Project design document form for CDM project activities

(Version 06.0)

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	Nallakonda wind farm in Andhra Pradesh
Version number of the PDD	04.0
Completion date of the PDD	23/11/2015
Project participant(s)	Tadas Wind Energy Private Limited (*previously known as Tadas Wind Energy 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) Selected Methodology: ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version- 13.0.0
Estimated amount of annual average GHG emission reductions	100,630 tCO_2e

Deleted: 03

Deleted: 1

Deleted: 057

Deleted: 2

Deleted: 2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The project activity involves generation of electricity from wind, a renewable source of energy at Anantpur district in Andhra Pradesh. The proposed project activity, an initiative by Tadas Wind Energy Private Limited (TWEPL) is aimed at exporting 50.4MW of renewable electricity generated using Wind Electric Generators (WEGs) to the southern regional grid. The project activity would help in reducing power shortage, abatement of Green House Gas (GHG) emissions and would contribute towards sustainable development of the country.

Scenario Existing Prior to the Implementation of the Project Activity

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected fossil fuel dominated power plants (which is also the baseline scenario).

Project Scenario and the Technology employed

The project activity involves installation of 63 WEGs of 0.8 MW capacity each of Enercon make, resulting in total installed capacity of 50.4 MW. The WEGs generate 3-phase power at 400V, which is stepped up to 33 KV. These WEGs are based on gearless technology, which helps in elimination of 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 across India.

Contribution to reduction in GHG emissions by the proposed project activity

The electricity generated as a result of implementation of the project activity will be supplied to the southern regional grid which at present is dominated by fossil fuel based power plants, thereby reducing an equivalent amount of GHG emissions associated with thermal generating sources. The project would result into 100,630 tCO_2e of annual average emission reduction and 1,006,300 tCO_2e of total emissions reductions over 10 years fixed crediting period.

Contribution of project activity to sustainable development

The proposed project activity has following sustainable development aspects:

Social Wellbeing:

- The project activity would help in providing job opportunities to the local population during installation and operation of the WEGs. Employment generation would help poverty alleviation in the local community and bring about reduction in the disparity of income.
- The project activity would also lead towards development of infrastructure like construction of roads and expansion of telecommunication network. These factors will give a boost to the social amelioration of the community and would also help in improving the living standards of the local community.

Environmental Wellbeing:

- The project activity produces electricity with the help of renewable energy. In the absence of project activity, power would have been generated using fossil fuels, leading to GHG emissions.
- The project activity not only helps in reducing GHG emissions but also help towards conservation of fossil fuels. Therefore, the project activity is contributing towards mitigation of impacts of climate change and hence the environmental wellbeing.

Economic Wellbeing:

- The electricity generated as a result of project activity will be fed to the regional grid, thereby improving the availability of electricity to the local consumers.
- This will further provide opportunities for industries and economic activities to be set up in the area resulting in greater local employment.

Technological Wellbeing:

- WEGs 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.

In addition to this, the project proponent will invest 2% of the CER revenues every year in sustainable development activities in the local communities of Andhra Pradesh. Details of the same are provided in Appendix 7.

A.2. Location of project activity

A.2.1. Host Party

>>
India

A.2.2. Region/State/Province etc.

>>
State: Andhra Pradesh

A.2.3. City/Town/Community etc.

>>
District: Anantpur
Village: Gondipalli, Duddebanda, Kogira, Mustikovilla

A.2.4. Physical/Geographical location

>>
The project site is located near village Nallakonda of Anantpur district in the state of Andhra Pradesh, India. The project consists of installation of 63 WEGs of 0.8MW capacity each. Details of their geo coordinates are given below:

SITE	LONGITUDE (E)	LATITUDE (N)	SITE	LONGITUDE (E)	LATITUDE (N)
48	77.571021	14.175637	82	77.556372	14.172389
49	77.571972	14.174507	83	77.556127	14.173656
50	77.571869	14.172782	84	77.556049	14.174940
51	77.572064	14.171235	85	77.554889	14.177238
52	77.571803	14.169431	86	77.554293	14.178554
53	77.571430	14.167574	87	77.558987	14.182579
54	77.571859	14.166151	88	77.553590	14.181959
55	77.570797	14.163904	89	77.553243	14.183237
56	77.571301	14.162688	131	77.528519	14.200070
57	77.571398	14.161422	132	77.529199	14.198734
58	77.571421	14.160121	133	77.529416	14.197449
59	77.571397	14.158811	134	77.529688	14.196073
60	77.572084	14.156500	135	77.530138	14.194875
61	77.574317	14.155057	136	77.530122	14.193457
62	77.570534	14.153707	137	77.531185	14.191603
63	77.571604	14.150127	138	77.529927	14.188418
65	77.564728	14.142151	139	77.529890	14.185048
67	77.563660	14.145948	140	77.532297	14.183351
68	77.564381	14.147548	141	77.534916	14.179845
68A	77.564904	14.149566	142	77.534991	14.178245
73	77.562634	14.153557	143	77.535346	14.176850
74	77.562280	14.154997	144	77.534193	14.173962
75	77.562303	14.156298	145	77.533870	14.172366
76	77.559724	14.158268	146	77.534474	14.170860
77	77.563069	14.159334	147	77.534503	14.169369
155	77.544314	14.158983	148	77.534682	14.167976
156	77.544225	14.157611	149	77.534963	14.166563

157	77.546908	14.157420
78	77.558897	14.161367
79	77.558291	14.162602
80	77.557982	14.164828
81	77.557702	14.166285

150	77.534952	14.164784
151	77.536622	14.164233
152	77.536329	14.162854
153	77.536922	14.161239

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 blades. When the blades rotate, the connected generator also rotates, thereby producing electricity.

The proposed project activity involves installation of 63 WEGs of 0.8 MW capacity each, i.e. total installed capacity of 50.4 MW and a PLF of 25.41%. The WEGs are of Enercon model, E-53, with

newly designed blades, type tested and approved by the Ministry of New and Renewable Energy (MNRE). 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	53m
Hub Height	75m (Concrete)
Turbine Type	Direct driven, horizontal axis wind turbine; variable rotor speed
Power Regulation	Independent pitch system for each blade
Cut – in speed	3 m/s
Rated wind speed	12.6 m/s
Cut – out wind speed	28 m/s
Extreme wind speed	57 m/s
Rated rotational speed	29 rpm
Operating range rotational speed	11 – 29.5 rpm
Orientation	Upwind
Number of Blades	03
Blade Material	Fiber glass, Epoxy reinforced
Gear box type	Gear less
Generator type	Synchronous generator
Braking	Aerodynamic
Output Voltage	400V
Yaw system	Active yawning with 4 electric yaw drivers and brake motor
Tower	74m (Concrete)
Turbine Lifetime	20 years

The Baseline scenario is same as the scenario existing prior to the project activity. Emission reductions will be claimed based on the net electrical energy that is supplied to the regional grid. The metering of the electricity generated would be done at Substation location using the appropriate metering devices. The detailed monitoring plan is in section B.7.3. 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: Tadas Wind Energy Private Limited (TWEPL)	No

A.5. Public funding of project activity

>>
No public funding and no ODA from Parties included in Annex I 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

>>
ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources - Version 13.0.0
The following tools have been used in the CDM-PDD-FORM:

- Tool for demonstration and assessment of additionality- Version 06.1.0;
- Tool to calculate the emission factor for an electricity system- Version 02.2.1

B.2. Applicability of methodology and standardized baseline

>>

The project meets all the applicability criteria as set out in the approved methodology ACM0002 Version 13.0.0 as described below:

APPLICABILITY CONDITIONS UNDER ACM0002, VER. 13.0.0	**PROJECT ACTIVITY IS ELIGIBLE SINCE:**
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 (greenfield 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 project activity involves option (a) install of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant). Hence, this criterion is justified.
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/ unit of one of the following types: hydro power plant/ unit (either with a run-of-river reservoir or an accumulated reservoir), wind power plant/ unit, geothermal power plant/ unit, solar power plant/ unit, wave power plant/ unit or tidal power plant/unit	The project activity is installation of a new wind power plant/ unit; satisfying the applicability condition.
In the case of capacity additions, retrofits or replacements, the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	This condition is not applicable as the project activity is installation of a new wind power plant and does not involve capacity additions, retrofits or replacements.
In case of hydro power plants, one of the following conditions must apply : ➲ The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or ➲ The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2; or ➲ The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2.	The proposed project activity involves installation of wind power plants; 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 4W/m^2 all the following conditions must apply: ➲ The power density calculated for the entire project activity using equation 5 is greater than 4W/m^2; ➲ Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant; ➲ Water flows between 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 power density lower than 4W/m^2, is lower than 15MW; ➲ Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.	The proposed project is installation of a new 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 plant that results in the creation of a new single reservoir or in the increase in existing single reservoir where the power density of the power plant is less than 4W/m^2.	➲ The proposed project activity is installation of new grid connected wind power project at site and does not involve fuel switching. Therefore, not applicable. ➲ The proposed project activity is installation of new grid connected wind power project at site and not a biomass fired power plants. Therefore, not applicable. ➲ The proposed project activity is installation of new grid connected wind power project at site and not a hydro power plant. Therefore, not applicable.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The project activity is a new grid connected wind power plant and not a retrofit, replacement or capacity addition. Therefore, this criterion is not applicable to the project activity.
APPLICABILITY CONDITIONS UNDER "TOOL TO CALCULATE THE EMISSION FACTOR FOR AN ELECTRICITY SYSTEM", VER. 02.2.1	**PROJECT ACTIVITY IS ELIGIBLE SINCE:**
This tool may be applied to estimate the OM,	The project activity involves installation of

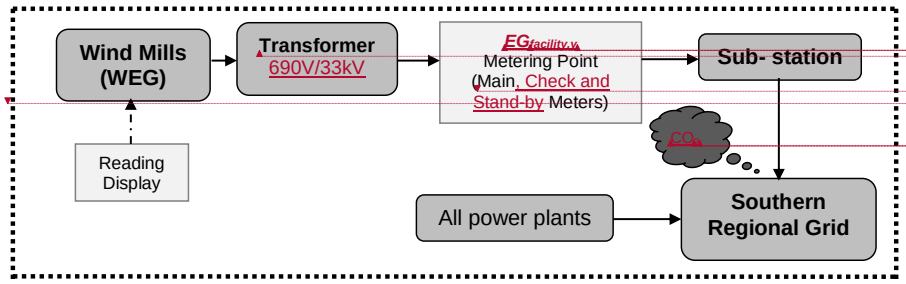
BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	a Greenfield wind farm and the power generated by the project activity will substitute the grid electricity, i.e. the power generated by the project activity will be supplied to the regional grid. Therefore, this tool is applied to estimate the Operating Margin (OM), Build Margin (BM) and/or Combined Margin (CM) when calculating baseline emissions for a project activity, thus satisfying the applicability criterion.
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% 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 the host country as off-grid power generation is not significant. Therefore, emission factor for the project electricity system is calculated only for the grid power plants. Thus, this applicability criterion is satisfied.
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 proposed CDM project is located in India which is not an Annex I country. Hence, this criterion is not applicable.

B.3. Project boundary

>>

The project boundary for the project activity is selected as per the approved methodology ACM0002, Version 13.0.0. As per the methodology, 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 emission factor for an electricity system, Version 02.2.1 defines grid/ project electricity system 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 Southern regional grid. A diagrammatic presentation of the project boundary is given below:



Formatted: Font: Bold, Italic
Formatted: Font: Bold, Italic, Subscript
Formatted: Font: Bold, Italic
Formatted: Font: Bold
Deleted: Check and
Deleted: <object>
Formatted: Font: 8 pt
Formatted: Font: 8 pt, Subscript
Formatted: Font: 8 pt, English (India)

The GHGs and emission sources included in or excluded from the project boundary are listed in the table below:

	Source	GHGs	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	The project activity is aimed at displacing the grid power, and thus reducing CO_2 emissions resulting from the power generation.
		CH_4	No	No CH_4 generation is expected
		N_2O	No	No N_2O generation is expected
Project activity	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 for wind projects
		CH_4	No	Not applicable for wind projects
		N_2O	No	Not applicable for wind projects
	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 for wind projects
		CH_4	No	Not applicable for wind projects
		N_2O	No	Not applicable for wind projects
	For the hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for wind projects
		CH_4	No	Not applicable for wind projects
		N_2O	No	Not applicable for wind projects

B.4. Establishment and description of baseline scenario

>>

According to the approved methodology ACM0002, Version 13.0.0, if the project activity is the installation of a new grid-connected renewable power plant/ unit, the baseline scenario is the following:

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

As the project activity is a greenfield project involving installation of WEGs the above mentioned baseline scenario is applicable for the project activity.

B.5. Demonstration of additionality

>>

As per ACM0002, Version 13.0.0 the proposed project activity uses "Tool for the demonstration and assessment of additionality" version 06.1.0 to determine the additionality.

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

While identifying the alternatives to the project activity, ACM0002, Version 13.0.0 directs to use Step 1 of the latest version of the additionality tool.

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

In order to identify credible and realistic alternative(s) available to the project participant that provide outputs or services comparable with proposed CDM activity "Tool for the demonstration and assessment of additionality" Version 06.1.0 provides the following options:

(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 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).

Of all the alternatives provided, Alternative (a) and (c) are the most credible and realistic alternatives available to the project activity.

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

The above identified realistic and credible alternative scenario(s) to the project activity are in compliance with all mandatory legislation and regulations, taking into account the enforcement in the country and EB decisions on national and/or sectoral policies 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 state and sectoral policies, framed primarily to encourage wind power projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments.
- The Indian Electricity Act, 2003 (May 2007 Amendment) does not influence the choice of fuel used for power generation.
- There is no legal requirement on the choice of a particular technology for power generation.

Thus, there are no legal and regulatory requirements that prevent Alternatives (e) and (g) from occurring.

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.

The "Guidelines on the Assessment of Investment Analysis" version 05, Annex 5, EB 62, Guidance 19 stipulates that if the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. 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.

The alternative to the project activity is supply of electricity from the grid, therefore, Option III (benchmark analysis) has been considered for the investment analysis.

Sub-step2b: Option III. Apply benchmark analysis

The additionality tool allows the project developer to choose the financial indicator, IRR to demonstrate the additionality of the project. The additionality tool provides an option to choose between project IRR and the equity IRR. Equity IRR is widely accepted and used by investors as financial indicator in financial decision making. Project proponent has chosen Equity IRR as a financial indicator to demonstrate the additionality.

As per the Guidelines on the Assessment of Investment Analysis version 05, If the benchmark is based on parameters that are standard in the market, the cost of equity should be determined either by: (a) selecting the values provided in Appendix A; or by (b) calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors.

In accordance with the values provided in the Appendix A of "Guidelines on the assessment of Investment Analysis" version 05, the benchmark has been calculated.

The default values of the expected return on equity for different type of project activities in different countries have been provided in the appendix to "Guidelines on the assessment of Investment Analysis" version 5. The project activity falls in the Group 1 type of project activity (Renewable Energy) and therefore relevant value from the appendix is used.

The default value for the expected returns on equity (in real terms) = 11.75%

As per paragraph 7 of the appendix to the "Guidelines on the assessment of Investment Analysis" version 05, EB 62, Annex 5
"*In situations where an investment analysis is carried out in nominal terms, project participants can convert the real term values provided in the table below to nominal values by adding the inflation rate. The inflation rate shall be obtained from the inflation forecast of the central bank of the host country for the duration of the crediting period. If this information is not available, the target inflation rate of the central bank shall be used. If this information is also not available, then the average forecasted inflation rate for the host country published by the IMF (International Monetary Fund World Economic Outlook) or the World Bank for the next five years after the start of the project activity shall be used.*"
In accordance with the above, the average forecasted inflation rate for India for 2011-2016 published by International Monetary Fund (IMF) has been used[1]. The average forecasted inflation rate of India for 10 years as per the central bank of host country (Reserve Bank of India) is 5.5%[2]. Therefore, on conservative note, PP chose data from IMF.

Average forecasted inflation rate for 2011-2016 = 4.76%

Benchmark = (1+ Expected return on equity (in real terms)) × (1+inflation rate) – 1
= (1+11.75%) × (1+4.76%) – 1
= 17.07%

In accordance with the "Guidelines on the assessment of Investment Analysis" version 05, EB 62, Annex 5 the benchmark (Expected return on equity) of 17.07% has been considered for the project activity.
In accordance with the "Guidelines of Investment Analysis" version 5 EB 62, Annex 5 the benchmark (Expected return on equity) of 17.07% has been considered for the project activity.

Sub-step2c: Calculation and comparison of financial indicators
The equity IRR has been computed based on the following assumptions:

PARAMETER	VALUE APPLIED	SOURCE
Plant Capacity (63 nos. of WEGs of 0.8 MW capacity each)	50.4	Proposal
Plant Load Factor (PLF) (%)	25.41	Calculation based on Wind Assessment Report
Cost of Project (Rs. in million)	2890.95	Proposal, Internal Assessment
Tariff Rate (INR per kWh)	3.50	Project Information Memorandum
Financial pattern – Equity (%)	25	Management Assumption based on previous projects
Financial pattern – Debt (%)	75	Management Assumption based on previous projects
Interest on Term Loan (%)	11	Management Assumption based on previous projects
Working Capital Interest Rate (%)	14	Management Assumption based on previous projects
Book depreciation – annual rate (%)	4.50	Companies Act
Depreciation as per Income Tax Act (WDV basis) (%)	15	Income Tax Act

[1] http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/weorept.aspx?pr.x=33&pr.y=8&sy=2011&ey=2016&scsm=1&ssd=1&sort=country&ds=.&br=1&c=534&s=PCPI%2CPCPIPCH&grp=0&a=
[2] http://rbi.org.in/scripts/PublicationsView.aspx?Id=13360

Corporate tax rate (%)	33.22	Income Tax Act
MAT rate (%)	19.93	Income Tax Act
Operation & Maintenance costs per WEG (Rs. in millions)	0.60	Proposal
Yearly escalation in O&M costs	6%	Proposal
Generation Based Incentive (GBI) (INR/KWh)	0.50	IREDA Guidelines
GBI cap (INR million/MW)	6.20	IREDA Guidelines

The equity IRR for the project without CDM benefit works out to be 9.53%. As evident, the equity IRR is lower than the corresponding benchmark rate of 17.07%. This clearly indicates that investment barrier exists in project activity implementation. Therefore, it can be concluded that the project activity is additional and requires CDM revenues to alleviate the investment barrier to the project activity.

Sub-step 2d: Sensitivity Analysis

"Guidelines on the Assessment of 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 factors 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:

FACTOR	**RESULTANT EQUITY IRR**		
	DECREASE BY 10%	*BASE CASE*	*INCREASE BY 10%*
Generation	6.15	9.53	13.01
Hard Cost	13.11	9.53	6.75
O&M Cost	10.02	9.53	9.02
Tariff	6.17	9.53	12.93

It is evident from the above table that the equity IRR does not cross the benchmark rate of **17.07%** even after an increase of 10% in the selected parameters. Hence the project is unlikely to be financially/economically attractive without CDM benefits.

Step 4: Common Practice Analysis

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 50.4 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 (MW)**	**+50%**
25.2MW	50.4MW	75.6MW

For the analysis, the projects falling in the range of 25.2 MW to 75.6 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

25.2MW to 75.6MW and having commercial operations date before project activity start date (19/08/2011) have been considered. The power generation plants identified in this step are hydro[3], thermal4[4] and wind power projects5[5]. The total number of power plants is 405.
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} = 394.

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}
As per additionality tool, different technologies that deliver the same output and differ by at least one of the following are:
(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 activities have 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 projects = 161
Number of hydro projects = 223
Total = 384
Investment climate in the date of the investment decision: The investment decision for the project activity was taken on 27/07/2011. The investment decision of the project activity was taken considering Generation Based Incentive (GBI) scheme[6] 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}). Therefore, the technologies different than the project activity, N_{diff} is calculated as:

Project Category	**Number of Projects**
Thermal	161
Hydro	223
With Large Scale (Without GBI)	10
Total (N_{diff})	394

[3] CO_2 baseline database for Indian power sector, CEA, version 7
[4] CO_2 baseline database for Indian power sector, CEA, version 7
[5] Directory: Indian Wind Power 2011
[6] www.mnre.gov.in/gbi-scheme.html

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 figure is arrived at:

N_{all} = 394

N_{diff} = 394

$N_{all} - N_{diff}$ = 0

F = 1- (N_{diff}/N_{all}) = 0

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 value of factor ***F*** as calculated in Step 4 is 0 which is less than 0.2 and the value of $N_{all} - N_{diff}$ is 0, which is also less than 3. Hence the project activity is not a common practice.

The analysis clearly demonstrates that project activity is not a common practice within the 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.

Serious Consideration of CDM and Continued Action to Secure CDM status

As per EB62 Annex13 (paragraph 2), *for project activities with a starting date on or after 02/08/2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity, using the standardized form F-CDM-Prior Consideration. Such notification is not necessary if a PDD has been published for global stakeholder consultation or a new methodology proposed to the Executive Board for the specific project before the project activity start date*.

Serious Consideration of CDM: The start date for the project activity is 19/08/2011. The project proponent has (as per EB 62, Annex 13, paragraph 2) 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 24/01/2012, 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.

S. NO.	EVENTS	DATE
1.	Board Resolution Date	27/07/2011
2.	Purchase Order for supply of WEGs (start date of the project activity)	19/08/2011
3.	Submission of form for Prior Consideration of CDM to UNFCCC	24/01/2012
4.	Submission of form for Prior Consideration of CDM to National CDM Authority	24/01/2012
5.	Local Stakeholder Consultation Meeting	08/06/2012

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 Version 13.0.0, 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 calculated as follows:

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

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 a 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" ver. 02.2.1 (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

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

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

Where:

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

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

As per the approved methodology, ACM0002 Version 13.0.0, "Tool to calculate emission factor for an electricity system" (version 02.2.1) 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 CO_2 emission factor of the electricity system. Following steps are applied to determine the combined margin CO_2 emission factor:

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

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) has 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, version 7[7].

The emission factor of the grid for the ex-ante approach is calculated in the following manner:

Step 1: Identify the relevant electricity systems

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 Southern regional grid.

NEWNE GRID				**SOUTHERN GRID**
NORTHERN	*WESTERN*	*EASTERN*	*NORTH – EASTERN*	*SOUTHERN*
Chandigarh	Chhattisgarh	Bihar	Arunachal Pradesh	Andhra Pradesh
Delhi	Gujarat	Jharkhand	Assam	Karnataka
Haryana	Daman & Diu	Orissa	Manipur	Kerala
Himachal Pradesh	Dadar & Nagar Haveli	West Bengal	Mizoram	Tamil Nadu
Jammu & Kashmir	Madhya Pradesh	Sikkim	Meghalaya	Pondicherry
Punjab	Maharashtra	Andaman Nicobar	Nagaland	Lakshadweep

[7] 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>

Rajasthan Uttar Pradesh Uttarakhand	Goa		Tripura	

The baseline emission factor (including Imports) of Southern regional grid published by CEA is considered for the calculation of emission reductions due to displacement of electricity in accordance with the "Tool to calculate the emission factor for an electricity system", version 02.2.1.

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 Southern 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) Dispatched data analysis OM; or
(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[8] 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 clearly shows that percentage of total grid generation by low cost/must run sources[9] for the Southern grid is less than 50% of the total generation. Hence, **Simple Operating Margin** method can be used to calculate operating margin emission factor for the proposed project activity.
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
Simple OM Method
The OM emission factor 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 Southern region is considered.
The simple OM may be calculated using one of the following two options:

[8] 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
[9] Source: Generation Data from CEA database, January 2012, Version 7.0

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

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 simple OM emission factor calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\Sigma_m EG_{m,y} \times EF_{EL,m,y}}{\Sigma_m EG_{m,y}}$$

Where:

$EG_{grid,OMsimple,y}$	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)
$FE_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
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:

$$EF_{EL,m,y} = \frac{\Sigma_i FC_{i,m,y} \times NCVi,y \times EF_{CO2,i,y}}{EG_{m,y}}$$

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

Step 5: Calculate the Build Margin (BM) Emission Factor

In order to calculate the build margin (BM) emission factor any one of the following options should be considered:

Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period

should be used. This option does not require monitoring the emission factor during the crediting period.

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

The value for Build Margin is taken from Central Electricity Authority (CEA) CO2 baseline database Version 7[10]. 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 for Indian power sector, version 7 as per the following procedure:

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

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) 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) ($SET_{\_20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\_20\%}$, in MWh);
(c) From $SET_{5\text{-units}}$ and $SET_{\_20\%}$ 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, $SET_{>20\%}$ 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:

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

Where:

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

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:

- 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:

[10] 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>

$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,OM,y} \times w_{OM}$
Where:
$EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year y (tCO_2/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.

Leakage Emissions
As per ACM0002 Version 13.0.0, no leakage emissions are considered (LE_y = 0).

Estimation of emission reductions
According to the approved methodology ACM0002 (Version 13.0.0) Emission Reductions are calculated as follows:
$ER_y = BE_y - PE_y$
Where:
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 for the project electricity system (Southern Electricity Grid) in the year *y*
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 7 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India[11].
Value(s) applied	Southern Grid - 0.9514
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" Version 02.2.1. The generation weighted average of simple operating margins of the year 2008-09, 2009-10, 2010-11 have been used to calculate ex-ante OM.
Purpose of data	To calculate baseline emissions
Additional comment	-

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	Build Margin CO_2 Emission Factor for the project electricity system (Southern Electricity Grid) in the year *y*
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 7 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India
Value(s) applied	Southern Grid - 0.7338

[11] CO_2 Baseline Database for Indian Power Sector, January 2012, Version 7.0

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" Version 02.2.1. The *ex-ante* value for the year 2010-11 has been used.
Purpose of data	To calculate baseline emissions
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	Combined Margin CO_2 Emission Factor for grid connected power generation in year y
Source of data	"CO_2 Baseline Database for Indian Power Sector" version 7 (January 2012) published by the Central Electricity Authority, Ministry of Power, Government of India.
Value(s) applied	Southern Grid - 0.8970
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 CO_2 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 $EF_{grid,\mathbf{BM,y}}$ are applicable as per ACM0002, version 13.0.0.
Purpose of data	To calculate baseline emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

>>

The baseline emissions are 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
Southern Grid	0.9729	0.9415	0.9419

Thus the final $EF_{grid,OM,y}$ for the Southern grid based on three years weighted average calculation is estimated to be **0.9514 tCO_2/MWh**.

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

The Build margin emission factor has been calculated *ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently as this sample group comprises larger annual generation than the generation of the sample group m consisting of the five power plants that have been built most recently.

Build Margin (tCO_2/MWh) (incl. Imports)	2008-09	2009-10	2010-11
Southern Grid	0.8179	0.7634	0.7339

$EF_{grid,BM,y}$ estimated for Southern grid is **0.73388 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 Combined Margin Emission Factor

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

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

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 calculated according to the above formula for Southern grid is 0.8970 tCO_2/ MWh.

Step 4: Calculation of Baseline Emissions (BE_y)

According to "Consolidated baseline methodology for grid- connected electricity generation from renewable sources' ACM0002, Version 13.0.0, the baseline emissions is calculated as electricity supplied to the grid multiplied by an emission factor (measured in tCO2/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)
$EG_{facility,y}$	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" (tCO_2/MWh)

Therefore,

Baseline emissions = 112186.00 MWh/yr × 0.8970 tCO_2/MWh
= 100630.84 tCO_2/yr
= 100,630 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 (BEy) and project emissions (PEy).

$ER_y = BE_y - PE_y$

Since, project emissions by sources of GHGs due to the project activity within the project boundary are zero, net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis. The project activity will evacuate approximately 112186.00 MWh of renewable power annually to the power deficit Southern. The annual emissions reductions are equal to **100,630 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)
Year 1	100,630	0	0	100,630
Year 2	100,630	0	0	100,630
Year 3	100,630	0	0	100,630
Year 4	100,630	0	0	100,630
Year 5	100,630	0	0	100,630
Year 6	100,630	0	0	100,630
Year 7	100,630	0	0	100,630
Year 8	100,630	0	0	100,630
Year 9	100,630	0	0	100,630
Year 10	100,630	0	0	100,630
Total	1,006,300	0	0	1,006,300

Total number of crediting years	10			
Annual average over the crediting period	100,630	0	0	100,630

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/ unit to the grid in year y
Source of data	Joint Meter Reading (JMR) or statement
Value(s) applied	Annual electricity supplied to the Southern grid by the project is 112186.00
Measurement methods and procedures	Electricity meters: Metering system for the project activity consists of three sets of electronic bidirectional tri-vector meters viz. Main meter, Check Meter and Stand-by Meter. - Accuracy class 0.2s for Main meter, Check meter and Stand-by meter **Recording frequency**: Continuous measurement, at least monthly recording **Calibration frequency**: Annual **Responsible person**: Plant operator
Monitoring frequency	Monthly
QA/QC procedures	Cross check the measurement results with bill or invoice.
Purpose of data	To calculate 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.

Deleted: Yard Meters (individual WEG site),

Deleted: Main

Deleted: Yard

Deleted: Main

B.7.2. Sampling plan

>>

As the parameter to be monitored does not require sampling approach for its determination, this section is not applicable for the proposed project activity.

B.7.3. Other elements of monitoring plan

>>

As per the applicable methodology ACM0002, monitoring is required for electricity generated from the project and the grid emission factor.

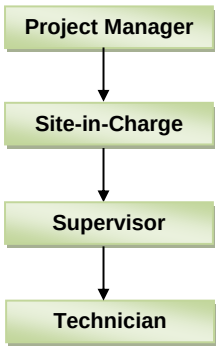
Since the methodology is based on *ex-ante* determination of the baseline emissions, the monitoring of the grid emission factor is not required. Thus, the sole parameter for monitoring for the project activity is the electricity supplied to the grid.

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 Enercon (India) Ltd. will be supervised by the Project Manager of TWEPL, assisted by the necessary technical and other staff. The following will be maintained during operation of the project activity.

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 on-site 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 certificates 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 thus reconciled and submission to TWEPL. This will then be forwarded to the CDM advisor for calculation and reporting of ERs.

The O&M organizational structure is provided as below:



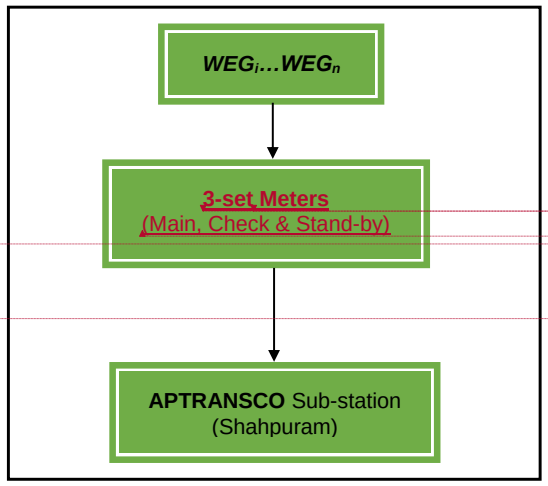
Metering system and monitoring plan

- The metering system consists of three sets of electronic bidirectional tri-vector meters, i.e., Main Meter, Check Meter and Stand-by meters. For this proposed project activity, there are seven such sets of meters.
- Joint Meter Reading shall be taken by the representatives of Enercon and APCPDCL at the high voltage side of the step up transformer (33kV) at metering points.
- 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 both the representatives.
- The metering systems shall be sealed in presence of representatives of Power producers, Enercon, and APCPDCL.
- When any of these metering systems is found to be outside acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, recalibrated or replaced.
- PP will raise a monthly energy bill/statement based on the JMR at the end of each calendar month and the payment by State Electricity Board 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.

Deleted: The reading will be taken at the individual WEG end by the Enercon operator on site.

Deleted: installed at the substation at a particular date

Deleted: main and the check



Deleted: Yard Meters
Deleted: of
Formatted: Font: Not Bold
Deleted: <object>
Deleted: <object><object>

Calculation of data

EGfacility,y = $\Sigma_{(i=1 \text{ to } n)}$ Net energy for each WEG

Formula for apportionment of net energy for each WEG

$$\text{Net Energy for each WEG} = \frac{EG_{net,SS}}{\Sigma EG_{net,p}} \times EG_{net,i}$$

Where:

$EG_{net,ss}$	= Net electricity at substation
$EG_{net,i}$	= Net Electricity generated by a WEG
$EG_{net,n}$	= Net electricity generated by the project
i	= Individual WEG
n	= Total number of WEGs

Cross checking and Internal Audit procedure

The internal audit will be undertaken by TWEPL which will verify the energy data records, billed units as per bills raised to the state electricity board, and cross verify with the reports furnished by the project site managers. The internal audit report will be furnished to the TWEPL management.

QA and QC Procedures

The electricity meter with accuracy class 0.2s at substation end (i.e. one main and one check meter) will be installed. 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 TWEPL.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion of application of methodology:
06/11/2015

Contact Information of responsible entity:
IL&FS Environmental Infrastructure and Services Limited

Deleted: ¶

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
19/08/2011
(Date on which first purchase order was issued to the equipment supplier Enercon (India) Ltd. for WEGs 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

C.2.2. Start date of crediting period

>>
15/12/2012 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[12] as described in EIA Notification of 1994, or the Amended Notifications of 2006 and 2009. Also, the project activity does not cause any negative impact on the environment, no EIA study was conducted.

D.2. Environmental impact assessment

>>
There are no significant environmental impacts due to implementation of the project activity.

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 Gandhi Circle, Near TDPO Office, Penukonda Village in Anantpur district, Andhra Pradesh on 08/06/2012. A public notice was published in the local daily named 'Metro Evenings' and in an English newspaper named 'Voice of Words' dated 25/05/2012 inviting all interested employees,

[12] 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>

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

The stakeholders were introduced to the project activity by a representative from the Enercon team. The representatives from Enercon and TWEPL gave detailed information to the stakeholders about the wind power project. A description of how electricity is generated from wind power was explained. The role of the project activity in mitigating the GHG emissions and benefits to the people in terms of improvement in pollution levels were also highlighted.

E.2. Summary of comments received

>>

The stakeholders shared their views on the project activity. Most of the villagers showed positive response. They were hopeful that the proposed project activity will help in the development of the local community, generate more employment and solve the electricity problem without harming their natural surroundings.

Following queries were raised by the local community:

- Will there be any effect on the cattle grazing near the project area from the commencement of the project?
- Will the machines installed create sound and disturb the surrounding?
- Will the local people employment relating to the project?
- Will the machines installed create any problem or disturbance to the clouds and rainfall in surroundings?

The meeting was very cordial and ended on a positive note. The stakeholders were very appreciative of the benefits coming to the community from the CDM project activity. Thus, no adverse comments were received regarding the project activity and all the queries raised were satisfactorily addressed. Overall, the development of infrastructure in the locality was appreciated.

E.3. Report on consideration of comments received

>>

The following responses were provided in relation to the comments received (as mentioned in section E.2) from the local stakeholders:

- There will be no effect on the cattle grazing near the project as there is no relation between the project and cattle grazing.
- Many companies have installed wind projects in several villages and no such problem has been faced. The sound from the machines is negligible and carries no significant effect or is of major concern.
- There will be opportunities for the people living in vicinity of the project area.
- In our country there are around 7000MW wind power commissioned and at all the places neither there is any shortage of rainfall nor is any disturbance to the clouds observed due to WEGs.

At the end of the consultation, the stakeholders were convinced that the project activity would not adversely impact their environment or livelihood. Moreover, the project would provide employment opportunities to the local people as construction workers, watchmen, security guards and drivers on site.

The project proponents were commended for their action towards environment protection. Apart from the above comments and questions, no major issues were raised that could be related to the environmental or CDM aspect of the project. All comments and questions were duly taken into account by the project developer and addressed satisfactorily.

SECTION F. Approval and authorization

>>

Host Country Approval, Ref: 4/15/2012-CCC, dated: 22/11/2012 have been received from the National CDM Authority of India, i.e. Indian DNA.

- - - - -

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	Tadas Wind Energy Private Limited *(previously known as Tadas Wind Energy Limited)*
Street/P.O. Box	Plot C- 22, G Block, Bandra Kurla complex
Building	8th Floor, IL&FS Financial Centre
City	Mumbai
State/Region	Maharashtra
Postcode	400051
Country	India
Telephone	+91 22 26593728
Fax	+91 22 2659 3728
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	-
Direct fax	+91 22 26593728
Direct tel.	+91 22 26593728
Personal e-mail	rohil.kudtarkar@ilfsindia.com

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	IL&FS Environmental Infrastructure and Services Limited
Street/P.O. Box	28, Barakhamba Road, Connaught Place
Building	4th Floor, Dr. Gopaldas Bhavan
City	New Delhi
State/Region	Delhi
Postcode	110001
Country	India
Telephone	+91 11 49691000
Fax	+91 11 49691099
E-mail	subrata.chakrabarty@ilfsenv.com
Website	http://www.ilfsenv.com/
Contact person	Mr. Subrata Chakrabarty

Formatted: Font: Italic
Deleted: 4
Deleted: 0
Deleted: 33038
Field Code Changed
Deleted: anand
Deleted: nair
Deleted: Anand Nair
Deleted: Director
Deleted: Nair
Deleted: Anand
Deleted: Operations
Deleted: 26533038
Deleted: 4
Deleted: 0
Field Code Changed
Deleted: anand
Deleted: nair
Formatted: Superscript
Field Code Changed
Field Code Changed
Formatted

Title	-
Salutation	Mr.
Last name	Chakrabarty
Middle name	-
First name	Subrata
Department	CDM
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	subrata.chakrabarty@ilfsenv.com

Field Code Changed

Appendix 2. Affirmation regarding public funding

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

Appendix 3. Applicability of methodology and standardized baseline

Refer to section B.2

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

For baseline calculation

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 Build Margin and the Simple Operating Margin for 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**
Southern Grid	0.9729	0.9415	0.9419

Build Margin (tCO_2/MWh) (incl. Imports)	**2008-09**	**2009-10**	**2010-11**
Southern Grid	0.8179	0.7634	0.7339

Appendix 5. Further background information on monitoring plan

Refer to section B.7.3

Appendix 6. Summary of post registration changes

Name of PP: The name of PP has been revised from Tadas Wind Energy Limited to Tadas Wind Energy Private Limited throughout the CDM-PDD-FORM, v04.0. The change in the name of PP has already been approved by CDM EB and is evident in the UNFCCC CDM website[13].

Project Boundary: The diagram in section B.3 of revised CDM-PDD-FORM, v04.0 has been revised in order to reflect the actual metering position and indicate the emission sources and GHGs included in the project boundary along with data and parameters to be monitored; in-line with Instructions for filling out the project design document form for CDM project activities, v06.0.

Electricity metering systems: The metering system has been corrected in section B.7.1 and B.7.3 of revised CDM-PDD-FORM, v04.0 in-line with the actual practice observed at site. Accordingly, the diagram in section B.7.3 has also been revised in order to reflect the actual metering system.

Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities: As required by the latest CDM-PDD-FORM, v06.0 and in-line with Instructions for filling out the project design document form for CDM project activities, v06.0; PP provided the required information in section B.8 of revised CDM-PDD-FORM, v04.0.

- - - - -

[13] https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1355495522.4/view

Deleted: Not Applicable

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Font: Bold

Formatted: Font: 8 pt