Project design document form

(Version 11.0)

BASIC INFORMATION	
Title of the project activity	27.3 MW Wind energy farm at Mokla Rajasthan by HZL
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	07
Completion date of the PDD	05/04/2021
Project participants	M/s Hindustan Zinc Limited (India) EKI Energy Services Limited (Australia)
Host Party	India
Applied methodologies and standardized baselines	ACM0002 Version 20.0 (EB 105) "Large-scale Consolidated Methodology: grid-connected electricity generation from renewable sources" Standardized Baseline: Not Applicable
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources
Estimated amount of annual average GHG emission reductions	44,307 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

M/s Hindustan Zinc Ltd. (HZL), a vertically integrated natural resources enterprise, headquartered at Udaipur, Rajasthan having broad operations ranging from exploration, mining, ore processing to smelting of non- ferrous metals is the owner and project proponent of the proposed project activity.

Purpose of the Project Activity

The project activity primarily aims at reducing Green House Gas (GHG) emissions through utilization of renewable energy technology for generation of electrical energy. The electricity generated from the project site displaces equivalent electricity generation in grid connected power plants. The project activity reduces the anthropogenic GHG emissions associated with the equivalent amount of electricity generation from the fossil fuel based grid connected power plants.

Measures Implemented within the Proposed Project Activity

The project activity involves installation and operation of thirteen Suzlon make 2.1 MW Wind Turbine Generators (WTGs) by M/s Hindustan Zinc Limited (HZL) in the state of Rajasthan. The cumulative capacity of the project activity is 27.3 MW. The electricity generated from the project activity is exported to Indian Grid.

Baseline Scenario

The project activity is a Greenfield wind power project, supplying electricity to the fossil fuel dominated Indian grid system. In the absence of the project activity equivalent amount of electricity would have been generated in the Indian grid. Since the wind power project is a Greenfield project, there is no difference between the pre-project scenario and the baseline scenario.

Project's contribution to Sustainable Development

The Designated National Authority (DNA) for the Government of India (GoI) in the Ministry of Environment and Forests and Climate Change (MoEFCC), called the National CDM Authority (NCDMA), has stipulated four indicators for sustainable development in the interim approval guidelines for CDM projects[1]:
Social well being

The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.

- The project activity generates employment in the region during construction as well as operation of the project activity.
- The project activity creates direct and indirect employment opportunities for the local population and lead to development of the region.

Economic well-being

The CDM project activity should bring in additional investment consistent with the needs of the people.

- The project activity leads to additional business for equipment suppliers, O&M contractors, civil work contractors etc .
- It also leads to additional investment for the development of infrastructure in the region including roads, power infrastructure, transmission lines, etc

[1] http://www.envfor.nic.in/cc/cdm/criteria.htm

Environmental well being

This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general.

- The project activity reduces the GHG emissions associated with the combustion of fossil fuels in grid connected power plants.
- The project activity utilizes wind power as the source of kinetic energy used to generate renewable power. Wind power generation does not consume any fuels or water for power generation.
- Wind is a clean form of energy and electrical power generation using wind does not produce any solid waste products (such as ash from combustion), emissions of carbon dioxide, SOx, or NOx.

Technological well being

The CDM project activity should lead to transfer of environmentally safe and sound technologies with a priority to the renewable sector or energy efficiency projects that are comparable to best practices in order to assist in up-gradation of technological base.

- The project activity demonstrates the use of wind based electricity generation, which an environmentally safe renewable energy technology.

A.2. Location of project activity

Village: Sonu, Mokla, Serawa

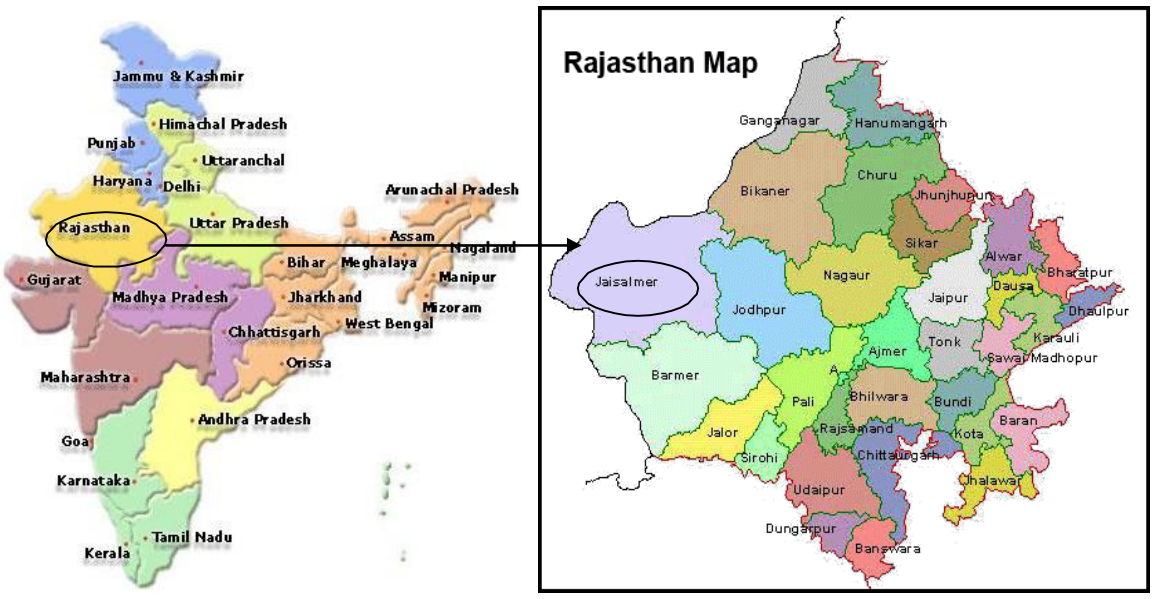
District: Jaisalmer

State: Rajasthan

The project activity consists of thirteen 2.1 MW wind turbines in villages Sonu, Mokla, and Serawa in the district of Jaisalmer in the state of Rajasthan, India. The specific geographical coordinates of the individual WEGs are as follows:

Sr. No.	WTG. No.	Latitude	Longitude
1	MK221	N27 15 09.6	E70 39 49.8
2	MK44	N27 10 46.2	E70 40 02.3
3	MK29	N27 07 46.5	E70 46 38.1
4	MK23	N27 08 29.6	E70 44 03.6
5	MK216	N27 14 36.9	E70 41 12.8
6	MK217	N27 14 43.6	E70 40 55.1
7	MK31	N27 08 27.5	E70 45 52.8
8	SKD186	N27 12 32.1	E70 37 03.6
9	MK178	N27 14 14.6	E70 40 29.1
10	MK179	N27 14 08.7	E70 40 49.1
11	MK180	N27 14 02.0	E70 41 06.7
12	MK181	N27 13 55.4	E70 41 24.5
13	MK215	N27 14 30.3	E70 41 30.4

The location of the project activity is delineated in the maps below:



A.3. Technologies/measures

The technology employed by the project activity converts kinetic energy in wind to mechanical energy and mechanical energy to electrical energy using wind turbine generators (WTGs). In this process, there are no greenhouse gas emissions or burning of any fossil fuels. The electricity is generated through sustainable means without causing any negative effect to the environment and therefore the technology is environmentally safe and sound.

The technical specifications of the WTGs are as below[2]:

WTG (S88 , 2.1 MW, 50 Hz) TECHNICAL DATA

Rated capacity :	2100 kW
Rotor diameter :	88 m
Hub height :	80 m

Rotor with Pitch Control

Type :	Upwind rotor with active pitch control
Number of blades :	3
Swept area:	6082 m²
Blade material:	The rotor blades are made of high grade GRP and manufactured by using Resin Infusing Moldings (RIM) technology
Rotor speed:	15.47 rpm
Tip speed:	71 m/s

Generator:

Type:	Single fed Induction Generator with slip-rings, variable rotor resistance with SUZLON-FLEXI-SLIP control system.
Hub:	Cast spherical hub
Bearings:	High tensile double-row ball-bearing
Braking System:	3 independent Aero Brakes with power back up supply.
Yaw Control:	Active through adjustment gears, friction damping
Tower:	Steel Tubular, 77.5 m height

[2] Technical specification of WTG supplied by the supplier

Technology Transfer

No technology transfer from other countries is involved in the project.

Plant Load Factor

The expected plant load factor for the project activity as determined by independent third party assessment is 19.67 %. The plant load factor is applied in accordance with paragraph 3(b) of the "Guidelines for the reporting and validation of plant load factors" for ex-ante estimation of emission reductions. However, for the investment analysis, the PLF available the time of investment decision (based on offer Letter from Suzlon dated 04/12/2010) is applied as explained in section B.5.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Country)	M/s Hindustan Zinc Limited (Private Entity)	No
Australia	EKI Energy Services Limited (Private Entity)	No

A.5. Public funding of project activity

No public funding from parties included in Annex – I is involved in the project activity. The project proponent hereby confirms that there is no divergence of Official Development Assistance (ODA) to the project activity.

A.6. History of project activity

The CDM project activity is registered as a CDM project activity and not included as a component project activity (CPA) in a registered CDM programme of activities (PoA);

The CDM project activity is not a project activity that has been deregistered.

The CDM project activity was a not CPA that has been excluded from a registered CDM PoA;

No any registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not Applicable

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

Title of the approved baseline and monitoring methodology: "Large-scale Consolidated Methodology: grid-connected electricity generation from renewable sources".

Reference: ACM0002, Version 20.0 (EB 105), Sectoral Scope: 01

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html)

The following tools and guidance's have been followed (References):

1. Tool to calculate the emission factor for an electricity system (Version 07.0)[3]

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

2. Tool for the demonstration and assessment of additionality (Version 07.0.0)[4]

B.2. Applicability of methodologies and standardized baselines

The project activity is Grid connected renewable power generation and meets the applicability conditions of the chosen methodology as follows:

S. No.	Applicability Conditions in the ACM0002	Position of the project activity vis-à-vis applicability conditions
1.	This methodology applies to project activities that include retrofitting, rehabilitation (or refurbishment), replacement or capacity addition of an existing power plant or construction and operation of a Greenfield power plant.	The project activity is the installation of a wind power project and it is a Greenfield power plant.
2	This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity is grid connected renewable power generation from wind which falls under applicability criteria option 1 (a) i.e., "Install a Greenfield power plant". Hence the project activity meets the given applicability criterion.
3	The methodology is applicable under the following conditions: (a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project activity is an installation of a new grid connected renewable energy wind power plant and hence this condition is met.
4	In case of hydro power plants, one of the following conditions shall apply:1 (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density,	The project is not a hydro power project. Hence, this applicability criterion is not applicable.

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

	calculated using equation (7), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
5	In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum of five years prior to the implementation of the CDM project activity.	The project activity is a grid connected renewable wind energy project. This condition is applicable only for hydro power plants and not applicable for wind projects. Therefore this condition is not applicable for project activity.
6	The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	The project activity is an installation of a new grid connected renewable energy project and does not involve switching from fossil fuel to renewable energy and hence this criterion is not relevant to the project activity.
7	In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the	The project activity is a new grid connected renewable wind energy plant and not a retrofits, replacement or capacity additions and therefore this criterion is not applicable to the project activity.

	project activity and undertaking business as usual maintenance"	

The project activity meets the applicability conditions of tools refereed in the methodology as follows:

S. No.	Relevant Applicability Criteria of "Tool for the demonstration and assessment of additionality"	Position of the project activity vis-à-vis applicability conditions
1.	Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory.	The tool is referenced in ACM0002. Application of the additionality tool is mandatory.
2.	Project activities with a start date before the date of validation shall specifically take into account the guidance provided in Chapter B "Specific guidelines for completing the Project Design Document (CDM-PDD)" section B, sub- section B-5. The start date of a project activity. is as defined in paragraph 76 of thirty-third report of the Board.	The project start date is prior to the date of validation. The guidelines are taken into account in section B.5.
3.	Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.	Only one alternative more attractive than the proposed project activity (no investment) has been identified.

S. No.	Relevant Applicability Criteria of "Tool to calculate the emission factor for an electricity system"	Position of the project activity vis-à-vis applicability conditions
1.	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 project activity supplies electricity to the grid. Therefore the tool may be applied.
2.	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.	Project Activity is located in India, which is not an Annex I Country. Therefore, the tool may be applied.

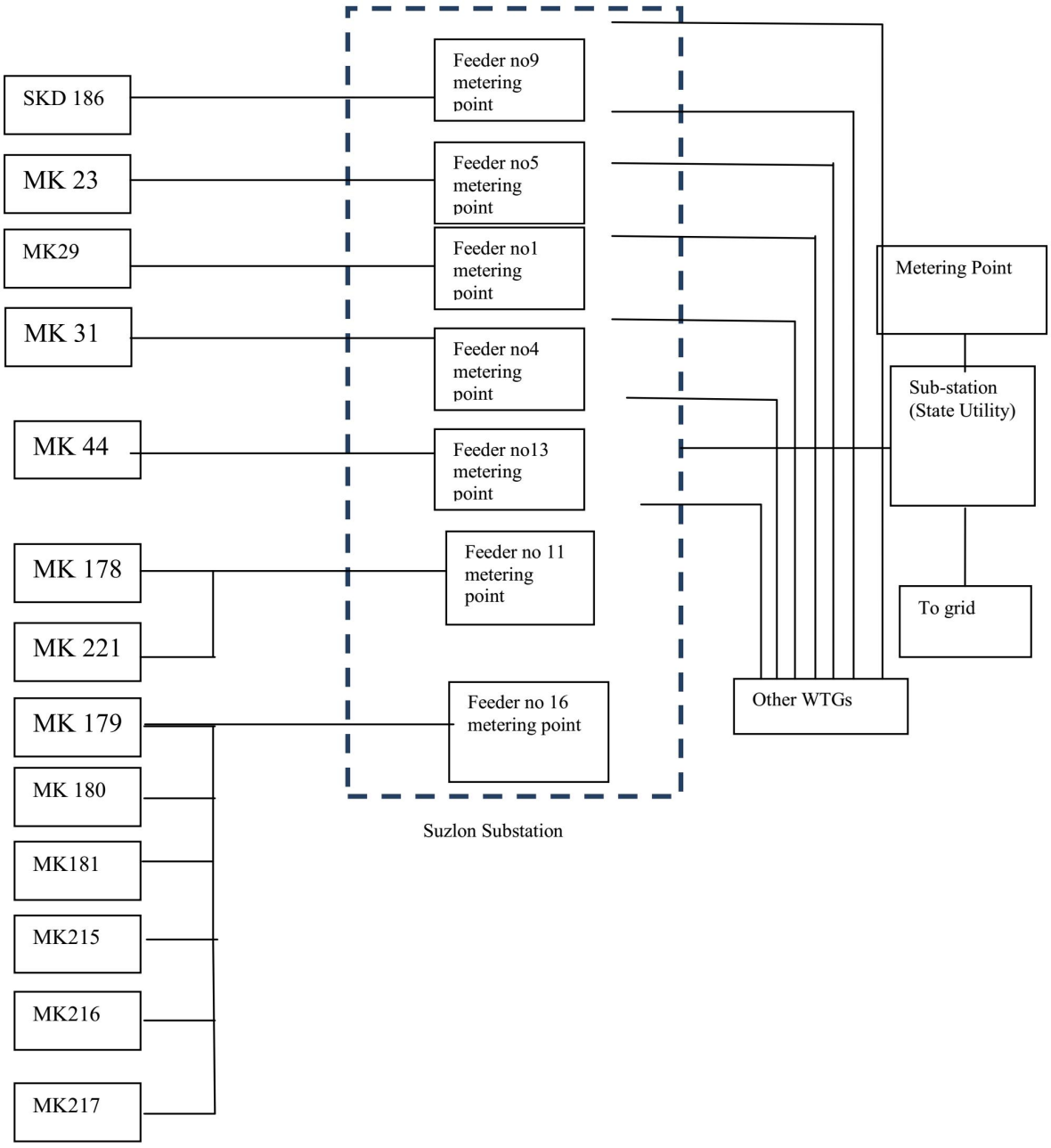
B.3. Project boundary, sources and greenhouse gases (GHGs)

ACM0002 version 20.0 specifies that the project boundary will be:

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The project is feeding the electricity in the Indian regional grid which constitutes several states and Union territories including Rajasthan. Thus all the power generation facilities connected to this grid form the project boundary for the purpose of baseline estimation. For conservative and accurate estimation, the imports of electricity from other regional grids have been included in the baseline calculation.

The project activity has a distinctive physical demarcated boundary as illustrated below:



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

	Source	GHG	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	This is the main emission source because the combustion of fossil fuels for electricity generation leads to emission of CO_2.
		CH_4	No	This is a minor emission source because the emission of CH_4 from the combustion of fossil fuels is low.
		N_2O	No	This is a minor emission source because the emission of N_2O from the combustion of fossil fuels is low.
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	The project activity is a wind power project and not a geothermal project. Thus these emission sources are not applicable to the proposed project.
		CH_4	No	
		N_2O	No	
	For geothermal power plants, CO_2 emissions from combustion of fossil fuels required to operate the geothermal power plant.	CO_2	No	The project activity is a wind power project and not a geothermal project. Thus these emission sources are not applicable to the proposed project.
		CH_4	No	
		N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	The project activity is a wind power project and not a hydro power project. Thus these emission sources are not applicable to the proposed project.
		CH_4	No	
		N_2O	No	

B.4. Establishment and description of baseline scenario

Updated baseline for the second crediting period in line with the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period." Version 03.0.1.
This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 283 to 286 of Project Standard version 02.0.
The tool stipulates the following steps to be carried out.

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

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

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

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plants and by the addition of new generation sources into the grid. Thus this project activity was a voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent

amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period under CDM.

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 356,100.20 MW as on 31.03.2019, consisting of 226,279.34 MW Thermal, 77,641.63 MW Renew,45,399.22 MW Hydro and 6,780 MW Nuclear. Sector-wise details of installed capacity are shown in Table 1. However, it is evident from Table 1[5] that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO_2 emissions in the country by increased use of renewable energy sources.

Furthermore, project participant has considered the latest available CO_2 Baseline Database (CEA database, version 15) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission. As per below table, the fossil fuel based thermal power generation is dominant over the renewable based power generation, thus baseline scenario remains same as original.

Table 1: Sector- wise installed capacity (MW) as on 31/03/2019 (CEA Database version 15)

Sector	Thermal				Nuclear	Hydro	RES	Total
	Coal	Gas	Diesel	Total				
State	65366.50	7118.71	363.93	72849.14	0.00	29878.80	2347.93	105075.86
Central	58820.00	7237.91	0.00	66057.91	6780.00	12126.42	1632.30	86596.63
Private	76518.00	10580.60	273.70	87372.30	0.00	3394.00	73661.40	164427.70
All India	200704.50	24937.22	637.63	226279.34	6780.00	45399.22	77641.63	356100.19

Thus, current baseline remain same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period.

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

As explained in step 1.2, the baseline scenario was the electricity import/generation from the power plants connected to the electricity grid. The project activity in green field project and there is no any baseline equipment or investment involved in project activity. Therefore this condition is not applicable to the project activity.

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

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

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

Step 2: Update the current baseline and the data and parameters

[5] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version of CEA database available at the time of PDD submission for renewal.

In line with the project standard version 02.0, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

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

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

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy[6] on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

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

The state electricity regulatory commission issues tariff order in respect of procurement of power generated wind generators and there is no mandatory national and/or sectoral policies have come into effect that would affect the compliance of the current baseline. Hence, it can be concluded the current baseline complies with all relevant mandatory national and/or sectoral policies that have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period.

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

The approved consolidated baseline methodology, ACM0002 (Version 20.0), has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "*Tool to calculate the emission factor for an electricity system*" *(version 07.0)* has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

[6] http://www.cercind.gov.in/Act-with-amendment.pdf

As per the CEA database version 15, fossil fuel dominated electricity is more than renewable sector and is continuing with same pattern. In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the Project Standard version 02.0, national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario. Hence the baseline scenario as applied for the present project activity remains justified.

As per the approved consolidated Methodology ACM0002 (Version 20.0) para 22: "If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

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

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

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 15 is the latest available data at the time of PD submission to DOE for validation, hence same is considered for emission factor calculations.

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

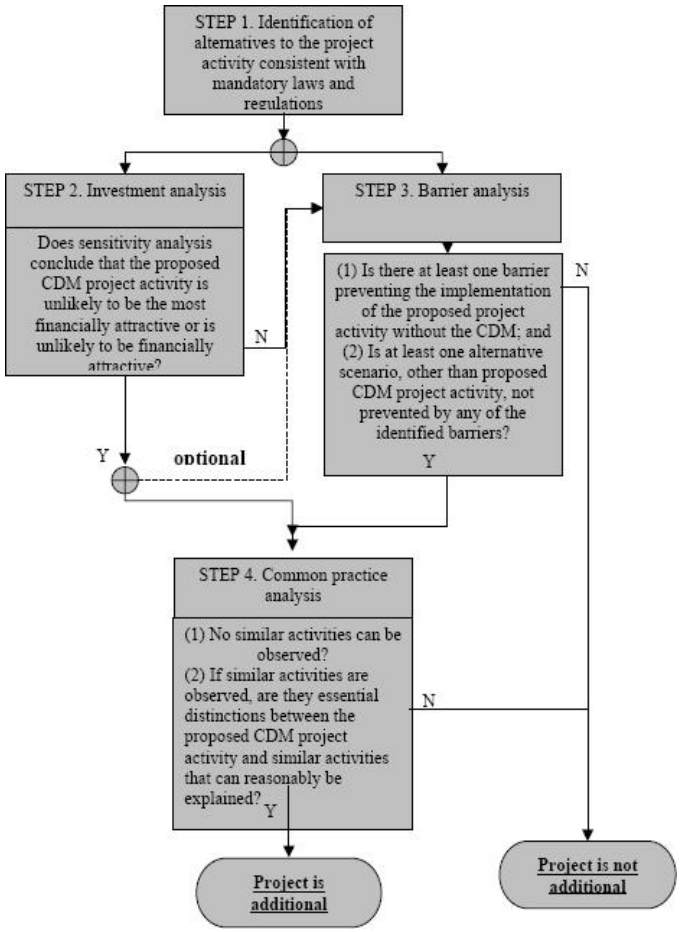
Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.9419 tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.25) & build margin (0.75) values, sourced from Baseline CO_2 Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9622 tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2016-17, 2017-18, 2018-19) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8811 tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Build margin for year 2018-19 sourced from Baseline CO_2 Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India

B.5. Demonstration of additionality

In accordance with "Guidance on the demonstration and assessment of prior consideration of the CDM" Version 4 EB 62 Annex 13, since the start date of the project activity falls after 02 August 2008, the project participant is required to inform the host party DNA and UNFCCC Secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. This notification was made by Hindustan Zinc Limited to the UNFCCC Secretariat and Ministry of Environment and Forests on 18/07/2011which is within six months of the project activity start date (15/06/2011) and contains the precise geographical location and a brief description of the proposed project activity.

Demonstration of Additionality for the project activity

As required in ACM0002 additionality has been demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality", Version 06.



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

Define realistic and credible alternatives to the project activity(s) that can be (part of) through the following Sub-steps:
Sub-step (1a): Define alternatives to project activity
Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity. These alternatives are to 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).

The project activity is a wind power project involving supply of electricity to Indian grid. Hence, according to baseline methodology ACM0002, since 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".

Paragraph 105 of the "Clean Development Mechanism Validation and Verification Manual" Version 01.2 states that "The PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required."

Since, the methodology has prescribed the baseline scenario as given above, there is no further analysis required of alternative scenarios that deliver output services with comparable quality, properties and application areas.

Therefore the following baseline alternatives are considered for further analysis:

Sl No.	Alternative
1	The proposed project activity undertaken without being registered as a CDM project activity;
2	Continuation of the current situation (no project activity or other alternatives undertaken)

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

The baseline alternatives identified above are in compliance with the applicable legal and regulatory requirements as follows:

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

Thus, the baseline alternatives are in line with the applicable legal and regulatory requirements.

The "Tool for the demonstration and assessment of additionality" (Version 06.0.0) states that project participants may choose to apply Step 2 (Investment analysis) OR Step 3 (Barrier analysis) to demonstrate the additionality of the project. In the present case, Step 2 is used to demonstrate the additionality of the project.

Step 2: Investment Analysis

Sub-step 2a. Determine appropriate analysis method

As the electricity generated from the project activity will be sold to the state utility, it will generate financial benefits in terms of revenues from the sale of electricity units. Thus simple cost analysis (option I cannot be applied to the proposed CDM project activity.

Amongst the other two options – investment comparison analysis (option II) and benchmark analysis (option III), the benchmark analysis has been adopted in accordance with the guidance on the assessment of investment analysis wherein the Internal Rate of Return (IRR) of the project activity serves as a benchmark to assess the financial attractiveness of the project activity.

The Guidelines on the Assessment of Investment Analysis', EB 62, Annex 5, Paragraph 19, states 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."

Since the project activity supplies electricity to the grid and since the baseline scenario does not involve any investment, a benchmark analysis has been applied to the project activity.

Option III assesses if the project's returns are sufficient for investors to make the initial investment and further bear the associated costs of successfully operating the project activity over the crediting period of the project.

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

As per paragraph 14 in the Guidelines on the Assessment of Investment Analysis, EB 62 Annex 5:
"In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market."
In accordance with the guideline, the benchmark has been determined using parameters standard in the market, and is based on the expected return on equity calculated using the Capital Asset Pricing Model (CAPM). The Capital Asset Pricing Model (CAPM) is a well accepted methodology for estimating the expected rate of return on equity. The reliability of CAPM as a tool for evaluating the minimum rate or return for an investor, is well documented.

It may be noted that three market indices (BSE Sensex, BSE 100, and BSE 200) were analyzed for calculating the market returns and the most conservative value of the market return has been used while calculating the Benchmark for the project activity. BSE 500 is not considered in the analysis since the index was launched in the year 1999 and BSE 500 data is available for only 10 years which is not comparable to the project life time of 20 years. Similarly, other market indices listed are not considered as the available data is not comparable to the project lifetime and/or because they are sectoral indices and not representative of the market. The benchmark calculation applying the three market indices is provided in the consolidated excel sheet.

As per CAPM, the required return on investment is computed as follows:

$$\mathbf{K_e = R_f + \beta \times (R_m - R_f)}$$

where:

K_e = Rate of return on equity capital; R_f = Risk-free rate of return;
β (Beta) = The stock's risk relative to that of the whole market;
R_m = Market return
Risk free rate:

The risk free rate is considered as the rate of return on an asset that is theoretically free of any risks.

Therefore the yield of Government of India Securities applicable at the time of investment decision (6 June 2011) is considered as risk free rate. This data is published by Reserve Bank of India and the latest risk free rate available has been applied (data corresponding to March 2011, published in May 2011). The risk free rate corresponding to 20 years maturity period was considered appropriate, as the lifetime of the project activity is also 20 years.

(reference: http://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/26CT_CS100511.pdf
The applicable risk free rate is 8.33%.

Risk Premium:

The market risk premium is the premium above the risk-free rate of return that investors expect to earn on a well-diversified portfolio of equities. The most common approach for estimating the risk premium is to base it on historical data. The premium is estimated by looking at the difference between average return on stocks (market rate of return) and return on government securities over a period of time.

The market rate of return for BSE 100, BSE 200, and BSE Sensex has been evaluated from July 1991 onwards, thus providing the market returns for 20 years (from July 1991 to May 2011). This corresponds with the operational lifetime of the project activity (20 years) and the period for which the investment analysis has been evaluated. Further, the use of data from 1991 is appropriate as the economic liberalization of the Indian economy started in 1991[7]. The economic growth path of India changed from 1991 and the use of data from this year provides a realistic representation of the market returns used to estimate the benchmark.

The market rate of return was evaluated as the compounded annual growth rate of the respective market index from July 1991 to June 2011 (prior to investment decision). The historical market index was taken from the BSE web-site (http://www.bseindia.com/stockinfo/indices.aspx) and the market rate or return for the three indices was determined to be:
BSE 100: 14.67%

BSE 200: 14.05%

BSE Sensex: 14.33%

On a conservative basis, the market returns are applied in accordance with BSE 200.
Market rate of return**,** R_m = 14.05%

The risk premium has been calculated as the difference in market rate of return and the risk risk free rate available at the time of decision making. The detailed calculations are presented in the benchmark calculation spreadsheet submitted to the DOE.
The applicable risk premium is determined as: 14.05% – 8.33% = 5.72%**.**

Beta:

Beta (β) indicates the sensitivity of the company to market risk factors. For companies that are not publicly listed, the beta is determined by referring beta values of publicly listed companies that are engaged in similar types of business. The project activity type is wind power generation; the approach therefore should be to base the beta for the project on the beta values of listed wind power generation companies in India. However, in the absence of adequate data on companies which are exclusively into the exactly same type of business (i.e. wind power projects), the next best option for assessing the risk of these projects is to consider the data available on companies which are involved in similar businesses.

Therefore, we have considered beta values of electricity generating companies in India. The group of companies considered includes renewable as well as conventional power generating companies. Investors demand a higher return from renewable energy projects than from conventional energy ones, given the higher risks in renewable, including risks of technology, risks

[7] Reference: http://www.indiainbusiness.nic.in/economy/economic_reforms.htm

from significantly varying and unpredictable resource availability and a lower established support base for such projects relative to that for conventional power (e.g. grid connections, bank finance, suppliers, etc.). The use of this Beta value is therefore considered conservative, as it does not add for the higher risk of non conventional energy.

The Beta value taken for this analysis is based on the beta values of the listed power producing companies engaged in similar business as the project activity at the time of investment decision estimated by regressing monthly returns on stock against local index, using 5 years[8] of data. The equity beta values have been taken from BSE. The beta value for PTC has not been considered in the analysis as it is a power trading company. Further, companies with less than 5 years of data (date of listing after July 2006) have not been considered in the analysis. The beta values for the five years period prior to the time of investment decision (July 2006 to June 2011) has been evaluated. The beta values determined applying **BSE 200** are as follows:

Name	Debt/Equity	Levered Equity beta	Unlevered Equity Beta
CESC Ltd.	0.62	1.0779	0.7131
Gujarat Industries Power Co Ltd	0.72	1.2837	0.8307
TATA Power	0.52	1.0325	0.7385
Reliance Infrastructure Limited	0.42	1.8275	1.3526
Neyveli Lignite Corporation	0.38	1.5768	1.2467
BF Utilities	1.10	1.9681	1.4164
NTPC	0.56	0.6214	0.4476
Jaiprakash Power Venture Limited	1.59	1.7589	0.7637
GVK Power	0.06	1.4908	1.4216
Average			0.9923

The average asset beta of companies engaged in power sector is thus **0.9923**

The cost of equity thus estimated is equal to 14.00%. Detailed calculations of cost of equity are given in the Benchmark calculation excel sheet. The Post Tax Equity calculated for the project activity without CDM revenue was **11.31%** which is well below the benchmark figure of **14.00%.**

S. No.	Parameters	Variation for IRR without CDM revenue to attain benchmark
1.	PLF	+20%
2.	Tariff rate	+21%
3.	O&M Cost	-200%
4.	Project Cost	-17%

It is unlikely that the above variations would be achieved as:

- The PLF considered in the financial analysis (based on offer letter dated 04.12.2010)

[8] Five years of Beta value has been chosen in line the Crisil Report on Cost of Capital for Central Sector Utilities which states that 'for such economies, and for companies whose capital structure and operating environment has been changing, the time period over which beta is calculated should be small',

is 20.11% whereas actual PLF as per third party report is 19.67%. An increase of 20% is highly unlikely after being conservative (PLF considered is 20.11% for IRR Calculation).

- The project proponent has entered into a power purchase agreement valid for 20 years. The tariff is fixed at INR 4.22 at the time of PPA signing and would not be varying further as the PPA has already been signed.
- The IRR remains below the benchmark at no O&M costs. It is not possible to have negative costs.
- The purchase orders for the project have been signed based on the offer letter considered at the time of investment decision. Therefore any decrease in the investment cost is not possible.

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

The project proponent has opted to demonstrate the additionality of the project activity by performing an investment analysis using Post Tax Equity IRR. Post Tax Equity IRR is one of the well-known financial indicators used by banks, financial institutions and project developers for making investment decisions. The chosen indicator, post tax equity IRR, represents the overall returns from an investment, and therefore, is duly considered as the financial indicator for the project activity.

The assumptions used to calculate the post tax equity IRR are listed below:

Capacity			
Project Size	27.3	MW	Techno-commercial offer from equipment supplier O&M service provider
Total Project Cost	1,440.54	INR Million	Techno-commercial offer from equipment supplier O&M service provider
Means of Finance			
Debt (0%)	0	INR Million	Investment decision
Equity (100%)	1,440.54	INR Million	Investment decision
Total Project Cost	1,440.54	INR Million	Investment decision
Operating Parameters			
PLF*	20.11	%	Estimated Electricity Generation specified in Offer Letter from Suzlon dated 04/12/2010
Net Energy Generation ($EG_{BL,y}$)	48,092.66	MWh	Calculated
Life of the WTG assumed	20	Years	WTG technical specifications
Operation & Maintenance Cost			
O & M Cost Exemption	2.00	Years	Techno-commercial offer from equipment supplier / O&M service provider
O & M Cost	1.8	INR Million/WTG	Techno-commercial offer from equipment supplier / O&M service provider
O & M escalation	5.0	%	Techno-commercial offer from equipment supplier / O&M service provider

Tax on OMS	10.30	%	Techno-commercial offer from equipment supplier / O&M service provider
Insurance Cost	0.11	INR Million/WTG	Insurance costs incurred in previously commissioned wind power projects
Depreciation Rate			
Yearly book depreciation	5.28%	%	As per Companies Act[9]
Yearly tax depreciation	7.69%	%	As per IT Act[10]
Tax			
Corporate Tax	33.22%	%	As per IT Act[11]
Minimum Alternate Tax	19.93%	%	As per IT Act
Tariff			
Tariff	4.22	INR/kWh	RERC Tariff order dated 03/06/2011
GBI	0.5	INR / kWh	http://mnre.gov.in/file-manager/UserFiles/faq_wind.pdf

*The PLF considered for the investment analysis is based on the estimated generation indicated by the equipment supplier in the offer letter dated 04/12/2010, which corresponds to a PLF of 20.11%. This PLF is applicable at the time of investment decision and is in compliance with EB 62 Annex 5, Paragraph 6.

However, in line with the requirements of EB 48, Annex 11, PLF has also been evaluated based on an independent third party assessment (after the investment decision for the project activity). However, as the PLF based on the offer letter (20.11%) is more conservative than the PLF based on the third party assessment (19.67%), the offer letter has been taken as the basis of the PLF applied for computation of the post tax equity IRR.

Using the assumptions in the table above, the post-tax equity IRR for the project activity works out to be **10.52%,** calculated in accordance with the "Guidance on the Assessment of Investment Analysis" Version 05, which clearly depicts the fact that the project activity is not very attractive as an investment option since the returns are much below the selected benchmark.
Sub-step 2d: Sensitivity analysis (only applicable to options II and III):

A sensitivity analysis has been carried out, by varying the critical parameters of the project activity. As per paragraph 20 of the "Guidance on Assessment of Investment Analysis", EB 62 Annex 5: "only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation."

Sensitivity analysis has been carried out considering variations in PLF, tariff rate, O&M cost, and project cost. In accordance with Paragraph 21 of the guidance, a range of +10% to -10% has been considered as the range of variation.

[9] http://asa-india.com/asa/Depreciation%20Rates%20Companies%20Act.pdf

[10] http://law.incometaxindia.gov.in/DIT/File_opener.aspx?page=ITRU&schT=rul&csId=2f13c0bd-dec4-4df6-a273-431e3b91a01b&rNo=&sch=&title=Taxmann%20-%20Direct%20Tax%20Laws

[11] http://www.incometaxindiapr.gov.in/incometaxindiacr/contents/forms2010/pamphets/COMPANIES_2012_13.htm

Upon introducing the variation of 10% in crucial parameters the IRR figures do not surpass the benchmark. The results of sensitivity analysis for the project activity are as given below:

S. No.	Parameters	Variation	IRR without CDM
1.	PLF	+ 10 %	12.30%
		- 10 %	8.71%
2.	Tariff rate	+10 %	12.25%
		-10 %	8.74%
3.	O&M Cost	+10%	8.86%
		-10 %	12.53%
4.	Project Cost	+10%	10.29%
		-10 %	10.75%

It is evident from the above that the IRR without CDM benefits is consistently below the benchmark of 14.00 %, even after introducing variation of 10% in the critical parameters.

Conclusion

The project activity was not financially viable to the project proponent considering the low financial returns as described above. The investment decision was approved after considering the CDM revenues, which would be accrued upon registration of the project activity with UNFCCC.
Step 4: Common Practice Analysis
Sub-step 4a: Analyze other activities similar to the proposed project activity:

Provide an analysis of any other activities that are operational and that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.

Paragraph 47 of the Additionality Tool Version 06.0.0 has been applied for the analysis of other activities similar to the proposed project activity. The following step-wise procedure is applied.

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

As the proposed project activity is of 27.3 MW capacity, the applicable output range for the identification of projects is 13.65 MW to 40.95 MW.
Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities shall not be included in this step

For this analysis the applicable geographical area is applied in accordance with the definitions given in the Additionality Tool Version 06.0.0. As per the tool, “the applicable geographical area” covers the host country by default; however project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions. Further, “different technologies” are defined as technologies that deliver the same output but differ by any of various factors including investment climate, energy source / fuel, feed stock, size of installation, etc. In India the regulatory regime and tariff structure is unique for each state, and therefore the investment climate varies considerably from state to state. Therefore, the applicable geographical area for the analysis is considered as the state of Rajasthan.

Further, all types of power plants have been considered for the common practice analysis. Similar project activity is being considered as any wind project with an installed capacity between 13.65 MW to 40.95 MW and set up by a single private investor within a particular time frame in the state of Rajasthan for the sale of power to the grid. In India the regulatory regime and tariff structure is unique for each state, and therefore the investment climate varies considerably from state to state. Therefore, the applicable geographical area for the analysis is considered as the state of Rajasthan.

http://www.cercind.gov.in/08022007/Act-with-amendment.pdf Following is the result of this analysis[12]:

Technology Area	Projects in applicable capacity range	Projects excluding CDM projects in applicable capacity range, N(all)	N(diff)
Thermal	3	3	3
Hydro	5	5	5
Wind*	7	0	0
Nuclear	0	0	0
Solar	0	0	0
Biomass	0	0	0
Tidal-Mechanical &Thermal	0	0	0
Geothermal	0	0	0

Wind projects by individual investors in Rajasthan where the installed capacity is between 13.65 MW to 40.95 MW are presented in the table below:

Name of Owner	Total	CDM	Weblinks
DLF Home Developers Ltd.	33	Yes	http://cdm.unfccc.int/Projects/DB/BVQI12709 85563.08/view
Enercon Wind Farms (Jaisalmer) Pvt. Ltd	24.6	Yes	http://cdm.unfccc.int/Projects/DB/DNV-CUK1143050217.74/view
Hindustan petroleum Corporation ltd.	21.25	Yes	http://cdm.unfccc.int/Projects/Validation/DB/H88VQDBMZDVSK37NPUUWXHR25K08FR/view.html
Kohinoor Planet Construction Pvt. Ltd.	24	Yes	http://cdm.unfccc.int/Projects/Validation/DB/WFO1YN18ZN4DI3FUZLD7CYRGLI20FT/view.html
Modern Road makers Pvt. Ltd,	20	Yes	http://cdm.unfccc.int/Projects/Validation/DB/AERX8YCUI2RBEAK41JC7IF8SN67G1P/view.html

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

Enercon India Ltd	28.8	Yes	http://cdm.unfccc.int/Projects/DB/SGS-UKL1181742063.57/view
Enercon India Ltd	31.2	Yes	http://cdm.unfccc.int/Projects/DB/SGS-UKL1181742063.57/view

Therefore, N_{all} = Thermal projects [13] + Hydro Projects [14] + Wind Projects [15] +Biomass projects[16]+Nuclear projects[17]+ Solar projects+ Geothermal & Tidal projects[18]

= 3+5+0+0+0+0+0+0

=8

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

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

Thermal power project and hydropower projects are different from the project activity (a wind based project) as they use different *Energy source/fuel* (para 9a of the Additionality Tool). Therefore, the eight projects identified in the determination of N_{all}, apply technologies different from the proposed project activity.

Therefore, $N_{diff} = 8$

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

$F= 1 – 8/8 = 0$

As per the Additionality Tool, the proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.
As the factor F has been calculated to be 0(less than 0.2), and $N_{all} – N_{diff} = 0$, the proposed project activity is not in common practice
Sub-step 4b: Discuss any similar options that are occurring:

The Project Activity is a wind power project.and is classified as one of the four types of measures listed under paragraph 6 of the tool for demonstration of additionality. It can be considered as: Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies).

Accordingly, the procedure given in paragraph 47 of the additionality tool has been applied as explained above.

From sub-step 4a it is clear that all similar projects have been undertaken only as CDM projects. Hence it can be concluded that similar activities are not widely observed or commonly carried out. Thus Sub-step 4b is not applicable.

[13] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
[14] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
[15] Source, Directory Indian Wind Power, dated August,2010
[16] http://mnre.gov.in/schemes/grid-connected/biomass-powercogen/
[17] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
[18] http://www.eai.in/ref/ae/oce/oce.html

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (LE_y), as follows:
$ER_y = BE_y - PE_y - LE_y$

Where

ER_y	=Emission reductions in year *y* (t CO_2/y)
BE_y	=Baseline Emissions in year y (t CO_2/y)
PE_y	=Project emissions in year y (t CO_2/y)
LE_y	=Leakage emissions in year y (t CO_2/y)

As per para 31 of ACM0002, For most renewable energy power generation project activities,
PEy = 0

Baseline Emissions:

As per the approved consolidated Methodology ACM0002, version 20.0:

Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid- connected power plants. The baseline emissions are to be calculated as follows:

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

Where:
BEy = Baseline emissions in year y (t CO2/yr)

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

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

As per para 41 of methodology, If the project activity is the installation of a Greenfield power plant, then
$EG_{PJ,y} = EG_{facility,y}$

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

As per methodology, combined grid emission factor as per the "Tool to calculate the emission factor for an electricity system" version 07 is calculated as below.

CO2 Baseline Database for the Indian Power Sector, Version 15, December 2019 published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per Methodological tool: Tool to calculate the emission factor for an electricity system (Version 07.0, EB 100, Annex 4), following six steps have been followed:

(a) Step 1: Identify the relevant electricity systems;

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

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

(d) Step 4: Calculate the operating margin emission factor according to the selected method;

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

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

Step 1: Identify the relevant electricity systems

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

However since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this CO2 Baseline Database. As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

Table: Geographical Scope of Indian Electricity Grid

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

Uttarakhand				

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)
Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.
The Project Participant has chosen only grid power plants in the calculation.

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

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

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

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

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

	2014-15	2015-16	2016-17	2017-18	2018-19
India	16.8%	15.1%	14.6%	14.3%	14.5%

Data Source: Central Electricity Authority (CEA) database Version 15, Dec 2019

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

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

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

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

OR

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

PP has chosen ex-ante option for calculation of Simple OM emission factor using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PD to the DOE for validation.

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

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

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

Net Generation in Operating Margin (GWh) (incl. Imports)			
	2016-17	**2017-18**	**2018-19**
INDIAN Grid	916,278	960,639	995,957

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2016-17	**2017-18**	**2018-19**
INDIAN Grid	0.9636	0.9543	0.9685

Weighted Generation Operating Margin	
INDIAN Grid	**0.9622**

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

As per Methodological tool: “Tool to calculate the emission factor for an electricity system” (Version 07.0, EB 100, Annex 4) para 72:

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

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

(b) Option 2 - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.
Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

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

Build Margin (tCO_2/MWh) (not adjusted for imports)	
	2018-19
INDIAN Grid	**0.8811**

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

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 81:

The calculation of the combined margin (CM) emission factor (EFgrid, CM,y) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

PP has chosen option (a) i.e. weighted average CM to calculate the combined margin emission factor for the project activity.
The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (t CO2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (t CO2/MWh)
W_{OM} = Weighting of operating margin emissions factor (per cent)
W_{BM} = Weighting of build margin emissions factor (per cent)

The following default values should be used for W_{OM} and W_{BM}:

For wind project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the second crediting period and for subsequent crediting periods. Since project activity is of power generation by using wind, the above weightage has been considered for OM and BM.

Therefore, $EF_{grid,CM,y}$ = 0.9622 * 0.75 + 0.8811 * 0.25
= 0.9419 tCO2/MWh

B.6.2. Data and parameters fixed ex ante

Data/Parameter	**$EF_{grid,BM,y}$**
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, Dec 2018[19]
Value(s) applied	0.8811
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for the most recent year 2017-18. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 15, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

[19] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

Data/Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 15, Dec 2019[20]
Value(s) applied	0.9622
Choice of data or measurement methods and procedures	Calculated as the last 3 year (2016-17, 2017-18, 2018-19) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period

Data/Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 15, Dec 2019[21]
Value(s) applied	0.9419
Choice of data or measurement methods and procedures	The combined margin emissions factor is calculated as follows: $\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}}$ Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

B.6.3. Ex ante calculation of emission reductions

The ex-ante estimation of emission reductions, based on baseline emission factor and expected electricity generation from the project activity, is tabulated below

	Parameter	Value	Units	Source
A	Baseline Emission factor ($EF_{grid,CM,y}$)	0.9419	tCO_2/ MWh	CEA Database Ver 6.0
B	Capacity per WTG	2.1	MW	Technical Specifications
C	PLF[22]	19.67	%	Third Party PLF Study

[20] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf
[21] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

[22] The PLF chosen for emission reductions is taken from third party PLF study in line with EB 48, Annex 11. This is conservative for emission reduction calculations as the PLF available in the offer letter (19.67%) at the time of investment decision was higher. PP has chosen this higher PLF of 20.11% for the IRR analysis and a lower PLF of % (from third party report) for emission reduction calculations to be conservative.

D	Net Energy Generation	47040.41	MWh	Calculated as: B x 13 x 24 x 365 x C%
E	Baseline Emissions (BE_y) = $EF_{grid,CM,y}$ x $EG_{PJ,y}$	44,307	tCO_2/y	Calculated as: D x A

For a given year, the emission reductions contributed by the project activity (ER_y) is calculated as follows:

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

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 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 2.2.0 of the "Tool to calculate the emission factor for an electricity system"

BE_y **=** 47,040.41 MWh/annum x 0.9419 tCO_2/MWh
= 44,307 tCO_2e/annum

$ER_y = BE_y - PE_y$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2e/yr)
PE_y	=	Project emissions in year *y* (t CO_2e/yr)

ER_y = 44,307 – 0 = 44,307 tCO_2e/annum

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

Year	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
Year 1*	44,307	0	0	44,307
Year 2	44,307	0	0	44,307
Year 3	44,307	0	0	44,307
Year 4	44,307	0	0	44,307
Year 5	44,307	0	0	44,307
Year 6	44,307	0	0	44,307
Year 7	44,307	0	0	44,307
Total	**310,149**	**0**	**0**	**310,149**
Total number of crediting years	**7**			
Annual average over the crediting period	**44,307**	**0**	**0**	**44,307**

* Year 1 represents first year of second crediting period and Year 1 represents period from 1 December 2020 to 30 November 2027. Same approach is applicable for remaining periods.

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	**$EG_{PJ,y}$** or $EG_{facility,y}$
Data unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)
Source of data	JMR Statements / Statements on Break-up of Net Export Units prepared by the O&M Service provider
Value(s) applied	47,040
Measurement methods and procedures	The main meter installed at the substation of the state utility measures the power delivered to the grid continuously. A monthly meter reading taken jointly by state electricity board and PP representative is recorded in the JMR. The meter would be a bi-directional meter measuring both the export and the import. The net electricity exported to the grid would be the difference of export and the import measured through the meter. The metered export and import of electricity in the JMR is apportioned among the various project developers based on the electricity generated at the WEG-Controller (LCS readings). The apportioned metered net electricity (export – import) corresponding to WEGs owned by a particular developer is then issued separately in a share certificate which is further used for ER calculation. There is also a check meter installed at the substation to measure the power delivered to the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter. The energy meters will be electronic meters of 0.2 accuracy class. Net electricity supplied by the project activity to the grid will be calculated based on the values of export and import of electricity as follows: Net Electricity **=** Total electricity exported by project proponent-Total electricity imported by project proponent The apportioning procedure is under control of state electricity board and PP do not have any control on it. Thus values of above parameters may or may not available with PP. PP have the data of net electricity supplied to grid and same parameter is used for emission reduction calculations. Hence single parameter of net electricity supplied to grid as per share certificate is considered as monitoring parameter as per methodology requirement. Please refer section B.7.3 for apportioning procedure followed by state electricity board.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures	The quantity of net electricity supplied will be cross-verified from the invoices/sales receipts raised to the state electricity board. The conservative values of net electricity exported would be considered for emission reductions. The energy meters would be calibrated on an annual basis by the state utility officials.
Purpose of data	To monitor baseline emissions
Additional comment	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data/Parameter	**EG_{Export}**
Data unit	MWh
Description	Electricity exported to the state electricity board by the project activity
Source of data	JMR Statements / Statements on Break-up of Net Export Units prepared by the O&M Service provider
Value(s) applied	-

Measurement methods and procedures	Electricity exported is monitored using digital energy meters of 0.2 accuracy class at the sub-station of the state electricity board. Joint meter readings of the energy meters will be carried out by representatives of the project promoter and representatives of the state electricity board on a monthly basis. An energy meter will be in place for each feeder, and each feeder will be connected to multiple WTGs, some of which may not be part of the project activity. The export readings will be apportioned based on the electricity generation from the individual WTGs connected to the respective feeder. The total electricity exported by the project activity is calculated as: • Total Electricity exported by Project activity = (Y/X)*A • (Electricity generated by the project activity(Y)/Total electricity generated by all WTGs connected to same feeder)(X)*(Total electricity exported by all WTGs connected to same feeder)(A)
Monitoring frequency	Reporting Frequency: Monthly
QA/QC procedures	For cross verification, the invoices raised by the project proponent to the state electricity board for sale of electricity and payment received will be checked. The energy meters will be calibrated on an annual basis.
Purpose of data	To monitor baseline emissions
Additional comment	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data/Parameter	**EG_{Import}**
Data unit	MWh
Description	Electricity imported from the state electricity board by the project activity
Source of data	JMR Statements / Statements on Break-up of Net Export Units prepared by the O&M Service provider
Value(s) applied	-
Measurement methods and procedures	Electricity imported is monitored using digital energy meters of 0.2 accuracy class at the sub-station of the state electricity board. Joint meter readings of the energy meters will be carried out by representatives of the project promoter and representatives of the state electricity board on a monthly basis. An energy meter will be in place for each feeder, and each feeder will be connected to multiple WTGs, some of which may not be part of the project activity. The import readings will be apportioned based on the electricity generation from the individual WTGs connected to the respective feeder. The total electricity exported by the project activity is calculated as: • Total Electricity exported by Project activity = (Y/X)*B • (Total electricity imported generated by the project proponent's WTGs (Y) / Total electricity imported generated by all WTGs connected to the same feeder(X))*(Total electricity imported by the feeder at the sub- station(B))
Monitoring frequency	Reporting Frequency: Monthly
QA/QC procedures	For cross verification, the invoices raised by the project proponent to the state electricity board for sale of electricity and payment received will be checked. The energy meters will be calibrated on an annual basis.
Purpose of data	To monitor baseline emissions
Additional comment	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data/Parameter	**X**
Data unit	MWh/yr

Description	Sum of Gross electricity generated by all WEGs connected to substation
Source of data	Individual WEG Controller Readings
Value(s) applied	To be determined ex post (Value to be used while apportioning)
Measurement methods and procedures	The WEG controllers measure the gross electricity generated by all the WEGs connected to the substation of the state utility. The parameter will be monitored continuously, and recorded monthly.
Monitoring frequency	-
QA/QC procedures	These WEG controller meters are factory calibrated and does not require further calibration.
Purpose of data	To monitor baseline emissions(Indirectly used to determine $EG_{p\ export,y}$ and $EG_{pimport.y}$)
Additional comment	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data/Parameter	**Y**
Data unit	MWh/yr
Description	Sum of Gross electricity generated by all WEGs owned by PP in project activity
Source of data	Individual WEG Controller Readings
Value(s) applied	To be determined ex post (Value to be used while apportioning)
Measurement methods and procedures	The WEG controllers measure the gross electricity generated by all the WEGs owned by PP connected to the main substation of the state utility
Monitoring frequency	-
QA/QC procedures	These WEG controller meters are factory calibrated and does not require further calibration.
Purpose of data	To monitor baseline emissions(Indirectly used to determine $EG_{p\ export,y}$ and $EG_{pimport.y}$)
Additional comment	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data/Parameter	**A**
Data unit	MWh/yr
Description	Total electricity exported to the grid measured at the substation
Source of data	Joint Meter Reading
Value(s) applied	To be determined ex post (Value to be used while apportioning)
Measurement methods and procedures	The main meter installed at the substation of the state utility would measure the total electricity exported to the grid continuously. A monthly meter reading taken jointly by state electricity board and PP representative is recorded in the JMR. There is also a check meter installed at the substation to measure the total electricity exported to the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter.
Monitoring frequency	Daily measurement and monthly recording
QA/QC procedures	These meters (main meter and the check meter) are the property of respective state electricity boards and calibration of the meters would be carried out once in a year. The accuracy class of the main meter and the check meter would be 0.2s.
Purpose of data	To monitor baseline emissions(Indirectly used to determine $EG_{p\ export,y}$ and $EG_{pimport.y}$)
Additional comment	The data will be kept for two years after the crediting period or from last

	issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

Data/Parameter	**B**
Data unit	MWh/yr
Description	Total electricity imported to the grid measured at the substation
Source of data	Joint Meter Reading
Value(s) applied	To be determined ex post (Value to be used while apportioning)
Measurement methods and procedures	The main meter installed at the substation of the state utility measures the total electricity imported from the grid continuously. A monthly meter reading taken jointly by state electricity board and PP representative is recorded in the JMR. There is also a check meter installed at the substation to measure the total electricity imported from the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter. The monitoring of the same is being done by state electricity board and PP has no role in it.
Monitoring frequency	Continuous measurement and monthly recording
QA/QC procedures	These meters (main meter and the check meter) are the property of respective state electricity boards and calibration of the meters would be carried out once in a year. The accuracy class of the main meter and the check meter would be 0.2s.
Purpose of data	To monitor baseline emissions(Indirectly used to determine $EG_{p\ export,y}$ and $EG_{pimport.y}$)
Additional comment	The data will be kept for two years after the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.

B.7.2. Sampling plan

Not Applicable.

B.7.3. Other elements of monitoring plan

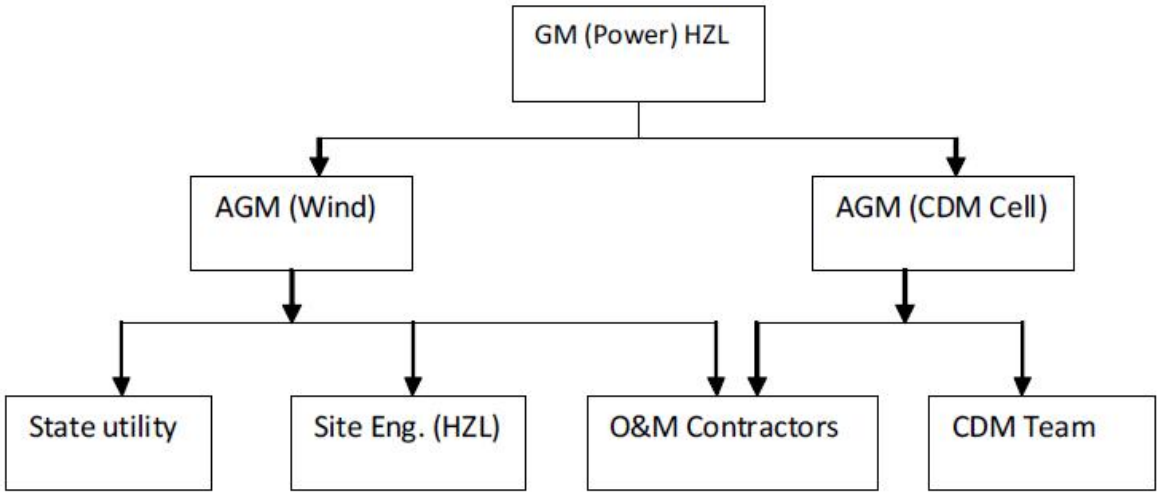
The purpose of the monitoring plan is to define the organizational structure of the monitoring team, monitoring practices, QA and QC procedures and archiving procedures. The monitoring plan will ensure that the emission reductions from the project activity are reported accurately and transparently.

Roles and Responsibilities of the Monitoring Team

The responsibility of project management as well as monitoring, measurement and reporting lies with HZL. The project proponent has formulated a Monitoring Team to ensure proper and continuous monitoring of the emission reductions as well as performance of turbines and generation of power.

To ensure trouble free operation of all the wind turbines, HZL has entered into a comprehensive Operation and Maintenance agreement with Suzlon Infrastructure Services Limited. The O&M contractor would be responsible for the operation and maintenance of the WTGs. The O&M personnel are qualified engineers and are trained for carrying out the operation and maintenance activities.

The monitoring team will interact with the O&M contractors as well as the State Utility officials for executing the monitoring plan. The structure of the Monitoring Team is as follows:



Monitoring Team	Roles & Responsibilities
General Manager (Power), HZL	• Communication with CDM EB • Communication with state utility
AGM (CDM Cell), HZL	• Overall coordination with monitoring team and DOE for verification activities • Maintaining data records, documentation and archiving
CDM Team	• Assisting the General Manager (Wind) with overall coordination and with maintaining data records, documentation, archiving etc.
AGM (Wind) HZL	• Coordinating with Site Engineer, O&M operators, and State Utility
Site Engineer, HZL	• Overseeing monitoring, operation and maintenance activites at site • Interacting with State Utility and O&M contractors for JMRs and calibration
O&M contractors	• Carrying out operation & maintenance of WTGs • Carrying out joint meter readings with state utility
State Utility	• Carrying out joing meter readings with representative of project proponent (O&M contractors) • Calibration of energy meters

The site engineer from HZL shall supervise the wind power plant operations under the guidance of the Manager. The Site Engineer of HZL will also interact with the O&M contractors and ensure that the WTG generation reports and JMR statements are forwarded to the Manger for review and electronic archiving. The O&M contractors would be responsible for forwarding monitoring data to Manager of HZL. The Manager would review the monitoring records and suggest corrective action

as and when required. The Manager – Commercial will ensure that records of payments for sale of electricity to the state utility are maintained and archived electronically. HZL management will have a CDM review meeting on a bi-annual basis for review of the emission reductions and performance of the project activity.

Metering Arrangements and Procedures

The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication shall be as per the PPA (power purchase agreement). The electricity exported from the sub-station will be metered using electronic trivector meters. A main and check meter of 0.2 accuracy class would be installed for every feeder at the sub-station of the state electricity board. On a monthly basis, a joint meter reading will be carried out in the presence of the state electricity board officials and representatives of the project promoters.

The WTGs will be connected to different feeders, and each feeder will have a corresponding metering point at the sub-station. Each feeder would have several WTGs connected to it, some of which may not be part of the project activity. An apportioning procedure would be carried out to calculate electricity exported from the HZL project activity. This procedure is described below.
Apportioning Procedures for calculation of Net Electricity Exported from Project Activity

The net electricity exported to the grid by project activity is recorded in JMR statements. The main billing meter at substation records total export, and total import by all the connected WTGs to the particular feeder. Additionally, the O&M contractors maintain records of the electricity generation from individual WTGs which is monitored through the SCADA system. This data is used for the apportioning of electricity export and import to individual WTGs.

The electricity export and import by the WTGs of HZL is calculated by using the following methodology

Parameter	Figure	Unit
Gross electricity generated by all WEGs connected to feeders and hence substation of the state utility	X	MWh
Gross electricity generated by all WEGs owned by PP in project activity	Y	MWh
Share of all WEGs owned by PP in project activity in gross generation	(Y/X) %	%
Total electricity exported to the grid measured at the substation of the state utility	A	MWh
Total electricity imported from the grid measured at the substation of the state utility	B	MWh
Share of all WEGs owned by PP in project activity in total export	(Y/X) % * A	MWh
Share of all WEGs owned by PP in project activity in total import	(Y/X) % * B	MWh
Net export of all WEGs owned by PP in project activity	[(Y/X) % * A] – [(Y/X) % * B]	MWh

Quality control and Quality Assurance procedures:

Calibration Procedures:

Main meters and check meters are installed for monitoring the energy exported. The main and check meters shall be tested for accuracy every calendar year with reference to a portable standard meter. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2 accuracy class. The data registered by the main meter alone will be adopted for the purpose of calculation as long as the error in the main meter is within permissible limits. If during the annual accuracy tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the limits, the main meter reading shall be

considered as usual. However, the check meter shall be calibrated immediately. If the main meter is found to be beyond the permissible limits of error, but corresponding check meter is within limits, then the check meter reading shall be adopted for that period. The main meter shall be calibrated immediately.

Apportioning Procedures in case the dates of monitoring period do not match with billing cycle dates

The monitoring period for the project activity may start from a date that does not coincide with the date of the initial reading of the respective JMR statement. For instance the monitoring period may start on the 20th of the month whereas the JMR Statement may report the net electricity generation data from the first of the month to the first of the next month. In such a scenario, the net electricity generation data from the start of the monitoring period to the first date of the next month (the apportioning period) would be determined as follows:

Apportioned Net Electricity Generation	=	Apportioning Ratio	x	Net Electricity Generation as per JMR Statement

The apportioning ratio would be determined as the ratio of the electricity generation at the WTG for the apportioning period to the electricity generation at the WTG for the entire period covered under the JMR statement. This procedure would only have to be followed for the first and last month of the monitoring period if the start and end dates do not coincide with the date of the joint meter readings of the energy meters.

Data collection and archiving

The daily data on electricity generation from WTGs at the site is collected in electronic form. Monthly JMR statements, invoices and break up sheets are collected and maintained in hard copy, and archived electronically. The project proponent shall keep complete and accurate records of all the data as a part of monitoring for at least a period of 2 years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

15/06/2011

This date corresponds to the date of purchase orders for the project activity.

C.2. Expected operational lifetime of project activity

The expected operational lifetime is 20 years, as given in the technical specifications for the WTGs.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

The project activity will use renewable crediting periods.

C.3.2. Start date of crediting period

The Project Proponent has applied of renewal of second crediting period. The strat date of the crediting period is 01/12/2020.

C.3.3. Duration of crediting period

7 years, 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

As per the Ministry of Environment and Forests (Government of India) notification the project activity does not fall under the purview of the Environmental impact Assessment thus the project activity is exempted from the environmental clearances. It should be noted here that though EIA is not a regulatory requirement in India for wind energy projects.

There are no negative environmental impacts that are envisaged due to the project activity. The following are the positive impacts due to the project activity.

- *Impact on air and water*: Wind energy is a form of renewable electricity generation; hence there would be no release of GHG into the atmosphere. Also as there is no fuel used for electricity generation no effluents or solid waste (such as ash) are generated.

- *Socio economic impact:* The project activity helps create demand for skilled and unskilled manpower in the region. The project will be providing employment opportunity to not only during the construction phase, but also during its operational life time. The project activity improves employment rate and livelihood of local populace in the vicinity of the project.

Moreover, the project generates eco-friendly, GHG free power, which contributes to sustainable development of the region.

D.2. Environmental impact assessment

The project activity i.e. electricity generation from wind, clean and green source of power which will result in no negative impact on environment. Further as per the applicable regulation, the implementation of the wind park does not require an environmental impact assessment. The Ministry of Environment and Forests (MoEF), Government of India notification dated 1st December, 2009 regarding the requirement of Environment Impact Assessment (EIA) studies[23] states that any project developer in India needs to file an application to the Ministry of Environment and Forests (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Wind parks are not included in this list and thus an EIA is not necessary.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The project activity being undertaken envisages the installation of a wind farm for supply to grid. The stakeholders for a project activity are defined as the public, including individuals, groups or communities, affected, or likely to be affected, by the proposed CDM project activity.

A meeting was organized by Suzlon Infrastructure Services Ltd. on 07/09/2011 at the office of M/s Suzlon Infrastructure Services Ltd. at L&D Centre, 3 Gokul, Behind Bhatia Bagichi, Hanuman Chauraha, Jaisalmer, to inform the local stakeholders about the project activity and discuss their concerns, if any, regarding the project activity. Local stakeholders including Sarpanchs and residents of the neighbouring villages were invited to the meeting through a newspaper advertisement and a public notice.

The agenda of the meeting was as follows:

- Welcome Speech
- Introduction to Climate Change and Clean Development Mechanism
- Views expressed by the villagers

[23] As per the Environment Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) MINISTRY OF ENVIRONMENT AND FORESTS) http://envfor.nic.in/legis/eia/so1533.pdf

- Interactive session with the stakeholders
- Vote of Thanks

The representatives of Suzlon Infrastructure Services Ltd. and the project proponent presented the salient features of the project activity to the stakeholders. The opinions expressed by the local stakeholders and the respective responses were recorded.

E.2. Summary of comments received

A summary of the comments and queries from the stakeholders are presented below along with the responses from the representatives of the project participants:

Comment / Query from Stakeholder	Response from Representative of the Project Participant
We feel that more projects can be brought here. Can the number of projects be increased?	With support given by villagers, state electricity board, and government officials, the number of wind turbines in the region can be increased.
Can electricity be supplied to the villagers and neighbourhood areas?	The power generated will be transmitted to the state electricity grid. The state electricity board distributes the power to according to the amount of power at its disposal and the power demand.

The stakeholders also acknowledged the socio-economic benefits of the project activity including improved infrastructure in the region, and employment opportunities for local residents.

E.3. Consideration of comments received

There were no concerns raised by the local stakeholders. The potential benefits of the project activity for the local stakeholders were acknowledged.

SECTION F. Approval and authorization

The project obtained Host Country Approval from MoEFCC vide letter number 4/6/2012-CCC dated 14/09/2012.

Appendix 1. Contact information of project participants

Organization name	Hindustan Zinc Limited
Country	India
Address	CPP-CLZS, Chanderiya lead zinc smelter,Putholi, Chittorgarh-312021, Rajasthan
Telephone	91-9928140302, +91-1472-2564801
Fax	+91-1472-256593
E-mail	V.Jayaraman@vedanta.co.in
Website	-
Contact person	Mr. V. Jayaraman

Organization name	EKI Energy Services Limited
Country	Australia
Address	Enking Embassy, Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010
Telephone	91-9584461638
Fax	-
E-mail	naveen@enkingint.org
Website	-
Contact person	Mr. Naveen Sharma

Appendix 2. Affirmation regarding public funding

There is no public funding from parties included in annex I in the said project activity

Appendix 3. Applicability of methodologies and standardized baselines

The baseline information has been provided in section B.6.

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

The monitoring plan has been already explained in section B.6.2.

Appendix 5. Further background information on monitoring plan

Please refer section B.7.3 of the PDD.

Appendix 6. Summary report of comments received from local stakeholders

Please refer section E.1 & E.2 of the PDD.

Appendix 7. Summary of post-registration changes

Not Applicable

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.

Version	*Date*	*Description*
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document