Project design document form

(Version 11.0)

BASIC INFORMATION	
Title of the project activity	5 MW Solar PV Power Project at NTPC-Dadri, a Business unit of NTPC limited
Scale of the project activity	☐ Large-scale ☒ Small-scale
Version number of the PDD	Version 7.0
Completion date of the PDD	25/09/2020
Project participants	NTPC LIMITED
Host Party	India
Applied methodologies and standardized baselines	Methodology: AMS-I.D.: Grid connected renewable electricity generation (version .18.0)
Sectoral scopes	Sectoral scope 1: Energy industries (renewable - / non-renewable sources).
Estimated amount of annual average GHG emission reductions	6,187[1] tCO2e

[1] Please Refer ER Sheet for Detailed Calculations

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Description of Project Activity

The 5 MW Solar Photo Voltaic project being developed by NTPC Limited at NTPC-Dadri is a green field activity and is being pursued as a part of its green initiatives. The project activity involves installation of plant to generate electricity from solar energy by utilizing the solar radiation potential available. The PV module is made from high efficiency crystalline silicon solar cells. Modules generate direct current (DC) which is converted to alternating current (AC) by inverter hardware. Power generated is stepped to 220KV to supply power to grid.

Implementation status

The LoA for the main plant has been placed in March, 2012 to M/s Wipro Eco Energy Limited as EPC contractor. M/s Wipro Eco Energy Limited is responsible for carrying out civil works including fixing up of Module Mounting Structure (MMS); supply of photovoltaic modules; supply of inverter, control and monitoring system; comprehensive installation of switchyard and mechanical & electrical integration..

Project activity commissioning date: 30/03/2013

Date of registration of project activity with UNFCCC: 29/12/2012

Purpose

The project proponent NTPC Limited is committed to make sustainable development through economic, environmental and social performance. With the growing concern for clean generation with less CO_2 emission, the company had focused on energy efficient technologies such as supercritical technology, integrated gasification combined cycle and renovation & modernization of old thermal power plants, generation with renewable energy sources like solar, wind, biomass, hydro.

Purpose of the project is to generate 6,568.9857 MWh/year of energy annually to supply to the Indian grid without emission of CO_2. Project activity is in line with its core purpose of the organisation as reflected in Mission statement of NTPC given below

"Develop and provide reliable power, related products and services at competitive prices, integrating multiple energy sources with innovative and eco-friendly technologies and contribute to society".

The pre-project scenario and baseline scenario

Pre-project scenario

The project activity is the green field activity, which involves installation of new solar power project at site where there was no renewable energy power plant operating prior to the implementation of the project activity.

NTPC and its stations are assimilating new technologies to retain competitive advantage in power generation and are striving for satisfaction all stakeholders through sustainable performance.

Baseline Scenario

Currently in India 81.2% of power generation is from coal, gas, diesel, naphtha, lignite and oil. This is resulting in emission factor 0.9419 tCO2 /MWh in Indian grid. The baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources. In the absence of the project activity, the electricity would be generated using fossil fuel based power plants. Hence, the electricity grid has been taken as the baseline for the project activity. The main emission sources in the pre-project scenario are the power plants connected to the Indian grid and the main greenhouse gas involved is CO_2. On the basis of estimated annual generation as detailed in section B.6.3 of this PDD, the annual average GHG emission reduction in the second crediting period through the project activity estimated to be 6,187 tCO_2e based on the generation.

Sustainability Aspects

This project is contributing to the sustainable development of the Indian society as following detailed below:

Technological Well-being: The installed capacity for non-captive power generation in India as on 31/03/2019 was 356,100.19 MW while solar PV power contribution to installed capacity is 35122.33 MW[2]. Taking up the solar plant boosted the sector and accelerate technology development and encourage investment for further capacity addition. Introduction of solar photovoltaic technology upgrades its efforts for cleaner technology. It results in the improvement of the technical skill and knowledge level of the employees of the organization.

Social well-being: As a responsible corporate entity, NTPC owns social responsibilities. Apart from the number of facilities for its employees and their families the company is taking up community development activities. The project activity effectively results in corresponding social benefits by saving or enhancing availability of a corresponding amount of natural resources like

[2] https://cea.nic.in/reports/monthly/installedcapacity/2020/installed_capacity-06.pdf

coal and natural gas for other use. The project activity is to reduce the effect of global warming .As per CERC regulation, the proceeds of carbon credit from approved CDM project shall be shared between generating company and the beneficiaries of power in the following manner, namely a) 100% of the gross proceeds on account of CDM benefit to be retained by the project developer in the first year after the date of commercial operation of the generating station ; b) In the second year, the share of the beneficiaries shall be 10% which shall be progressively increased by 10% every year till it reaches 50%, where after the proceeds shall be shared in equal proportion, by the generating company and the beneficiaries.

Environmental well- being: The electricity generated by the 5 MW solar power plant, which is clean and non polluting, has displaced the equivalent power generated by the already operational emission intensive power plants in the grid thus, resulting in reduction of greenhouse gases.

Economic Well-Being: Station has been producing and supplying power to grid in the most economic and competitive manner, leading to overall economic development of the region.. It enhances the investment in clean environment and diversify the sources of electricity generation, which is important for meeting the growing energy demands and the transition away from the electricity generation from fossil fuel.

A.2. Location of project activity

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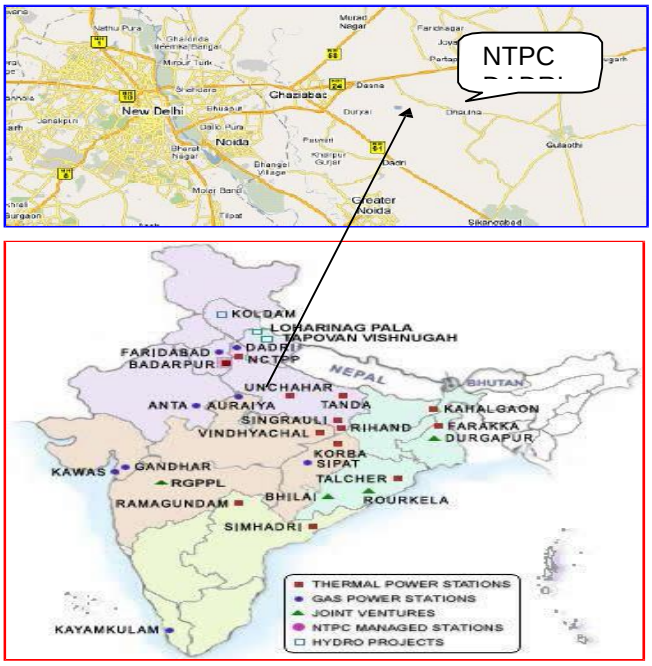
The station is situated on the Dadri -Dhaulana road, 10 kilometres away from Grand Trunk road and 12 kilometres away from the National Highway # 24. The project is well connected with Delhi & Ghaziabad by rail & road. The nearest city is Ghaziabad at a distance of 25 kilometres approximately.

Sl no	Description	Location details
1.	Latitude	28°34'40.13"N
2.	Longitude	77°37'56.35"E
3.	Elevation	205 M above MSL
4.	Site	Land between tube well no 3 and 4, adjacent to the plant boundary wall.



A.3. Technologies/measures

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The project has installed the photovoltaic power plants with 5 MW capacity. PV panels convert sunlight to electrical energy. They generate direct current (DC) that is converted to alternating current (AC) by inverter hardware. Voltage is stepped up in stages to 220KV for feeding to the electricity grid. The high efficiency crystalline silicon solar cells are used for the proposed project. Each string consisting of modules connected in series is taken to the String combiner Box (SCB). SCB's are combined to form the input of one inverter. The plant consists of 20,856 no. of 240 Wp high efficiency crystalline silicon solar modules arranged in 869 nos. of array with 24 modules in each array. The combined capacity of all inverters taken together has 5 MW requirement. The respective digital outputs are taken to a supervisory controller located in the control room. Electronic surge arrestors provided at the DC input & the AC output of each inverter. Necessary HT switch gears are provided for HT isolation & protection.

Each inverter system having conversion efficiency over 96%, and have an independent Data Acquisition system (DAS) which produces the real time data as well as event logs indicating all the supervisory faults also. These data via bus is taken to a master Supervisory control & Data Acquisition (SCADA System). Service interface on the operator panel is also provided.

Since the project activity is a Greenfield installation, there was no electricity generation at the project site prior to its implementation. As per CERC guidelines, the average life of the plant equipment is 25 years which is warranted by the manufacturer.

a. Main plant Equipment and System

- Solar Photovoltaic modules
- Power conditioning units
- Control equipments
- Data Acquisition system (DAS) with event log
- Supervisory control & Data Acquisition (SCADA System).
- 1.1 KV/33 KV 2.5 MVA transformer
- 33 kV transmission line
- Switchgear equipments and 33KV/220 KV 7.5 MVA transformer
- Main energy meter on 1.1 KV /33KV line to monitor energy generated and exported

Sl. No	Equipment	Efficiency
1.	Module (240 Wp)	≥14.6 %
2.	Inverter (Satcon 500 kW)	97.6 % (peak)
3.	Transformer	Minimum 98%
The PLF (Plant Load Factor) is 16.58%		

b. Energy and mass flow

Being a solar plant, there is no mass flow. Further, energy and mass flow of the project activity does not have any effect on GHG emissions.

c. Existing Facilities, systems, equipment

Being a new project there are no existing facilities, systems or equipment.

d. Technology Transfer

NTPC has placed order for equipment to M/s Wipro Eco Energy Limited which in turn is procuring solar panels from M/s Waree Energy. There is no technology transfer from Annex – I country.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	NTPC LIMITED (Public entity)	No

A.5. Public funding of project activity

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No public funding from Parties included in Annex I to the Convention is available for the project, and hence there is no diversion of official development assistance.

The Project is assumed to be funded through a debt and equity mix in the ratio of 70:30. The project is considered to be financed on the balance sheet of NTPC. Project financing has not been considered for the proposed project. Accordingly, equity shall be financed through NTPC sources and debt would be borrowed by NTPC for infusion in the project. With regard to the debt component, it has been assumed that 100% of the debt shall be borrowed by way of domestic commercial borrowings. (Source: Financial Appraisal Report by M/s CRISIL).

A.6. History of project activity

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The proposed CDM project activity is a registered CDM project activity with registration number 9392 and registration date 29/12/2012; please refer the below weblink

https://cdm.unfccc.int/Projects/DB/RINA1356736344.31/view

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

(b) The proposed CDM project activity is not a project activity that has been deregistered.

(c) The Project activity is not rejected by any other GHG mechanism.

A.7. Debundling

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Based on the information provided in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity.

The project participant confirms that none of the conditions mentioned above is applicable to this project activity and we have not registered any small scale CDM activity or apply to register another small scale CDM project activity within the same project boundary, in the same project category and technology. Accordingly, the project is not a debundled component of a larger project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

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The project falls under UNFCCC sectoral scope 1: Energy industries (renewable - / non-renewable sources).

Methodology Title:

AMS-I.D.: Grid connected renewable electricity generation (version 18), EB 81, Annex 24, dated 28/11/2014

Tool used:

Tool to calculate the emission factor for an electricity system, Version 07, EB 100, Annex 4 , dated 31/08/2018

Further information for the methodology can be found at:

https://cdm.unfccc.int/methodologies/SSCmethodologies/approved

B.2. Applicability of methodologies and standardized baselines

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S.No	>>**AMS-I.D. ver 18 applicability conditions**	**Project Applicability**
1.	This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal, and renewable biomass: (a) supplying electricity to a national or a regional grid. or (b) supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	This project generates energy from solar energy and supply electricity to the national grid. Hence the condition (a) is applicable.
2.	Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies as included in Table 2 (as shown below.) of the methodology.	The project supplies electricity to the national grid. Hence, this criteria for AMS-I. D is applicable.
3.	This methodology is applicable to project activities that: (a) Install a Greenfield plant; (b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s).	The project activity is installation of a new grid connected solar power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (green field plant) and hence this criteria (a) is applicable.

4.	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m^2 • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2	This project activity is solar based renewable energy power generation and doesn't involve installation of hydro power plant. Hence, this is not applicable.
5.	If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	The project activity is a solar based renewable electricity generation project. Hence, there is no fossil fuel fired in this project activity. The total installed capacity of this project activity is 5 MW, which is below than the limit of 15 MW.
6.	Combined heat and power (co-generation) systems are not eligible under this category.	This project activity is not a combined heat and power (cogeneration) systems and hence, the criterion is not applicable.
7.	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	This project activity is a solar based renewable electricity generation project and does not involve addition of capacity in any existing renewable energy generation unit. The total capacity of this project activity is 5 MW which is less than the limit of 15 MW.
8.	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Since there is no retrofit or replacement of unit in the project activity, this criterion is not applicable.
9.	In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	Not applicable This project activity is a Solar power projects.

10.	In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	Not applicable The project activity is not a biomass related project.

Table 2: Applicability of AMS-I. D, AMS-I.F and AMS-I.A based on project types

	Project type	AMS-I.A	AMS-I.D	AMS-I.F
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	
4	Project supplies electricity to a mini grid[3] system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

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

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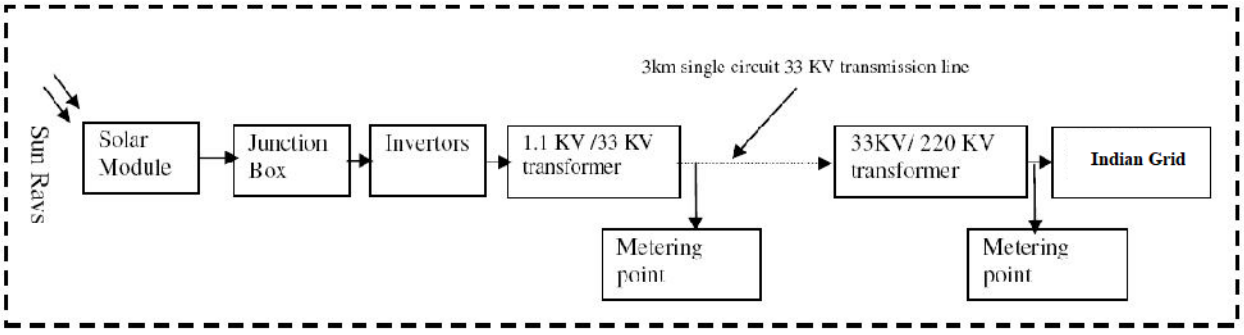
As per the approved small scale methodology AMS I.D, the spatial extent of the project boundary "includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to". Hence the project boundary includes the solar PV array, invertors, transformers, metering/substation system and Indian grid.



The project boundary is diagrammatically represented in the figure above.

[3] The sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW.

Location of Physical Boundary of Proposed Solar Plant in the vicinity of Ash Mound.

Source		GHG	Included?	Justification/Explanation
Baseline	Power Generation in the Regional Electricity Grid	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	On site fossil fuel consumption due to project activity	CO_2	No	Electricity generation through Solar does not lead to emission of greenhouse gases. The CO_2 emission through fossil fuels are neglected.
		CH_4	No	Electricity generation through Solar does not lead to emission of greenhouse gases.
		N_2O	No	Electricity generation through Solar does not lead to emission of greenhouse gases.

B.4. Establishment and description of baseline scenario

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As per the approved consolidated Methodology AMS-I. D (Version 18) para 19:

*"*The baseline scenario is that 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".

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” (EB66 Annex 47), the demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have been resulted from that scenario. The “CDM project standard for project activities” (Version 02.0) states in paragraph 284 that project participants shall assess and incorporate the impact of national and/or sectoral policies and circumstances existing at the time of requesting renewal of the crediting period, on the current baseline GHG emissions, without reassessing the baseline scenario.

As such and in accordance with Tool and AMS-I. D version 18, the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” is applied for the demonstration of the validity of the current baseline;

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

The validity of the current baseline is assessed using the following sub-steps:

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

The Project has received necessary approvals for development and commissioning for wind project from the state nodal agencies and is in compliance to the local laws and regulations. The Project activity conforms to all the applicable laws and regulations in India

The relevant national laws and regulations pertaining to generation of energy in India are:

- Electricity Act 2003
- National Electricity Policy 2005
- Tariff Policy 2006

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

- Power generation using renewable energy is not a legal requirement or a mandatory option
- There are state and sectoral policies, framed primarily to encourage Renewable power projects
- These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments
- The Indian Electricity Act, 2003 (May 2007 Amendment) does not influence the choice of fuel used for power generation

- There is no legal requirement on the choice of a particular technology for power generation

Thus, the project is in compliance with laws and regulations required. There is no mandatory requirement to implement the project activity. Thus, the present national and/or sectoral policies and circumstances toward installation of any electricity generation is similar compared to at the time of project registration. Thus, baseline of this project has not changed.

Step 1.2: Assess the impact of circumstances

An assessment of the impact of circumstances exists at the time of requesting renewal of the crediting period on the current baseline emissions has been conducted, without reassessing the baseline scenario. The emission factor for the Indian grid as well as the current grid matrix in the country has been revised. Accordingly, Baseline CO_2 Emission Database, Version 15, published by Central Electricity Authority (CEA), Government of India has been used for estimation of baseline emissions.

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

Since the project activity is a Greenfield project with a life time of 25 years, the baseline scenario identified during the validation of the project was electricity generation in power plants which are connected to Indian Integrated grid, that are displaced due to the project activity and was not the continued use of the current equipment(s) or investment for the crediting period of which the renewal is being requested. Hence this sub step is not applicable for this project activity.

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

The emission factor for the grid as well as the current grid matrix in the country has been revised. Accordingly, Baseline CO_2 Emission Database, Version 15, published by Central Electricity Authority (CEA), Government of India has been used for estimation of baseline emissions.

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

As a result of Step 1.4 above, this Step 2 is applied.

Step 2.1: Update the current baseline

Based on the latest approved AMS-I.D and the assessment results of Steps 1.1, 1.2 and 1.4 above, the current baseline has been updated.

Step 2.2: Update the data and parameters

In line with Step 1.4, the following data and parameters that were only determined at the start of the first crediting period and not monitored during the crediting period are updated according to relevant data sources listed in table below. These data and parameters are applied to calculate the grid emission factors are described under section B.6.2 as well as described below: -

In accordance with the methodology AMS-I. D, Version 18.0, the baseline scenario is that 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. The proposed project activity will evacuate the power to Indian grid which would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid (Indian grid) in baseline scenario. For the proposed CDM project activity, as per AMS- I.D. (Version 18.0), the baseline emissions are the product of electrical energy baseline $EG_{BL,y,}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} \times EF_{CO2,grid,y}$$

Where,

BE_y	is the baseline emissions in year y, tCO_2
$EG_{BL,y}$	is the quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	is the CO_2 emission factor of the grid in year y, tCO_2e/MWh

As per AMS- I.D. (Version 18), the Emission Factor ($EF_{CO2,grid,y}$) can be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the '***Tool to calculate the emission factor for an electricity system***'.

OR

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The applicable methodology also states that, calculations must be based on data from an official source (where available) and made publicly available. With the purpose of providing a ready reference for the emission coefficients to be used in CDM projects, the Government of India, has published, "CO_2 Baseline Database for the Indian Power Sector", Version 15..0,

December 2019. This database is an official publication of the Government of India for the purpose of CDM baselines. It is based on the most recent data available with the Central Electricity Authority (CEA), Government of India.

Option (a) has been considered to calculate the grid emission factor as per the'Tool to calculate the emission factor for an electricity system' as data is available from an official source.

In this project activity, Grid emission factor has been calculated and **fixed ex-ante.**

The Operating Margin has been taken as a generation-weighted average of the past 3 years:

Operating Margin (OM)

Year	2016-17	2017-18	2018-19
Simple Operating Margin (tCO_2/MWh) including imports	0.9636	0.9543	0.9685
Net generation (GWh) including imports	916,278	960,693	995,957
Generation-weighted OM	0.9622		

According to 'Tool to calculate the emission factor for an electricity system' EB 100, annex 04, Build Margin of the last one year has been selected:

Build Margin

Year	2018-19
Build Margin (tCO_2/MWh)	0.8811
Net Generation (GWh)	233,460

Further, based on the baseline emission factor (combined margin) arrived above, the expected baseline emissions in year y (BEy in tonnes of CO_2) has been calculated in section B.6.3.

Source: CO_2 Baseline Database for the Indian Power Sector", Version 15.0, December 2019, Central Electricity Authority, India. For more detail calculation, please refer Section B.6.1 of this PDD.

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 (0.75) & build margin (0.25) values, sourced from Baseline CO_2 Emission Database, Version 15 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 and 2018-19) generation weighted average, sourced from Baseline CO_2 Emission Database, Version 15, 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	Baseline CO2 Emission Database, Version 15, published by Central Electricity Authority (CEA), Government of India.

B.5. Demonstration of additionality

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As per Annex 27 **"GUIDELINES ON THE DEMONSTRATION OF ADDITIONALITY OF SMALL-SCALE PROJECT ACTIVITIES"** (Version 09.0) of EB 68 report, documentation of barriers is not required for the positive list of technologies that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW). The positive list consists grid-connected and off grid renewable electricity generation solar technologies (photovoltaic and solar thermal electricity generation). Since the installed capacity of the project is 5MW i.e. much below 15MW and photovoltaic technology power generation is in the positive list, the project activity defined as automatically additional.

The start date of the project activity is 07 March 2012, which corresponds to date of placing notification of award for supply and erection of equipments for the project. Start date is prior to the date of publication of the PDD for the global stakeholder consultation. The following are the evidences of prior consideration:

S no	Event	Date /Month
1.	Publication of feasibility report with CDM Consideration by NTPC Renewable Energy & Distributed Generation wing	Dec 2009
2.	Local external stake holder consultation meet	22/07/2011
3.	Initiation of proposal for validation contract	17/08/2011
4.	Signed Power supply agreement with Gridco Limited ,Orissa	26/04/2011

5.	Approval of director (Tech) NTPC Ltd for applying for approval of host country	09/09/2011
6.	Intimation to UNCCC EB of intention for CDM project activity	16/09/2011
7.	Host country approval received	16/03/2012
8.	Award of contract for supply and installation of equipments of project	07/03/2012

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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Applied Methodology: AMS - I.D, version 18, EB 81, Annex 24

Baseline Emissions:

As per the Methodology AMS-I.D (Version 18.0, EB 81) para 22:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid- connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline emissions in year y (t CO_2/yr)

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

$EF_{grid,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

According to Paragraph 26 of AMS I.D Ver. 18, if the project activity is the installation of a greenfield power plant, the quantity of net electricity generation is as follows;

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

Where,

$EG_{PJ,facility,y}$ Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

Calculation of $EF_{grid,y}$

The methodology provides following approaches for emission factor calculations:

(a) *Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology "Tool to calculate the emission factor for an electricity system".*

OR

(b) *The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.*

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' (Version 07.0, EB 100 Annex 4) since data is available from an official source.

CO_2 Baseline Database for the Indian Power Sector, Version 15, Dec 2019[4], 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 7.0, 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

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

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, all the 5 zones have been synchronized and called as Indian Grid.

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

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

The data required to calculate Simple adjusted OM 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 CO_2 emissions per unit net electricity generation (t CO_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 CDM-PDD to the DOE for validation.

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

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

a) **Simple OM**

In the Simple OM method, the emission factor is calculated as generation - weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants. Simple OM can be calculated using any of the two available methods. Option A has been selected where the data on fuel consumption and net electricity generation of each power plant/ unit is available. The CEA baseline is derived using the following formulae to calculate simple OM

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

Where:

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

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

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

m = All power units serving the grid in year *y* except low-cost / must-run power units

y = The relevant year as per the data vintage chosen in Step 3

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

The emission factor of each power unit *m* is determined applying Option A1.

If for a power unit m data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows:

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

Where:

$EF_{EL,m,y}$= CO_2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$FC_{i,m,y}$= Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)

$NCV_{i,y}$= Net calorific value (energy content) of fossil fuel type *i*in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$= CO_2 emission factor of fossil fuel type *i*in year *y* (tCO_2/GJ)

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

m = All power units serving the grid in year *y* except low-cost/must-run power units i = All fossil fuel types combusted in power unit *m* in year *y*

y = The relevant year as per the data vintage chosen in Step 3

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

Simple Operating Margin Emission Factors (t CO2/MWh) (incl. Imports)			
	2016-17	**2017-18**	**2018-19**
Indian Grid	0.9636	0.9543	0.9685

Net Generation in Operating Margin (GWh) (incl. imports)			
	2016-17	**2017-18**	**2018-19**
Indian Grid	916,278	960,693	995,957

Weighted Generation Operating Margin (t CO_2/MWh)	**0.9622**

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

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

(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 PDD and is fixed for the entire crediting period.

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

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

Where:

$EF_{grid,BM,y}$–Build margin CO_2 emission factor in year y (tCO_2/MWh)

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

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

m –Power units included in the build margin

y –Most recent historical year for which power generation data is available

Build Margin (tCO_2/MWh) (not adjusted for imports)[5]	
	2018-19
Indian Grid	**0.8811**

Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)

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

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

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

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}:

(a) Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods

Therefore, $EF_{grid,CM,y}$	=	0.9622*0.75 + 0.8811*0.25
	=	0.9419 t CO_2/MWh

Baseline emission factor (EF_y):

The baseline emission factor is calculated using the combined margin approach as described in Step 6 above:

Therefore, $EF_y = EF_{grid,CM,y}$ = 0.9419 t CO2/MWh.

Project Emissions:

According to AMS I.D Ver.18, it states that,

"For most renewable energy power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$

Where:

PE_y = Project emissions in year y (t CO_2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (t CO_2/yr)

$PE_{GP,y}$ = Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (t CO_2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (t CO_2e/yr)

As the project activity is the installation of a new grid-connected solar power plant/ unit and does not involve any project emissions from fossil fuel, operation of dry, flash steam or binary geothermal power plants, and from water reservoirs of hydro power plants. Therefore $PE_{FF,y}$, $PE_{GP,y}$, $PE_{HP,y}$ are equal to zero and thus, $PE_y = 0$.

Leakage Emissions:

No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

Emission reductions:

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$

Where:

ER_y = Emission reductions in year *y* (t CO2e/yr)

BE_y = Baseline emissions in year *y* (t CO2/yr)

PE_y = Project emissions in year *y* (t CO2e/yr)

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operational Margin of the Indian Grid
Source of data	Central Electricity Authority (CEA) of India Database as given in user guide version 15 of Dec 2019
Value(s) applied	0.9622
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0.0" as 3-year generation weighted average using data for the years 2016-17, 2017-18 & 2018-19. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 15.0, published by the Central Electricity Authority, Ministry of Power, Government of India
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build Margin of the Indian Grid
Source of data	Central Electricity Authority (CEA) of India Database as given in user guide version 15 of Dec 2019
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 07.0.0" as 3-year generation weighted average using data for the years 2018-19. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 15.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{grid,CO2,y}$
Data unit	tCO_2/MWh
Description	Emission factor of the Indian Grid
Source of data	Central Electricity Authority (CEA) of India Database as given in user guide version 15 of Dec 2019
Value(s) applied	0.9419(Indian grid)
Choice of data or measurement methods and procedures	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh) $EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (tCO2/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

>>

Global radiation data was taken from the METEONORM 6.1.0.12 software. The following assumption was taken into consideration:

- Temperature correction of the module was taken as 0.35 % per degree centigrade.
- The energy output to grid is arrived after considering 97% transformer efficiency 2% Cable loss and 96% inverter efficiency.
- Energy output further reduced by 6% due to the uncertainty of radiation data of METEONORM.
- Energy output was further reduced by 4% due to UV degradation, dust etc
- Energy production would reduce @ 1% every subsequent year (degradation factor) due to aging (as per feasibility report).
- Auxiliary Power Consumption is taken negligible as per industry standard, i.e. CERC guidelines.

Annual electricity generation

Plant Load Factor as per financial appraisal report done by M/s CRISIL	16.58% (This is in line with EB 48,Annex 11)
Working days /annum (assumed)	365
Working hours/days (assumed)	24
Degradation Factor (2nd year onwards)	1%
$EG_{BL, y}$ – second crediting period energy output (MWh)	
1st Year	6,768.6958
2nd Year	6,701.0089
3rd Year	6,633.9988
4th Year	6,567.6588
5th Year	6,501.9822
6th Year	6,436.9624
7th Year	6,372.5928

Equations used for emission reductions

Baseline Emission

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

$$BE_y = EG_{BL\ y} * EF_{CO2, grid, y}$$

Where:

BE_y Baseline Emissions in year y (t CO_2)

$EG_{BL, y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{CO\ 2, grid\ y}$ CO_2 emission factor of the grid in year y (t CO_2/MWh)

Project Participant	Capacity	PLF (%)	Average Annual Generated Power in the 2nd crediting period (MWh/year)	Baseline Emission Factor (tCO2/MWh)	Baseline emissions (tCO2/ year)
NTPC Ltd	5 MW	16.58%	6,568.9857	0.9419	6,187

BE_y = 6,568.9857* 0.9419 t CO_2/ year = 6,187 tCO_2/year

The project activity pertains to supply of power to Indian Grid .So emission factor 0.9419 tCO_2/MWh applies to our project activity as mentioned in B.6.1

Project emissions:

Project activity being a construction of a new solar power plant there is no project emission.

Leakage emissions:

There is no leakage involved as the energy generating equipment is not transferred from another activity.

Emission reductions:

Year	Estimation of baseline Emissions (tCO_2e) BEy	Estimation of project Activity emissions (tCO2e) PEy	Estimation of leakage (tCO2e) LEy	Estimation of emission reductions (tCO2e)- ERy = BEy – PEy – LEy
2020	6,768.6958*0.9419= 6,375.43 say 6,375	0	0	6,375

2021	6,701.0089*0.9419= 6,311.68 say 6,311	0	0	6,311
2022	6,633.9988*0.9419= 6,248.56 say 6,248	0	0	6,248
2023	6,567.6588*0.9419= 6,186.07 say 6,186	0	0	6,186
2024	6,501.9822*0.9419= 6,124.21 say 6,124	0	0	6,124
2025	6,436.9624*0.9419= 6,062.97 say 6,062	0	0	6,062
2026	6,372.5928*0.9419= 6,002.34 say 6,002	0	0	6,002

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2020	6,375	0	0	6,375
2021	6,311	0	0	6,311
2022	6,248	0	0	6,248
2023	6,186	0	0	6,186
2024	6,124	0	0	6,124
2025	6,062	0	0	6,062
2026	6,002	0	0	6,002
Total	43,308	0	0	43,308
Total number of crediting years	7			
Annual average over the crediting period	6,187	0	0	6,187

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{BL\,y}$
Data unit	MWh/y
Description	Quantity of net electricity supplied to the grid in year y
Source of data	Energy meter is used for billing purpose. Energy meters are the property of M/s PGCIL who is the pan India transmitter of power in India.
Value(s) applied	6,568.9857 (Average)
Measurement methods and procedures	Measurement methods and procedures is according to that detailed in the Power Purchase Agreement (PPA). ABT compliant Main meter, Check meter and stand-by meter with 0.2 accuracy class as per CEA (Installation & operation of meters) regulations 2006 / IEGC as applicable are installed. Main meter and check meter are installed at the common connection point at which all the solar modules are connected i.e. at the premises of generating station on the HV side of 1.1 KV / 33 KV step-up transformer and Stand-by meter is installed on the HV side of 33KV/220KV transformer. (Refer to Section B.7.3). 1. Two no. of Export Energy meter (Joint Energy Meter, JEM) installed at PP ends by M/s PGCIL one is main meter another is check meter. These meters are tamper proof & any types of problem in meter are resolved jointly. 2. Net Export data are downloaded through special type of down loader from the JEM in DAT format and that can not be tampered. 3. Net Export data are downloaded on daily basis (only main meter) by the PP for blockwise generation data and the weekly data main & check meter are sent to Northern Region Load Dispatch Centre (NRLDC) on Monday to Monday in DAT format only. 4. These data are compiled by the NRLDC and sent to Northern Regional Power Committee (NRPC) for further compilation. NRPC publishes the Regional Energy Account (REA) data on the website on weekly basis and any discrepancy in the data are also resolved through revised REA data. 5. At PP ends these REA data are downloaded from the NRPC site (www.nrpc.gov.in) and compared with station end data and if there is any discrepancy in the REA it will be intimated to the NRLDC for resolving the issue. If the REA data are ok then it is uploaded at PP SAP. On the basis of SAP data monthly invoices are prepared by the commercial department and sent to the concerned consumer. 6. Net electricity supplied to the grid are cross checked with records for sold / purchased electricity (e.g. invoices / receipts) and saved in SAP system. Data are downloaded from the meters at regular intervals as decided by SLDC/RLDC for preparation of the REA account.
Monitoring frequency	- Continuous monitoring of power generated from control room - 15 minute block wise measurement - Daily recording of energy - Reporting data of energy exported to regional load despatch centre weekly

QA/QC procedures	There are two metering points, one after 1.1/33KV step-up transformer and another after 33KV/220KV step-up transformer. Three types of meters, i.e., main meter, check meter and stand-by meters are installed. Main and check meters of 0.2S accuracy class are installed in upstream of 1.1/33KV transformer and standby meter of 0.2S accuracy class is installed in upstream of 33/220KV step-up transformer. The main and check meters is checked jointly at the installation as per the CEA (Installation & operation of meters) regulations 2006 as amended from time to time. Data is downloaded from the meters at regular intervals as decided by SLDC/RLDC for preparation of the REA account Regular cross checking and analysis of meter readings and meter failure or discrepancies are reckoned as per CEA (Installation & operation of meters) regulations 2006 as amended from time to time. If the main meter or check meter is found to be not working at the time of meter reading or at any other time, NTPC informs the SLDC/RLDC of the same. In case of failure of meters, energy accounting for the period are as per procedure laid down by CERC or as per the mutually agreed procedure. In case of absence of any such procedure, the following procedure is followed: In case of failure of main meter, reading of check meter for the corresponding period is considered for energy accounting. If both the main and check meter(s) fail to record or if any of the PT fuses is blown out, energy is computed based on standby meters. In case of disputes, resolution is mutually discussed and amicably resolved within 90 days. **Testing and Calibration:** All meters are calibrated and tested as per procedure laid out in CEA (Installation & operation of meters) regulations 2006. The meters are tested once in five years by NABL accredited agency engaged by M/s PGCIL in the presence of representative of NTPC and M/s GRIDCO as per procedure laid out in CEA (Installation & operation of meters) regulations 2006. These meters are also be tested whenever the energy and other quantities recorded by the meter are inconsistent with electrically adjacent meter or regional load despatch centre reports abnormality in reading. After testing, the meter are recalibrated if required at manufacturer's works or replaced. Quality assurance system elaborating the roles and responsibilities has been implemented to ensure consistency and accuracy of monitoring.
Purpose of data	Calculation of baseline emissions
Additional comment	- Data are kept for two years after the last issuance of CERs for this project activity. - Data are aggregated daily, monthly and yearly

B.7.2. Sampling plan

>>

Data and parameters monitored in this project activity is being generated energy which are measured continuously and totalised using energy meter. Sampling approach is not required.

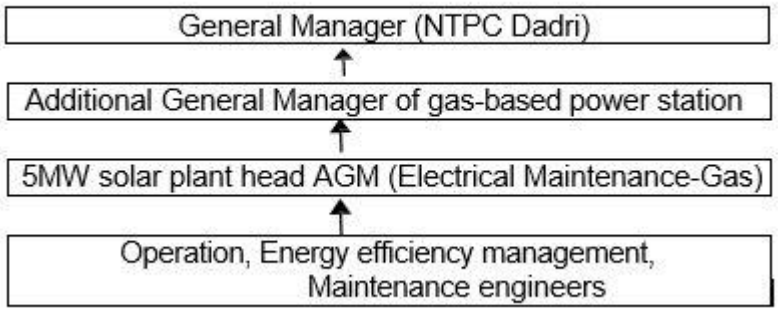
B.7.3. Other elements of monitoring plan

>>

The project activity falls under Category type **I.D. Grid connected renewable electricity generation** and AMS I.D version 18.0 is applicable for monitoring

Operational and management structure

The organisation structure for the proposed power plant envisages a head for operations and maintenance of solar power plant with reporting structure as given below



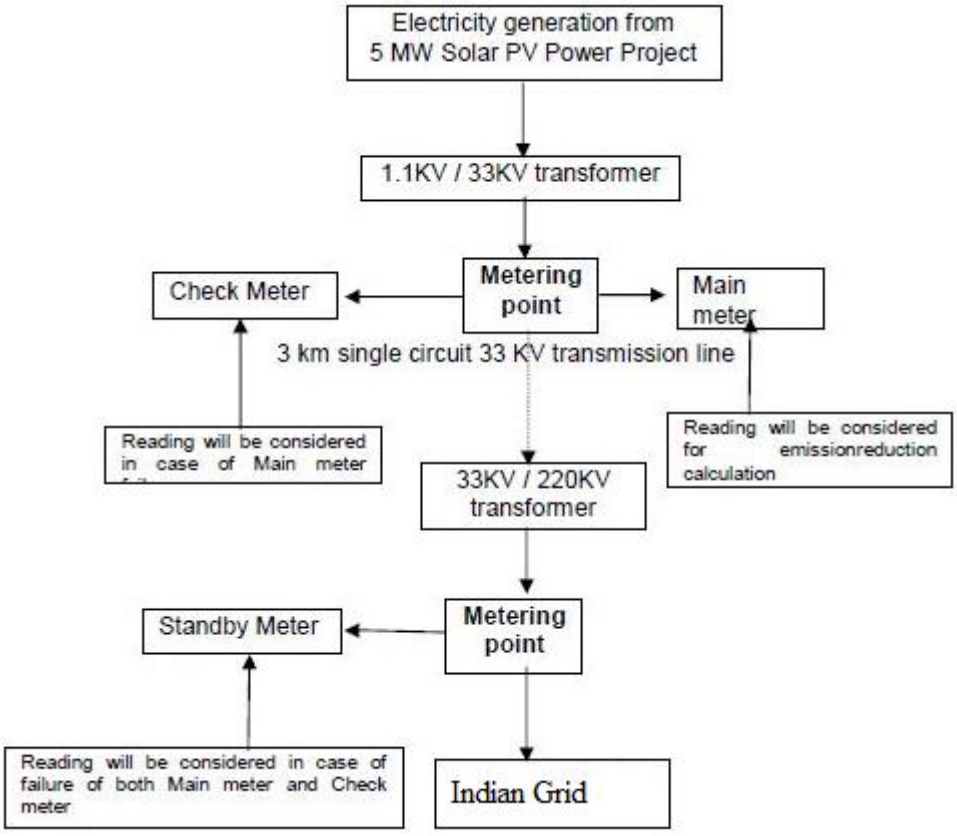
Responsibility:

General Manager i.e. Station Head has complete control over all activities. AGM (Electrical Maintenance-Gas) have been assigned responsibility as Head of solar plant. He has assisted by operation, energy efficiency management and maintenance personnel and have overall responsibility of monitoring of power generation and measurement of power generated in 15 minutes blocks and consolidating daily, weekly, monthly & yearly and archiving the same. The day- to-day operation control is performed by the shift in charge engineers who monitor solar power generation continuously. Energy efficiency management engineer are responsible for archiving and reporting of energy generated as measured by online special energy meter

Designation	Responsibility
Head of the Station	➢ Holds complete control over monitoring aspects pertaining to the project ➢ Review of Monitoring report
AGM (O&M Gas)	➢ Oversees the collection, recording and storage of data ➢ Entire power plant operation & maintenance
Head of Solar Plant AGM (EM GP)	➢ Maintenance of all equipments ➢ Coordination with other maintenance groups ➢ Training of the staff

Operation Personnel AGM (OPN)	➢ Day to day operation ➢ Data collection and storage
Energy and Efficiency Monitoring group	➢ Archiving and reporting of energy generated as measured by online special energy meter ➢ Monitoring of power generation and measurement of power generated in 15 minutes blocks ➢ Periodic checking of recorded & stored data ➢ Responsible for carrying out periodical testing and calibration of equipments and meters. ➢ Emission reduction calculation & Monitoring report preparation

Metering Arrangement:



Data Measurement:

Main and check meters are installed as per the specification stipulated in the PPA. The accuracy of energy meter is 0.2S. There is continuous monitoring of power generated from control

room, 15 minute block wise measurement and reading is recorded daily and data of energy exported is reported to regional load despatch centre weekly. The electricity supplied to the grid is measured continuously using main meter and check meter installed at the HV side of 1.1 KV / 33 KV transformer of the project. In case of failure of main meter, reading of check meter for the corresponding period is considered for energy accounting. If both the main and check meter(s) fail to record or if any of the PT fuses is blown out, energy is computed based on standby meters.

Data collection and archiving:

The meter readings from main and check meters are collected under the supervision of Energy and Efficiency Monitoring Group of Gas station, NTPC Dadri. The net electricity supplied data should be recorded and stored in electronic form. The records are checked periodically by the AGM (O&M Gas). The period of the storage of the monitored data is 2 years after the end of crediting period or till the last issuance of CERs for this project activity whichever occurs later.

QA/QC procedures:

Refer section B.7.1 of PDD.

Personal training:

In order to ensure proper functioning of the project activity and proper monitoring of emission reductions, the staff is trained. The Operation personnel are trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan. Head of the solar plant are responsible for the training of the staff.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>

As per Glossary CDM terms version 10.0, the start date has been considered as the earliest date at which either the implementation or construction or real action of a CDM project activity begins.

Start date of project activity is 07/03/2012, the day of issuing notification for award for supply and erection of solar plant equipments to M/s Wipro Eco Energy. This is the earliest date in which NTPC Limited has committed expenditures for construction and supply of plant.

C.2. Expected operational lifetime of project activity

>>

25 years 00 months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Type of Crediting period - Renewable

This is the second renewal crediting period .

C.3.2. Start date of crediting period

>>
Start date of Second Crediting period is: 01/01/2020

C.3.3. Duration of crediting period

>>
7 Years 00 Month. Seven-year crediting period will be renewed twice.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
As per circular No. J-11013/41/2006-IA.II(I) “Applicability of environmental clearance for Solar Photo Voltaic (PV) Power Projects”, by Government of India, Ministry of Environment and Forests, the Solar PV power project are not covered under the ambit of EIA notification 2006, and no environment clearance is required for such projects

(refer http://moef.nic.in/divisions/iass/Cir/Circulars.html).

D.2. Environmental impact assessment

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Operation stage of the PV power plant does not have significant environmental impact as there are no waste products, any requirements for cooling, any moving parts, any noise, any emission or any discharge of effluent into water. In life cycle stages of solar cell where there is environmental impact are mining stage, manufacturing stage and decommissioning stage not in operational stage. Installing solar power plants may require 20 acres of land. Since the land being used is an area inside boundary of existing thermal power generating units use of land does not impact existing ecosystems much. During decommissioning solid waste generated has been disposed to recyclers as per e-waste management rule 2011 and environmental system guidelines.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

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As per definition of Stakeholders in annexure of Decision 3/CMP.1 of UNFCCC stakeholders means the public, including individuals, groups or communities affected, or likely to be affected, by the proposed clean development mechanism project activity.

The project proponent has invited comments / suggestions from local stakeholders for the proposed project activity on 22/07/2011. The stakeholders identified for the project activity were:

1. Individuals from local communities
2. Head of gram panchayat of nearby villages
3. School principals of local villages
4. Local shop keepers
5. Government agencies
6. Various customer from transmission and distribution company
7. Vendors of the company
8. Officials from the customer organization

To inform the local stakeholders about the project activity, invitation for attending stakeholder consultation meet on 22/07/2011 was given in the local newspapers “Veer Arjun”, “Prabhat” and “Mahamedha” ON 21/07/2011. Forty two (42) stakeholders have attended the meeting on 22/07/2011 and were explained about the project activity and the related benefits arising out of the project activity.

Feedback / queries were invited from the stakeholders. Comments were invited by circulating a printed format. The comments received in written and verbal form in these meetings were compiled.

E.2. Summary of comments received

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The meeting was chaired by AGM (O&M Coal), Sh. M. Siva Rama Krishna who was officiating as station head. During the deliberations NTPC officials made presentation and replied various queries raised by stakeholders. Few of the comments received along with the stakeholders are tabulated below

S.No	Comment	Stakeholder	Response
1.	Passing CDM benefit to customer	Shaswat Srivastava, Executive from North Delhi Power Limited	CERC guidelines was explained in this regard.

2.	Will the installation cost of the project be passed to the consumer?	Heera Das Maity, Manager, Bombay Suburban Electric Supply (BSES) Yamuna Power Limited	No. However benefit from carbon credits will be shared with the consumer as per the CERC guidelines.
3.	We sincerely admire the efforts of NTPC to generate green power	Surendra Kumar, Gram Pradhan (Village: Chauna)	
		Suresh yadav (Village: OonchaAamirpur)	
		Raj Singh Rana (Village: Rasulpur)	
4.	It is an excellent effort	K D Veer, principal, KendriyaVidyalaya, NTPC Dadri	
5.	I'm in favour of solar power as it is 100% clean energy	KapeeshRastogi, Manager, North Delhi Power Limited	NTPC officials explained other social and economic benefits of the project activity
6.	Being CO_2 free, this kind of projects are always welcome	Kuldeep K Saxena, Technical Manager, Shell India Markets Pvt. Ltd., Gurgoan	

All the stakeholders unanimously ensured their support to make this project a successful one. They were in favour of such projects being set up in their locality as it would help them in standardising their economic conditions.

E.3. Consideration of comments received

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The queries of the stakeholders were answered satisfactorily by the project participant. The project proponent explained the positive impacts of the proposed solar photovoltaic project in detail. The stakeholders were happy about the fact that there will be overall development of the local region due to the project activity. There were no negative comments received from the stakeholders on environmental impact.

SECTION F. Approval and authorization

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The project activity has been received Host Country Approval on 16/03/2012 from the National CDM Authority i.e. Government of India Ministry of Environment and Forests.

Appendix 1. Contact information of project participants

Organization name	NTPC LIMITED
Country	India
Address	Engineering Office Complex, Noida , U.P
Telephone	0120-2410569
Fax	0120-2410538
E-mail	nspsingh@ntpc.co.in
Website	ntpc.co.in
Contact person	Mr. N.S.P Singh

Appendix 2. Affirmation regarding public funding

Refer to Section A.5

Appendix 3. Applicability of methodologies and standardized baselines

Refer to section B.2

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

CO_2 Baseline Database for the Indian Power Sector version-15.0 December 2019 published by Central Electricity Authority.

http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf

Appendix 5. Further background information on monitoring plan

Refer to Section B.7

Appendix 6. Summary report of comments received from local stakeholders

Please refer to section E of the PDD.

Appendix 7. Summary of post-registration changes

Two corrections have been identified in the registered PDD

1. There are corrections in geographical coordinates due to typo graphical error. These corrections do not affect design of the project. These corrections are as per para 1 of Appendix 1 of CDM project Standard and fall under the category of changes that do not require prior approval of the Board.
2. DGM has been re-designated to AGM due to delayering of organizational hierarchy as per NTPC internal circular no 710/2012 dated 21.08.2012. Please refer operational and management structure in section B7.3. The correction does not affect the design of the project. This correction is in line with para 1 of Appendix 1 of CDM project Standard and falls under the category of changes that do not require prior approval of the Boar.

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.

Version	*Date*	*Description*
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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