded to the CDM advisor for calculation and reporting of ERs.

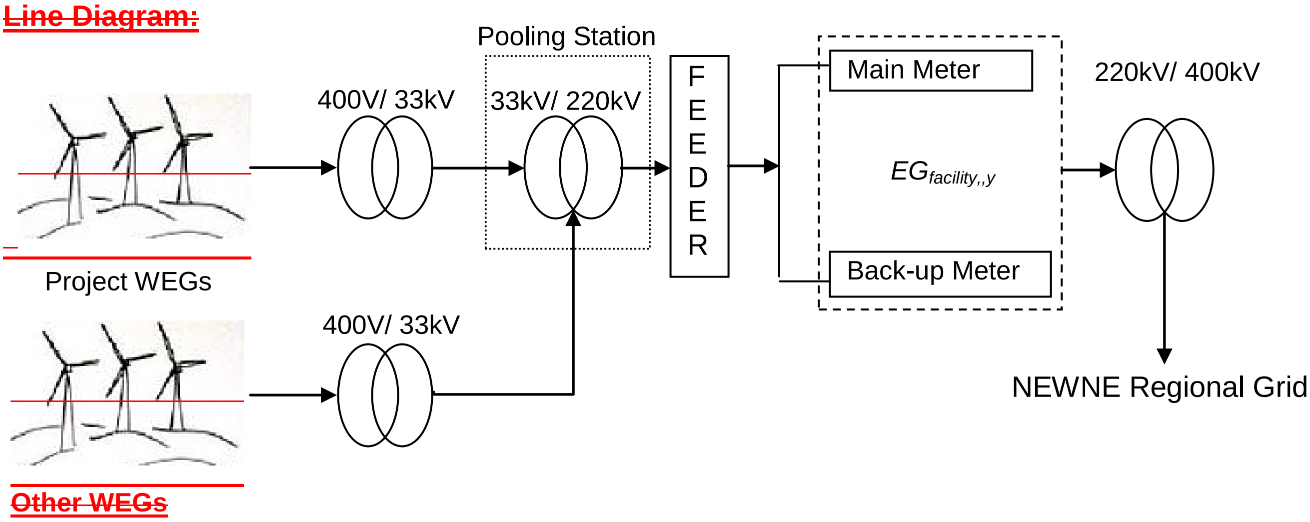
Roles and Responsibilities:

ROLE	ORGANIZATION	RESPONSIBILITY
Project Manager	PP	➢ Cross – checking of the data collected by O&M Team (Site In-charge, Supervisor, Technician); ➢ Review of the collected data; ➢ Forwarding monitored data to CDM Advisors for calculation of emission reductions.
Site In-charge	Wind World (India) Ltd.	➢ Primary collection of data; ➢ Conducting timely periodic testing and calibration of monitoring equipment; ➢ Monitoring, recording, reporting and archiving of data; ➢ Preparation of credit statement.
Supervisor		
Technician		

Metering details:

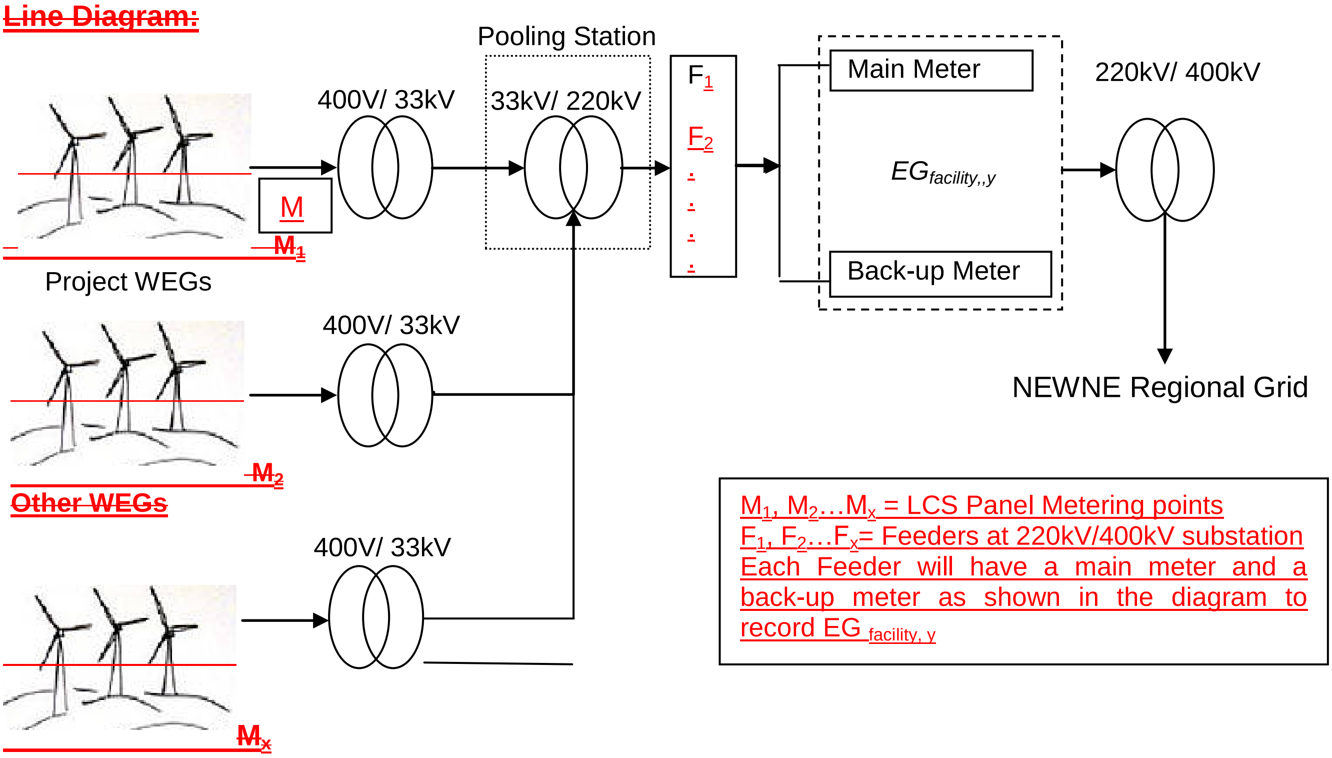
- There is a LCS reading panel at each WEG end, and one main meter and a check meter at the SEB owned substation end.
- The reading will be taken at the individual WEG end by the Wind World (India) Limited operator on site.
- A Joint Meter Reading shall be taken by the representatives of respective DISCOMs and representative of PP [Wind World (India) Limited] at ~~the high voltage side of the step up transformer installed at the~~SEB owned substation at a particular date.
- In case the main metering system is not in service, then the check metering system shall be used until the main system is back to service.
- Meter reading would be jointly signed by the representatives of DISCOMs and PP.
- The main and the check metering systems shall be sealed in presence of representatives of all ~~Power producers~~PPs whose WEGs are installed in the windfarm, Wind World (India) Limited, and respective DISCOMs.
- When any of these metering systems is found to be beyond acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, recalibrated or replaced.
- The monthly credit note will be generated by Wind World (India) Limited on the basis of monthly JMR statement. It is worth noting that the credit note consist of the apportioned data for individual PPs and data of other investors in the wind farm is not visible to PP. PP will raise a monthly energy bill/statement (invoice of sale of electricity) based on the credit note and joint meter reading ~~-~~at the end of each calendar month and the payment by DISCOMs is done on this basis. The billing and payment records will be maintained by the PP.
- Calibration and Testing of Meters will be done annually as per the PPA and/or State Electricity Board norms, which is outside the control of PP.

Line Diagram:



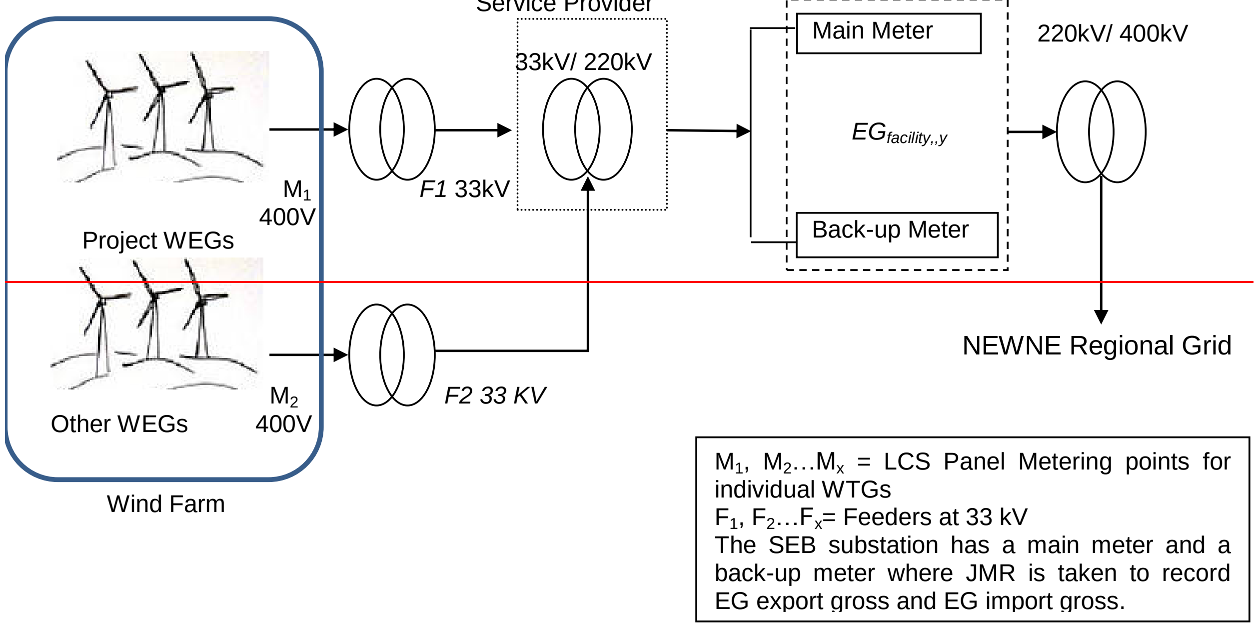
As evident from the line diagram, electricity in the wind farm is generated at 400V by all the WEGs (including project and non-project WEGs). Electricity is then stepped-up to 33kV and transmitted to the pooling station, which is maintained by service provider [Wind World (India) Limited]. In the pooling station, the accumulated electricity from the complete wind farm is further stepped-up to 220kV and transmitted to state-owned sub-station. Meters (Main and back-up) is installed at 220kV line. These meters are used for Joint Meter Reading. The electricity is then stepped-up to 400kV and supplied to NEWNE regional grid.

Line Diagram:

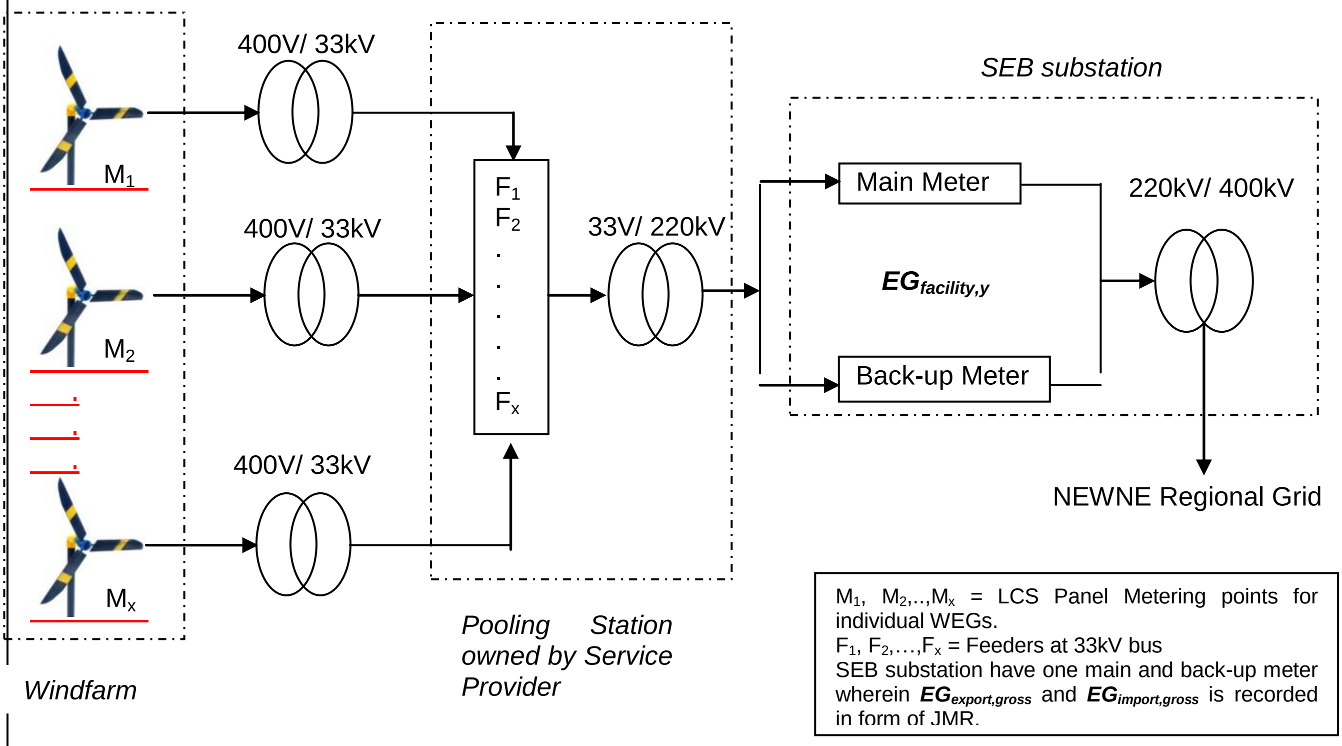


Other WEGs/wind farm

Line Diagram:



Line Diagram:



~~As evident from the line diagram, electricity in the wind farm is generated at 400V by all the WEGs (including project and non-project WEGs). Electricity is then stepped-up to 33kV and transmitted to the pooling station, which is maintained by service provider [Wind World (India) Limited]. In the pooling station, the accumulated electricity from the complete wind farm is further stepped-up to 220kV and transmitted to state-owned sub-station. Meters (Main and back-up) is installed at 220kV line. These meters are used for Joint Meter Reading. The electricity is then stepped-up to 400kV and supplied to NEWNE regional grid.~~

It could be seen that for each WE~~T~~G, the gross generation ($EG_{gross,-project}$~~) is~~) is available on LCS panel (M_1) at ~~generator~~WEG end (400–V). The summated generation (M_1, M_2…M_x) by all ~~WTG~~WEGs of the wind farm ($EG_{gross,-wind-farm}$) is available on SCADA with the service provider [Wind World (India) Limited] and accessible to PP. The gross electricity from individual ~~WTG~~WEGs are stepped up ~~and taken through~~to 33-kV ~~feeders (F_1, F_2….F_x)~~ and transmitted to the pooling

station– 33kvV/–220–kVKv maintained by service provider [Wind World (India) Limited]. The total gross generation by the wind farm is fed through a 220 kVKv line to 220k–KV–/–400k–KV SEB substation at Akal where Electricity exported ($EG_{export,gross}$) from the windfarm /and electricity imported , ($EG_{export,gross}$) / ($EG_{import,gross}$) by the entire wind–farm is measured at 220 KV bus by energy meters which has a (main meter and back--up meter). The monthly joint meter reading is taken from the set of main and back-up meter. based on which the monthly JMR is generated.

Procedure of Apportionment:

The service provider [Wind World (India) Limited] has developed the wind farm. The project activity is part of the wind farm along with the project activities of different project owners. The electricity generated at the wind farm is transmitted to Wind World (India) Limited owned substation from individual WEGs. From Wind World (India) Limited substation, the electricity is supplied to substation owned by State Electricity Board at Akal. At SEB's substation, the electricity exported by the wind farm and imported to the wind farm is measured. In order to calculate the electricity exported by the project activity and imported to the project activity, an apportionment procedure has been adopted, based upon which monthly credit statement is prepared. The formula used for apportionment has been detailed below:

$$EG_{export} = EG_{gross,project} \times \frac{EG_{export,gross}}{EG_{gross,windfarm}}$$

MF_{export}

$$EG_{import} = \frac{EG_{gross,project} \times EG_{import,gross}}{EG_{gross,windfarm}}$$

$EG_{gross,project} \times MF_{import}$

Where:

EG_{export}	Electricity exported to the grid by the project activity
EG_{import}	Electricity imported from the grid by the project activity
$EG_{gross,project}$	Sum of gross generation readings of LCS panel readings at individual WEGs in project activity [= Σ(Panel reading$_{closing}$ – Panel reading$_{opening}$)]

Multiplication factors are calculated as follows:

$$MF_{export} = \frac{EG_{export,gross}}{EG_{gross,windfarm}}$$

$$MF_{import} = \frac{EG_{import,gross}}{EG_{gross,windfarm}}$$

Where:

MF_{export}	Export multiplication factor, applied to arrive at electricity supplied to the grid by the project activity
MF_{import}	Import multiplication factor, applied to arrive at electricity imported from the grid by the project activity
$EG_{export,gross}$	Electricity exported by the wind farm measured at SEB sub-station
$EG_{import,gross}$	Electricity imported by the wind farm measured at SEB sub-station
$EG_{gross,windfarm}$	Sum of panel readings of generation of all WEGs connected to the wind farm

$$EG_{facility,y} = EG_{export} - EG_{import}$$

It is worth noting here that the LCS panel reading of generation of all WEGs included under the project activity can be derived from the online customer care portal maintained by the service provider [Wind World (India) Limited]; however, the LCS panel reading of all WEGs connected to the wind farm (which includes generation data of other project owners) are not disclosed to PP due to confidentiality of service provider. The apportionment is under the jurisdiction of service provider [Wind World (India) Limited] and DISCOM.

QA and QC Procedure:

There is a LCS reading panel at each WEG end and 0.2 accuracy class electricity meters at substation end (one main and one check meter) to measure the energy generated from the project activity. The calibration certificates of meters will be kept in records in seriatim.

Data Storage and Archiving:

All the data items monitored under the monitoring plan will be kept for 2 years after the end of crediting period or till the last issuance of CERs for this project activity, whichever occurs later. The data will be archived both electronically and manually, and kept in safe storage by PP.

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

>>

Date of completion of application of methodology:
13/08/2014

Contact Information of responsible entity:
IL&FS Environmental Infrastructure and Services Limited
4th floor, Dr. Gopal Das Bhawan, 28 Barakhamba Road
Connaught Place, New Delhi – 110 001 (India)

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

22/11/2010 (Date on which first purchase order was issued to the equipment supplier Enercon (India) Ltd. for wind electricity generators to be installed at the site)

C.1.2. Expected operational lifetime of project activity

>>

20 years, 0 months

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Fixed Crediting Period

C.2.2. Start date of crediting period

>>

30/11/2012 or the date of registration of project, whichever is later.

C.2.3. Length of crediting period

>>

10 years, 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

As per the Ministry of Environment & Forest (MoEF), Government of India, Environmental Impact Assessment (EIA) studies of the wind power generation plant is not an essential requirement as it is not covered under the eleven categories as described in EIA Notification of 1994, or the Amended Notification of 2006[17].

As the project activity does not cause any negative impact on the environment, no EIA study was conducted. However, to ascertain that there is no trans boundary impact of the project activity, the analysis can be tabulated as below:

S.No.	Parameter	Impact
1	Land Environment	Nil
2	Water Environment	Nil
3	Vegetation	Nil
4	Fauna	Nil
5	Air Environment	Nil
6	Aesthetics	Nil
7	Socio-Economic Aspects	Nil

D.2. Environmental impact assessment

>>

There are no significant environmental impacts due to implementation of the project activity, hence no EIA was required to be conducted.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The comments from local stakeholders were invited through a local stakeholder meeting conducted at Bhu Sub Station in Jaisalmer district, Rajasthan on 29/01/2011. A public notice was published in the local daily named 'Nafa Nuksan' dated 19/01/2011 inviting all interested employees, community members, wind turbine suppliers, environment regulators, NGOs and local citizens for the stakeholder consultation meeting.

The meeting was attended by the following stakeholders:

- Representatives from IWPL
- Representatives from Enercon (India) Ltd.
- Representatives from IL&FS Environmental and Infrastructure Services Limited
- Local villagers

A brief on the project profile, climate change and environmental benefits arising from the project activity was provided to the participants. A description of how electricity is generated from wind power was also explained.

E.2. Summary of comments received

>>

Development of infrastructure in the locality was highly appreciated. The following comments were received from the stakeholders:

- Mr Kishan Singh: The wind is a clean source of energy and will not result into any pollution/discharge of effluents.
- Mr Sawai Singh: suggested that the project activity should employ more local people as construction workers, watchmen, security guards and drivers on site.

[17] Ministry of Environment & Forests, 2006, S.O.1533(E) Environmental Impact Assessment Notification-2006, Schedule: List of projects or activities requiring prior environmental clearance, page 10 [online] Available at: <http://envfor.nic.in/legis/eia/so1533.pdf>

- Mr Shravan Singh: When the project activity starts, large number of security personnel are employed but as the project gets over, the number of such personnel is considerably reduced making guarding of wind mills difficult. Hence the number of security personnel should be appropriate.

Thus, no adverse comments were received regarding the project activity.

E.3. Report on consideration of comments received

>>

The following responses were provided in relation to the comments received from the local stakeholders:

- It was clarified that operation of wind farms has no probable effect on the air, water or land and reduces the need to depend on coal fired power plants, addressing Mr Kishan Singh.
- The villagers were assured that local people will be given more employment in the project activity and also appropriate number of guards will be appointed during and after the completion of the project activity to ascertain the safety and proper functioning of the turbines, thus addressing Mr Sawai Singh and Shravan Singh.

SECTION F. Approval and authorization

>>

Letter(s) of approval from Party(ies) for the project activity is not available at the time of submitting the CDM-PDD-FORM to the validating DOE.

- - - - -

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

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Ratedi Wind Power Private Limited (*previously known as IL&FS Wind Power Limited*)
Street/P.O. Box	Plot C- 22, G Block, Bandra Kurla complex
Building	The IL&FS Financial Centre
City	Mumbai
State/Region	Maharashtra
Postcode	400051
Country	India
Telephone	+91 22 26593728
Fax	+91 22 26593728
E-mail	rohil.kudtarkar@ilfsindia.com
Website	http://www.ilfsindia.com
Contact person	Mr. Rohil Kudtarkar
Title	Authorized Signatory
Salutation	Mr.
Last name	Kudtarkar
Middle name	-
First name	Rohil
Department	Finance
Mobile	+91 989 265 5948
Direct fax	+91 22 26593728
Direct tel.	+91 22 26593728
Personal e-mail	rohil.kudtarkar@ilfsindia.com

Appendix 2. Affirmation regarding public funding

No public funding and no ODA from a country listed in Annex I, is involved in this project activity

Appendix 3. Applicability of methodology and standardized baseline

Has been discussed in section B.2

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

The latest data available has been used for the estimation of baseline emissions. The Central Electricity Authority (CEA) under the Ministry of Power, Government of India, has estimated the Built Margin and the Simple Operating Margin for the NEWNE and the Southern Grid., the details of which is available on the following website and is detailed below:

http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Version 7.0 of the database has been used.

Generation Data

Gross Generation Total (GWh)					
	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	499,380	531,539	548,956	586,311	622,447
South	161,897	167,379	167,587	180,638	185,257
India	661,277	698,918	716,543	766,950	807,704
Net Generation Total (GWh)					
	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	465,361	496,119	510,693	544,915	579,181
South	152,206	157,247	157,336	169,765	173,925
India	617,567	653,366	668,029	714,680	753,106
Share of Must-Run (Hydro/Nuclear) (% of Net Generation)					
	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	18.5%	19.0%	17.4%	15.9%	17.6%
South	28.3%	27.1%	22.8%	20.6%	21.0%
India	20.9%	21.0%	18.7%	17.1%	18.4%
Net Generation in Operating Margin (GWh)					
	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	379,471	401,642	421,803	458,043	476,987
South	109,116	114,634	121,471	134,717	137,387
India	488,587	516,275	543,274	592,760	614,374
20% of Net Generation (GWh)					
	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	93,072	99,224	102,139	108,983	115,836
South	30,441	31,449	31,467	33,953	34,785
India	123,513	130,673	133,606	142,936	150,621
Net Generation in Build Margin (GWh)					
	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
NEWNE	93,524	100,707	102,589	109,064	117,779
South	30,442	31,613	31,606	36,100	35,268
India	123,965	132,320	134,195	145,164	153,047

Emission Data

Absolute Emissions Total (tCO_2)			

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	385,692,794	406,861,785	430,502,442	453,067,520	468,438,871
South	109,020,456	113,586,133	117,880,640	126,786,215	129,093,636
India	494,713,250	520,447,919	548,383,082	579,853,735	597,532,507
Absolute Emissions OM (tCO_2)					
	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	385,692,794	406,861,785	430,502,442	453,067,520	468,438,871
South	109,020,456	113,586,133	117,880,640	126,786,215	129,093,636
India	494,713,250	520,447,919	548,383,082	579,853,735	597,532,507
Absolute Emissions BM (tCO_2)					
	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	59,042,467	60,193,616	69,297,387	88,593,337	101,146,601
South	21,348,182	22,550,310	25,851,338	27,558,555	25,882,886
India	80,390,649	82,743,926	95,148,726	116,151,892	127,029,488

Electricity Transfer:

Year 2010-2011				
From To	**Combined**	**Southern**	**Bhutan**	**Nepal**
Combined		7,689.2	-5,610.0	0.0
Southern	-7,689.2		0.0	0.0
Bhutan	5,610.0	0.0		0.0
Nepal	0.0	0.0	0.0	
Net imports	-2,079.2	7,689.2	-5,610.0	0.0
Total Imports	5,610.0	7,689.2	0.0	0.0

Emission Factor Calculation:

Simple Operating Margin (tCO_2/MWh) (incl. Imports)	2008-09	2009-10	2010-11	Source/ Remarks
NEWNE Net Generation in OM (GWh)	421,803	458,043	476,987	CEA Database, Version 7.0
Net electricity import from Southern Region (GWh)	0	0	0	CEA Database, Version 7.0
Electricity import from other countries (GWh)	5,897	5,341	5,610	CEA Database, Version 7.0
Net generation incl imports (GWh), $\sum EG_{m,y}$	427,700	463,384	482,597	**Calculated** (NEWNE Net Generation + Electricity import from Southern Region + Electricity import from other countries)
Simple Operating Margin (tCO2/MWh) (incl.	1.0066	0.9777	0.9706	CEA Database, Version 7.0

Imports), $EF_{EL,m,y}$				
Weighted Generation Operating Margin, $EF_{grid,OM,y}$	$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$ **$EF_{grid,OM,y}$** = [(427700*1.007) + (463384*0.9777) +(463384*0.9706)] / (427,700+ 463,384 + 463,384) = **0.98422**			**Calculated** (As per Equation 4)

Build Margin (tCO_2/MWh) (incl. Imports)	**2010-11**	**Source/ Remarks**
NEWNE	0.85878	CEA Database, Version 7.0

Combined Margin (tCO_2/MWh)	**2010-11**	**Source/ Remarks**
w_{OM}	0.75	Tool to calculate Emission Factor for an Electricity System
w_{BM}	0.25	Tool to calculate Emission Factor for an Electricity System
$EF_{grid,CM,y}$	$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$ **$EF_{grid,CM,y}$** = 0.9842 x 0.75 + 0.8587 x0.25 = **0.95286**	**Calculated** (as per Equation 7)

Appendix 5. Further background information on monitoring plan

Refer to section B.7.1 and B.7.3

Appendix 6. Summary of post registration changes

Changes in Monitoring Parameters: The monitoring plan has been simplified considering the actual monitoring that has been followed in site. The brief description of the changed parameter has been provided below:

PARAMETER	DESCRIPTION	RATIONALE BEHIND OMISSION FROM MONITORING PLAN
EG_{export}	Electricity exported by the project activity	The parameter is calculated value and depends upon the parameter $EG_{gross,windfarm}$ which is beyond the control of PP. Therefore, the dependent parameter has been omitted from the current monitoring plan.
EG_{import}	Electricity imported from the grid by the project activity	The parameter is calculated value and depends upon the parameter $EG_{gross,windfarm}$ which is beyond the control of PP. Therefore, the dependent parameter has been omitted from the current monitoring plan.
~~$EG_{gross,project}$~~	~~Sum of gross generation readings of panel meter at individual WEGs in the project activity.~~	~~The parameter is measured and displayed at the LCS Panel, which is installed along witht each WEG. LCS Panels are computerized digital display panel capable of displaying real time data for parameters such as kWh, KVA, and KVAr, etc. It is worth noting here that these LCS panels cannot be calibrated. Further, the LCS panel does not comes under the definition of meter as per the host country regulation, CEA Meter Regulations, 2006 and therefore, cannot be calibrated. Monitoring of the parameter is not possible considering the fact that it cannot be measured through meter as per the host country regulation definitionIn addition, there exist no cross-checking point in order to verify the data as required by the applied methodology. The data is not used for calculating emission reductions and therefore, the parameter is omitted from the current monitoring plan.~~
$EG_{export,gross}$	Electricity exported from the wind farm measured at State Electricity Board substation	The parameter under discussion is the electricity exported by the wind farm to the grid, measured at state-owned sub-station. Hence, the figure provides the generation data (electricity export) of complete wind farm and not particularly, this project activity. ~~Further, it is calculated value based on $EG_{gross,windfarm}$, monitoring of which is beyond the control of PP.~~ Therefore, monitoring of this parameter is not relevant to the proposed CDM project activity.~~monitoring of this parameter for the project activity is not appropriate.~~
$EG_{import,gross}$	Electricity imported by the wind farm, from the grid measured at State Electricity Board substation	The parameter under discussion is the electricity imported by the wind farm from the grid, measured at state-owned sub-station. Hence, the figure provides the electricity ~~generation~~ import data of complete wind farm and not particularly, ~~–~~this project activity.

		Further, it is calculated value based on $EG_{gross,windfarm}$, monitoring of which is beyond the control of PP. ThereforeTherefore, monitoring of this parameter for the project activity is not appropriateis not relevant to the proposed CDM project activity.
$EG_{gross,windfarm}$	Sum of panel reading (for generation) of all the WEGs connected to the wind farm	The parameter under discussion is beyond the monitoring control of PP as the data contains the generation data of WEGs installed by other project owners which are not disclosed to PP by the service provider due to the reason of confidentiality. Further, as required by ACM0002, v13.0.0; there is no cross-check point for the parameter under consideration. Therefore, the parameter is omitted from the current monitoring plan.

Other element of the Monitoring Plan: The roles and responsibilities has been clearly specified in the revised monitoring plan. Further, the apportionment procedure adopted at site has been clarified more transparently along with the corrected formula used for apportionment. Please refer to section B.7.3 of revised CDM-PDD-FORM, v05.0132.

Update on Contact Information: The contact information has been updated considering the change in Modalities of Communication Statement approved by CDM EB on 27/05/2014 following the change in:

- Legal name of project participant and focal point entity from 'IL&FS Wind Power Limited' to 'Ratedi Wind Power Private Limited'; and
- Contact details for Ratedi Wind Power Private Limited in its role as project participant and focal point, i.e. Mr. Anand Nair and Mr. Ateesh Samant have been replaced by Mr. Rohil Kudtarkar and Mr Dipan Bhuptani as the new authorized representatives.

Please refer to Appendix 1 to revised CDM-PDD-FORM, v05.0 132 for details.

- - - - -

Appendix 7. Contribution of CER Revenues to Sustainable Development

IWPL will contribute 2% of its CER revenues every year towards sustainable in the local community in Rajasthan for the following activities:

Education

- Staff - induction and training to new and old staff
- Building and maintaining networks and linkages with the key representatives of government educational system
- Forming an official partnership with the education department for various activities
- Improving the quality of education in government schools
  - Refurbishment of school infrastructure: Provision and renovation of furniture, electricity appliances etc. and periodic maintenance and repairs
  - Setting up of Libraries
- Capacity building of key stakeholders involved in providing education
  - Regular trainings of teachers of government schools on English speaking, personality development and other relevant aspects
  - Organizing periodic workshops on innovative and newer methods of teaching
- Reinstating the school dropouts into education system
  - Creation and maintenance of Non-Formal Education centres in the communities across the district
  - Mobilising the school drop outs and adults to enroll in the non-formal education centres as per their convenience
  - Providing educational classes to the target beneficiary groups
  - Counselling services for the students

Livelihood skills Enhancement and opportunities

- Staff - induction and training to new and old staff
- Livelihood mapping exercise in the district and creation of Interest Inventory based on the exercise
- Mobilisation of youth for Vocational Trainings
- Vocational trainings of the eligible youth and provision of placement services for trained youth.

Health care facilities and Community Health Sensitization

- Staff - induction and training to new and old staff
- Building networks and linkages with the key representatives of government health departments in the district
- Improve health care facilities in the district
  - Health Camps for disease like Malaria, Monsoon Ailments, Hepatitis B and C and other pertinent health issues
  - Awareness creation on best practices of personal and community health and hygiene
  - Health talks and health education classes within the community and in schools and colleges through health educators

Appendix 8. Physical Location of Wind Units

S. No.	Location No.	Latitude	Longitude	Village	District	Date of Commissioning
1	52	26.727150	70.728270	Sipla	Jaisalmer	29/09/2011
2	54	26.721874	70.733056	Sipla	Jaisalmer	07/09/2011
3	59	26.726464	70.743732	Sipla	Jaisalmer	07/09/2011
4	65	26.704149	70.749564	Sipla	Jaisalmer	29/09/2011
5	67	26.705585	70.753928	Sipla	Jaisalmer	29/09/2011
6	68	26.703583	70.755978	Sipla	Jaisalmer	29/09/2011
7	108	26.709921	70.811090	Pithla	Jaisalmer	07/09/2011
8	109	26.701917	70.811566	Kotri	Jaisalmer	23/06/2011
9	111	26.702881	70.806013	Senag	Jaisalmer	23/06/2011
10	112	26.704865	70.802667	Senag	Jaisalmer	23/06/2011
11	116	26.696241	70.806471	Senag	Jaisalmer	23/06/2011
12	121	26.700260	70.814063	Kotri	Jaisalmer	23/06/2011
13	130	26.723726	70.831957	Senag	Jaisalmer	23/06/2011
14	132	26.719629	70.815737	Pithla	Jaisalmer	07/09/2011
15	133	26.725969	70.816863	Pithla	Jaisalmer	07/09/2011
16	250	26.804916	70.773824	Satta	Jaisalmer	12/11/2011
17	251	26.802507	70.768717	Satta	Jaisalmer	12/11/2011
18	253	26.804322	70.763554	Jajiya	Jaisalmer	24/11/2011
19	254	26.802584	70.759583	Jajiya	Jaisalmer	24/11/2011
20	255	26.804002	70.755903	Jajiya	Jaisalmer	29/09/2011
21	256	26.804534	70.753084	Pithla	Jaisalmer	29/09/2011
22	506	26.692491	70.805326	Senag	Jaisalmer	23/06/2011
23	531	26.709008	70.837803	Kotri	Jaisalmer	23/06/2011
24	532	26.710096	70.834654	Kotri	Jaisalmer	23/06/2011
25	533	26.710839	70.832404	Kotri	Jaisalmer	23/06/2011
26	534	26.710305	70.829651	Kotri	Jaisalmer	23/06/2011
27	539	26.715566	70.821412	Senag	Jaisalmer	23/06/2011
28	551	26.720260	70.831891	Senag	Jaisalmer	23/06/2011
29	555	26.780995	70.783118	Satta	Jaisalmer	31/01/2012
30	556	26.782674	70.781666	Satta	Jaisalmer	31/01/2012
31	557	26.784049	70.780008	Satta	Jaisalmer	31/01/2012
32	602	26.705995	70.790402	Pithla	Jaisalmer	29/09/2011
33	605	26.734079	70.769597	Pithla	Jaisalmer	07/09/2011