



**Project design document form for  
CDM project activities  
(Version 08.0)**

**PROJECT DESIGN DOCUMENT (PDD)**

<b>Title of the project activity</b>	30 MW Solar PV Project by Nirosha Solar Power Private Limited
<b>Version number of the PDD</b>	03
<b>Completion date of the PDD</b>	17/02/2018
<b>Project participant(s)</b>	Nirosha Solar Power Private Limited
<b>Host Party</b>	India
<b>Applied methodology(ies) and, where applicable, applied standardized baseline(s)</b>	ACM0002- Grid-connected electricity generation from renewable sources --- Version 17.0
<b>Sectoral scope(s) linked to the applied methodology(ies)</b>	Sectoral Scope 1: Energy Industries (renewable - /non-renewable sources)
<b>Estimated amount of annual average GHG emission reductions</b>	46,815 tCO <sub>2</sub> e per year

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

The main purpose of this project activity is to generate clean form of electricity through renewable solar energy source. Nirosha Solar Power Private Limited is the promoter of the proposed project activity. The project activity involves installation of 30 MW (AC) solar power project Village: Bendo, District: Mahoba, Uttar Pradesh. The project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 46,815 tCO<sub>2</sub>e per year ( average of 7 year crediting period), thereon displacing 47,884 MWh/year amount of electricity from the generation-mix of power plants connected to the Indian grid, which is mainly dominated by thermal/fossil fuel based power plant.

The details of the project and the state of installation are mentioned in the table:-

Project Promoters' Name	Capacity in MW	Connection with Grid	State	Usage of Electricity <sup>1</sup>
Nirosha Solar Power Private Limited	30 MW (AC)	Indian Grid	Uttar Pradesh	Sale to Grid

Sectoral Scope: 01 : Grid-connected electricity generation from renewable sources

Methodology : ACM0002: Grid-connected electricity generation from renewable sources- Version 17.0 (EB 89)

Project Type: (i) : Renewable energy projects

#### Tools referred with above methodology are:

Tool to calculate the emission factor for an electricity system<sup>2</sup> - Version 05.0 (EB 87, Annex 09)

#### Scenario existing prior to the implementation of project activity:

The scenario existing prior to the implementation of the project activity, is electricity delivered to the grid by the project activity that 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".

#### Baseline Scenario:

As per the applicable methodology, a Greenfield power plant is defined as "a new renewable energy power plant that is constructed and operated at a site where no renewable energy power plant was operated prior to the implementation of the project activity".

As the project activity falls under the definition of a Greenfield power plant, the baseline scenario as per paragraph 24 of Section 5.2.1 of applied methodology is the following:

*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".*

Hence, pre-project scenario and baseline scenario are the same.

<sup>1</sup> Currently project activity is exporting electricity to grid, however in case of change of scenario from sale to grid to either third party sale, captive purpose or sale in open access, there is no change in baseline scenario and project activity emission reduction calculations is depends on electricity supplied to grid by project activity.

<sup>2</sup> <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf>

**Sustainable development indicators**

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment and Forests (MoEF), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India<sup>3</sup>. Thus the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

**Social well-being**

The project activity provided / provides job opportunity to local people during erection, commissioning and maintenance of the solar project. Frequency of visiting villages and nearby areas by skilled, technical and industrialist increase due to installation /site visit/operation and maintenance work related to solar plant. This directly and indirectly positively effects the economy of villages and nearby area.

**Environmental well-being**

Solar power is one of the cleanest renewable energy powers and does not involve any fossil fuel. There are no GHG emissions. The impact on land, water, air and soil is negligible. Thus the project activity contributes to environmental well-being without causing any negative impact on the surrounding environment.

**Economic well-being**

The CDM project activity generates permanent and temporary employment opportunity within the vicinity of the project. The electricity supply in the nearby area improves which directly and indirectly improves the economy and life style of the area.

**Technological well-being**

The project activity is step forward in harnessing the untapped solar potential and further diffusion of the solar technology in the region. The project activity leads to the promotion and demonstrates the success of solar projects in the region which further motivate more investors to invest in solar power projects. Hence, the project activity leads to technological well-being.

**A.2. Location of project activity****A.2.1. Host Party**

India

**A.2.2. Region/State/Province etc.**

Uttar Pradesh

**A.2.3. City/Town/Community etc.**

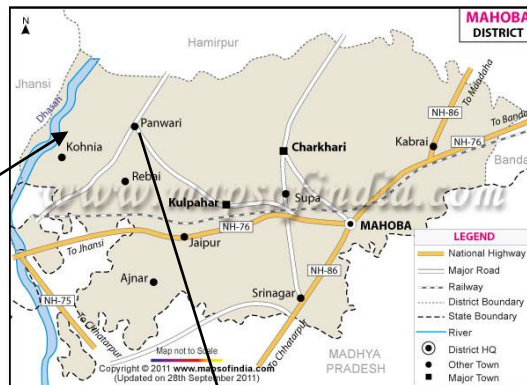
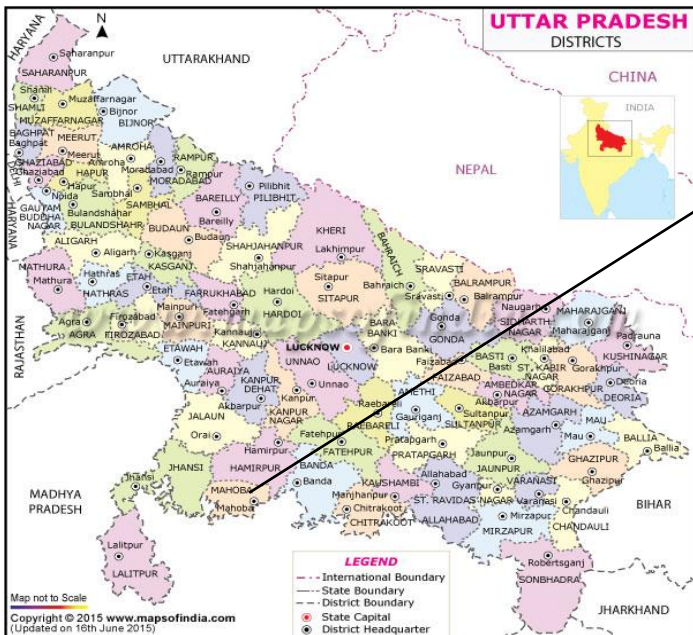
Village: Bendo, District: Mahoba

**A.2.4. Physical/Geographical location**


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<sup>3</sup> [http://www.cdmindia.gov.in/approval\\_process.php](http://www.cdmindia.gov.in/approval_process.php)

Project Promoters' Name	Latitude	Longitude	Date of Commissioning
Nirosha Solar Power Private Limited	25.42 N	79.44 E	20/09/2016



**A.3. Technologies and/or measures**

Sectoral Scope : 01 - Energy industries (renewable / non-renewable sources)  
 Project Type : I - Renewable Energy Projects  
 Project Category : ACM0002: Grid-connected electricity generation from renewable sources-  
 Version 17.0 (EB 89)

The project activity aims to harness solar energy through installation of PV with total installed capacity of 30 MW (AC).  
 For Plant Load Factor, please refer Section B.6.3.

Technical detail of the equipment <sup>4</sup>	Remark
Technology	Polycrystalline modules on Seasonal Tilt at 25 degree and 5 degree.
Solar photovoltaic module	(255 Wp,260 Wp Module make: BYD) (260 Wp,265 Wp Module make: Suntech)
No. of modules	132384
Total Number of Invertors	38 Units
Transformer	Power transformer: 31500 KVA(1 Nos), Aux. Trafo: 100 KVA(1 Nos), Inv. Trafo.: 4080 KVA (1 Nos),2800 KVA (8 Nos), Aux Trafo. ICR: 5 KVA (5 Nos)
Central inverters of nominal AC power output	680 KW , Schneider-total 38 invertors
Technical & Operational Lifetime	25 years

Section B.3 & B.7 mentions information related to metering & monitoring system.

#### Baseline Scenario:

As the project activity is the installation of a Greenfield power plant, the baseline scenario is the following as per applied methodology:

*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".*

Hence, pre-project scenario and baseline scenario are the same.

#### A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Nirosha Solar Power Private Limited	No

#### A.5. Public funding of project activity

There is no public funding from Annex 1 countries and no diversion of Official Development Assistance (ODA) involved in the project activity.

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

#### B.1. Reference of methodology and standardized baseline

Title : Grid-connected electricity generation from renewable sources  
Reference : The project activity meets the eligibility criteria of large scale project as it is more than 15 MW

<sup>4</sup> It is to be noted that module configuration ( i.e module rated capacity and number of modules) may change in future if existing modules have any problem, but total project output capacity remains same i.e 30 MW.

Methodology : ACM0002: Grid-connected electricity generation from renewable sources --- Version 17.0  
 Type I : Energy industries (renewable / non-renewable sources)  
 Category : Approved Consolidated Methodology (ACM0002)

**Tools referred with above methodology and applicable for project activity are:**

- Tool to calculate the emission factor for an electricity system<sup>5</sup> - Version 05.0 (EB 87, Annex 09)
- Tool for the demonstration and assessment of additionality<sup>6</sup>- Version 07.0.0 (EB 70, Annex 08)

**B.2. Applicability of methodology and standardized baseline**

The project activity involves generation of grid connected electricity from renewable solar energy. The project activity has an installed capacity of 30 MW (AC) which will qualify for a large CDM project activity under Type-I of the large scale methodologies. The project status is corresponding to the methodology ACM0002 version 17.0 and applicability of methodology are discussed below:

Applicability Criterion	Project Case
1. This methodology is applicable to grid-connected renewable energy power generation project activities that: <ul style="list-style-type: none"> <li>(a) Install a Greenfield power plant;</li> <li>(b) Involve a capacity addition to (an) existing plant(s);</li> <li>(c) Involve a retrofit of (an) existing operating plants/units;</li> <li>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</li> <li>(e) Involve a replacement of (an) existing plant(s)/unit(s)</li> </ul>	The project activity is a Renewable Energy Project i.e. Solar Power Project which falls under applicability criteria option 1 (a) i.e., "Install a Greenfield power plant". Hence the project activity meets the given applicability criterion.
2. The methodology is applicable under the following conditions: <ul style="list-style-type: none"> <li>(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;</li> <li>(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</li> </ul>	The option (a) of applicability criteria 2 is applicable as project is renewable energy solar power plant/unit.

<sup>5</sup> <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v5.0.pdf>

<sup>6</sup> <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-01-v7.0.0.pdf>

<p>3. In case of hydro power plants, one of the following conditions shall apply:<sup>7</sup></p> <ul style="list-style-type: none"> <li>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</li> <li>(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(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 (3), is lower than or equal to 4 W/m<sup>2</sup>, all of the following conditions shall apply: <ul style="list-style-type: none"> <li>(i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m<sup>2</sup>;</li> <li>(ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>(iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m<sup>2</sup> shall be: <ul style="list-style-type: none"> <li>a. Lower than or equal to 15 MW; and</li> <li>b. Less than 10 per cent of the total installed capacity of integrated hydro power project.</li> </ul> </li> </ul> </li> </ul>	<p>The project is installation of new solar based electricity generation plants (not a hydro power plant).</p>
<p>4. In the case of integrated hydro power projects, project proponent shall:</p>	<p>The project is solar power project and thus the criterion is not applicable to this project activity.</p>
<p>5. 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</p>	<p>The project is solar power project and thus the criterion is not applicable to this project activity.</p>

<sup>7</sup> Project participants wishing to undertake a hydroelectric project activity that result in a new reservoir or an increase in the volume of an existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

<p>6. 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 five years prior to implementation of CDM project activity.</p>	<p>The project is solar power project and thus the criterion is not applicable to this project activity.</p>
<p>7. 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.</p>	<p>(a) The project activity is Greenfield and there is no switching of fossil fuel to renewable energy. Hence the criteria is not applicable to the project activity                  (b) The project is not a biomass fired power plant</p>
<p>8. In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.</p>	<p>Not applicable, the solar project is a Green field project activity and this project is not the enhancement or up gradation project.</p>
<p>9. In addition, the applicability conditions included in the tools referred to below apply.<sup>8</sup></p>	<p>Please refer tables below.</p>

Tool to calculate the emission factor for an electricity system<sup>9</sup> - Version 05.0 (EB 87, Annex 09)

Applicability Criterion	Project Case
<p>This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).</p>	<p>The project is a grid connected Greenfield Solar power project and thus the tool is applicable.</p>
<p>Under this tool, the emission factor for the project electricity system can be calculated either for grid</p>	<p>Steps involved in calculation of Emission Factor is included in section</p>

<sup>8</sup> The condition in the “Combined tool to identify the baseline scenario and demonstrate additionality” that all potential alternative scenarios to the proposed project activity must be available options to project participants; does not apply to this methodology, as this methodology only refers to some steps of this tool.

<sup>9</sup> <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v5.0.pdf>

Applicability Criterion	Project Case
power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in “Appendix 2: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	B.6.3 of the PDD as per the requirement of the tool
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 is located in non-Annex I country and hence the tool is applicable
Under this tool, the value applied to the CO <sub>2</sub> emission factor of biofuels is zero.	The project is a Solar project and there is no involvement of biofuels.

- Tool for the demonstration and assessment of additionality- Version 07.0.0 (EB 70, Annex 08)

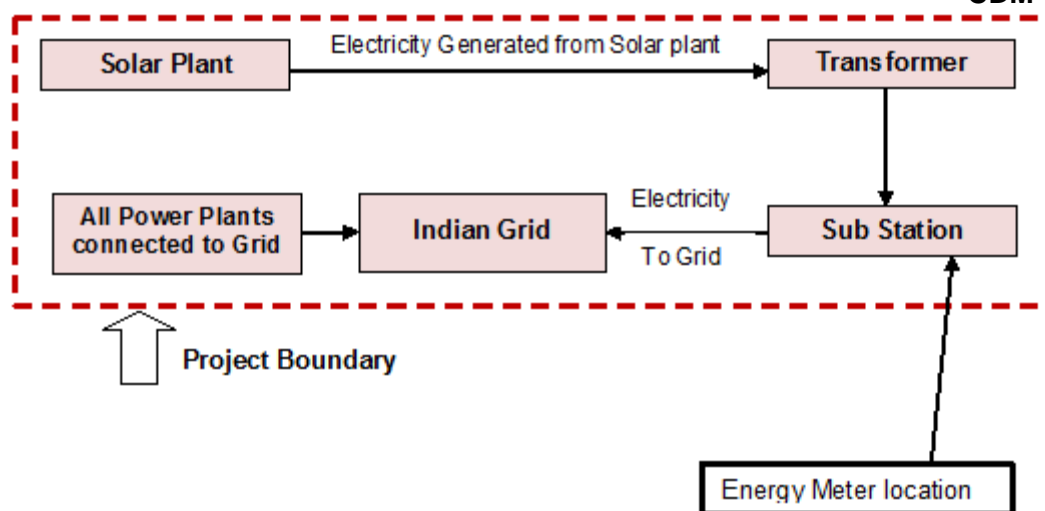
Applicability Criteria has been demonstrated in section on additionality below.

The project activity qualifies as Type I during every year of the crediting period in accordance with applicable provisions for project activity eligibility as discussed above. Also the total installed capacity of project activity is 30 MW which is more than 15 MW threshold limit for large scale project activities as per ACM0002: Grid-connected electricity generation from renewable sources Version 17.0. The project capacity will be always remain the large scale project activities throughout the crediting period and thereafter.

### B.3. Project boundary

As per ACM002 version 17 - “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 boundary includes the solar project, sub-stations, grid and all power plants connected to grid. The proposed project activity will evacuate power to the Indian grid. Therefore the entire Indian grid and all connected power plants have been considered in the project boundary for the proposed CDM project activity.



The GHG emission sources considered for the project boundary and their explanations are as follows:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Grid connected electricity generation.	CO <sub>2</sub>	Yes	Main emission source
		CH <sub>4</sub>	No	Minor emission source
		N <sub>2</sub> O	No	Minor emission source
Project scenario	Greenfield Solar PV Power Project Activity.	CO <sub>2</sub>	No	No CO <sub>2</sub> emissions are emitted from the project
		CH <sub>4</sub>	No	Project activity does not emit CH <sub>4</sub>
		N <sub>2</sub> O	No	Project activity does not emit N <sub>2</sub> O

**B.4. Establishment and description of baseline scenario**

As per the approved consolidated Methodology ACM0002 (Version 17.0, EB 89, Annex 1) para 24:

*“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 of solar projects to harness the power of sun 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 11 was the latest available data at the time of PDD 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:

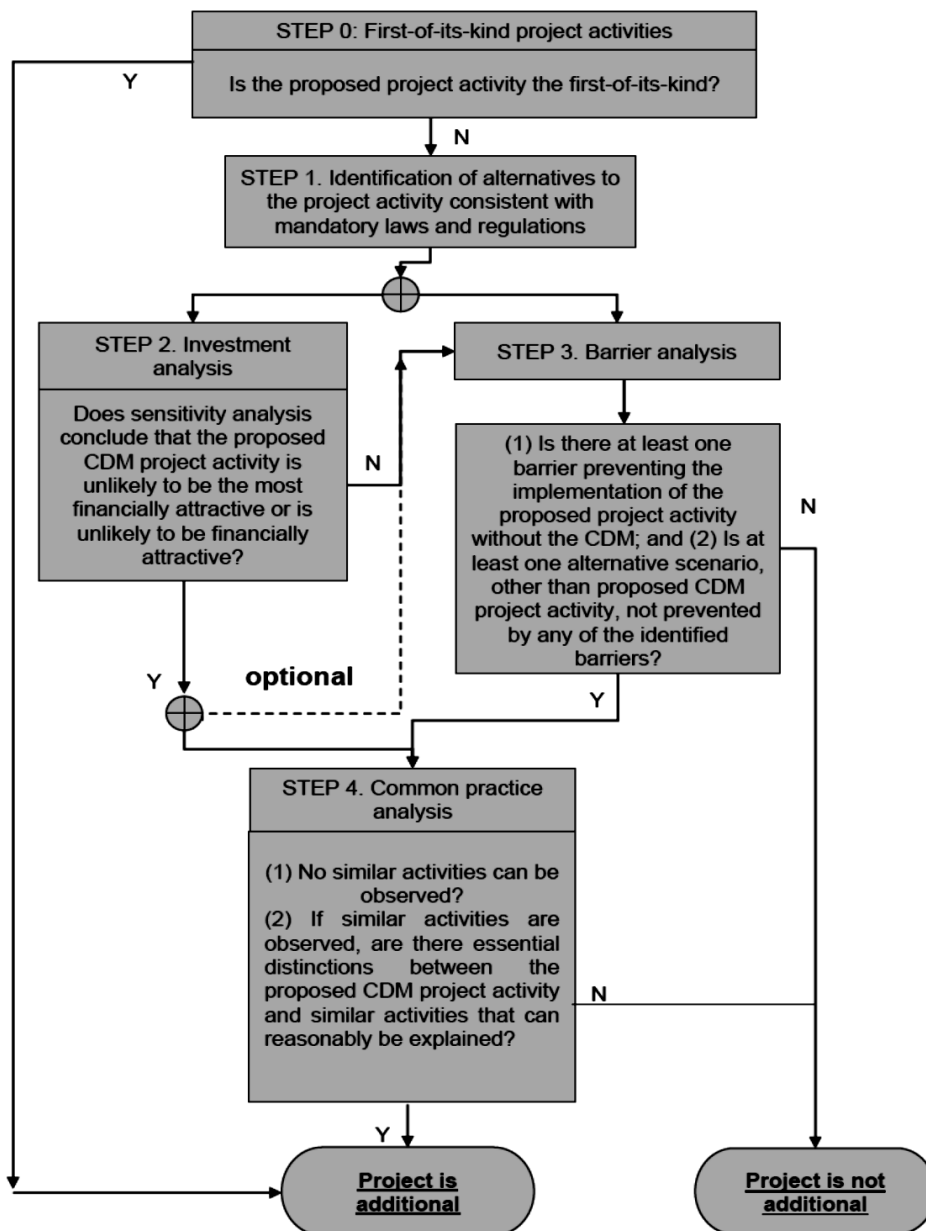
Parameter	Value	Nomenclature	Source
EF <sub>grid,y</sub>	0.9777 tCO <sub>2</sub> /MWh	Combined margin CO <sub>2</sub> emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline CO <sub>2</sub> Emission Database, Version 11.0, April 2016 published by Central Electricity Authority (CEA), Government of India
EF <sub>grid,OM,y</sub>	0.9903 tCO <sub>2</sub> /MWh	Operating margin CO <sub>2</sub> emission factor for the project electricity system in year y	Calculated as the last 3 year (2012-13, 2013-14, 2014-15) generation-weighted average, sourced from Baseline CO <sub>2</sub> Emission Database, Version 11.0, April 2016 published by Central Electricity Authority (CEA), Government of India
EF <sub>grid,BM,y</sub>	0.9285 tCO <sub>2</sub> /MWh	Build margin CO <sub>2</sub> emission factor for the project electricity system in year y	Baseline CO <sub>2</sub> Emission Database, Version 11.0, April 2016 published by Central Electricity Authority (CEA), Government of India

**B.5. Demonstration of additionality**

The table below is only applicable if the proposed project activity is a type of project activity which is deemed automatically additional, as defined by the applied approved methodology or standardized baseline.

Specify the methodology or standardized baseline that establish automatic additionality for the proposed project activity (including the version number and the specific paragraph, if applicable).	NA
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology or standardized baselines.	NA

The proposed CDM project generates power using Solar PV energy which is a renewable, zero emission source of energy. Baseline considerations for the project are based on approved consolidated baseline methodology ACM0002 (Version 17.0). The methodology requires the project proponent to determine the additionality based on “Tool for the demonstration and assessment of additionality”, Version 7.0.0. The step-wise approach to establish additionality of the project activity has been followed, details of which are provided in the following paragraphs:



**Step 0: Demonstration whether the proposed project activity is the first-of-its-kind**

The proposed project activity is not the first of its kind. Hence, this step is not applicable.

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

As per the applied methodology ACM0002 version 17.0; Para 24, 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 plant and by the addition of new generation sources.

As the baseline scenario is prescribed by applied methodology, hence no further analysis is carried out to identify alternatives.

**Step 2: Investment Analysis**

**Sub-step 2a: Determine appropriate analysis method**

As per “Tool for the demonstration and assessment of additionality” (version 07.0.0), for financial analysis of the project, the following three options are available:

- Option I: Simple Cost Analysis  
 Option II: Investment Comparison Analysis  
 Option III: Benchmark Analysis

The project will generate revenues from sale of electricity, therefore Option I is not applicable. Option II also does not apply since there is no comparable investment alternative available to the project participant. The most appropriate financial analysis method is therefore option III: the benchmark analysis, where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country.

**Sub-step 2b: Option III. Apply benchmark analysis**

Project proponents have considered Post-Tax Equity IRR for investment analysis at the time of decision-making. As Project proponents is only interested in the returns project is generating on the portion of investment costs, which is financed by them in the form of equity.

Since EB62 Annex 5 (Guidance on Investment Analysis Version 5) was applicable at the time of investment decision made (i.e on 16/05/2015) for the project activity, the same is referred for default value for cost of equity. As per Para 16 of EB62, Annex 5 states that Required/expected returns on equity are appropriate benchmarks for an equity IRR. Therefore, the Expected return on equity is considered appropriate benchmark.

Accordingly, the post-tax Equity IRR has been considered as the relevant financial indicator for Investment Analysis.

**Default Value Benchmark:**

As per EB 62, Annex 5, Page 9 Dated: 15 July 2011 the cost of equity is determined by selecting the values provided in the Appendix, i.e. Default values for cost of equity (expected return on equity) is presented below:

As per Table 1. Default values for the expected return on equity in EB 62, Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.75%**

The Required return on equity (benchmark) was computed in the following manner:

$$\text{Nominal Benchmark}^{10} = \{(1+\text{Real Benchmark}) \times (1+\text{Inflation rate})\} - 1$$

Where:

- Default value for Real Benchmark = 11.75% (As per EB 62, Annex 5)
- Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India) for India & in case where RBI Inflation forecast was not available Average Inflation rate forecast for India has been sourced from IMF web site.

**Benchmark estimation:**

As per Table 1. Default values for the expected return on equity in As per EB 62, Annex 5, Page 9 Dated: 15 July 2011 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.75%**

Inflation Forecast for India as per RBI website<sup>11</sup>:

Since RBI publishes the inflation forecast for 5 years and 10 years, PP has considered the maximum 10 year inflation considering the renewable crediting period of total 21 years.

<sup>10</sup> As per Pg. 320 of Corporate Finance, Second Edition of Aswath Damodaran

<sup>11</sup> <https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=15774>

Project Investor	Project Investor	Inflation Forecast (10 Years)	Benchmark
Nirosha Limited	Solar Power Private	5.30%	17.67%

Thus the benchmark of **17.67%** has been selected for this project activity.

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

Kindly refer the financial spread sheets for the key assumptions (web links & sources of input parameters) supporting the financial projections.

<b>Cost of the Project Activity</b>	
SPV Name	<b>Nirosha Solar Power Private Limited</b>
Project Location	Baidun, Mahoba
State	Uttar Pradesh
Project Capacity (MW)	30
Date of Commissioning	30-Sep-2016
Life of Plant in years	25
<b>DPR</b>	
<b>14-July-14</b>	

in INR MN

Items	Cost	Tax	Cost + Tax
Total Project Cost	2,600.00	-	3,001.70
<b>Total</b>	<b>2,600.00</b>	<b>-</b>	<b>3,001.70</b>
O&M Expenses	<b>24.00</b>	<b>3.71</b>	<b>27.71</b>
5% Escalation, starting from 2nd Yr.			

<b>Details of the project</b>		<b>Source</b>
State where the project is situated	Uttar Pradesh	DPR
Total Capacity (MW)	30.00	DPR
Expected Date of Commissioning	30-Sep-16	Assumption
Life of the plant (Yrs.)	25	DPR
<b>Generation of electricity</b>		
PLF (%)	18.30%	DPR
Annual generation (kWh)	4,80,92,400	Calculated Value
Degradation per year	0.50%	DPR
Tariff rate at the decision making (INR/kWh) for first 12 years	8.93	PPA
Tariff rate for rest years ( from 13 <sup>th</sup> to 25 <sup>th</sup> year) is 11th year APPC	3.55%	PPA
Transmission & Wheeling Losses (%)	0.00%	

GBI Benefit (INR/kWh)	-	As per MNRE scheme dt. 04.09.2013,
<b>Operation and maintenance cost and Insurance</b>		
O & M Expenses (INR Mn.)	27.71	
O & M free for (Yr.)	-	
Escalation in the operational expenses (%)	5.00%	
Administrative expenses (INR MN)	0.00	Administration and Miscellaneous expenses
Escalation in Administrative expenses	5.00%	Escalation for Admin Expenses
Insurance (INR Mn.)	13.00	CERC order
<b>Financial parameters</b>		
TOTAL COST (INR Mn.)	2600.00	DPR
Loan Amount (INR Mn.)	1950.00	
Equity Investment (INR Mn.)	650.00	Calculated Value
<b>Term loan</b>		
Loan Amount (INR Mn.)	1950.00	75% loan and 25% equity
Interest rate (%)	13.00%	
Loan Tenure (Qtr.)	56	
Moratorium Period (Qtr.)	3	
Repayment Period (Qtr.)	53	Calculated Value
Repayment instalments value (INR Mn.)	36.792	Calculated Value
1st instalment from (Qtr. end)	30-Jun-17	Considered from the next Quarter End
<b>Book Depreciation (SLM Method)</b>		
Land	-	
Gross Depreciable Value (INR Mn.)	2600.00	Calculated Value
Salvage Value (%)	10.00%	
Salvage value (INR Mn.)	260.00	Calculated Value
Net Depreciable Value (INR Mn.)	2340.00	Calculated Value
Residual Value (INR Mn.)	260.00	Calculated Value
<b>IT Depreciation</b>		
IT Depreciation (WDV Method) (%)	7.69%	As Per IREDA Operational Guidelines, Pg 5
<b>Income Tax</b>		
Financial Year	FY 2016-17	
Income tax rate (%)	30.00%	As Per Income Tax Rule, Pg 30 Para E(I)
MAT (%)	18.50%	As Per IT rule Pg 4
Service Tax including Swach Bharat and Krishi Kalyan Cess (%)	15.00%	As Per Income Tax Rule
Surcharge (%)	12.00%	As Per Income Tax Rule, Pg 30

Education cess (%)	3.00%	As Per Income Tax Rule, Pg 5, 11 and 12
<b>Final Tax rates</b>		
Income tax rate (%)	34.61%	Calculated Value
MAT (%)	21.34%	Calculated Value
Service Tax (%)	15.45%	Calculated Value

### **Justification for Tariff rate for rest years (from 13<sup>th</sup> to 25<sup>th</sup> year) is 11<sup>th</sup> year APPC:**

For the IRR calculation, the DPR is considered for the input parameters and tariff was fixed as INR 8.93 per KWh for initial 12 years and rest 13 years APPC (Average Power Purchase Cost) value was considered for financial calculation. The same is further demonstrated from PPA of the project activity. As per Article 2 Terms of Agreement of PPA, the price for rest 13 years will be considered as 11<sup>th</sup> year APPC.

The text of initial PPA is as below

### **2.3. Extension of PPA**

- 2.3.1 180 Days prior to expiry of this agreement, on willingness of SPP, UPPCL will extend this agreement with SPP for a further period of 13 years at the price of eleventh year Average Pooled Purchase Cost (APPC). However the budgetary support from UP State Government as incentive as per provision in the solar policy will be available only for initial 12 years of PPA and will not be available for the extended PPA of 13 years.

In this scenario, PP has considered the INR 3.55 per KWh for rest 13 years of the project activity. The APPC tariff rate considered for the project activity can be cross checked from below facts. As per CERC order dated 03/12/2015 which is in the matter of Calculation of Average Power Purchase Cost (APPC) at the national level <http://www.cercind.gov.in/2015/orders/SO15.pdf>. The tariff has been worked out as INR 3.40 per kWh for year 2015-16.

As per below web link, CERC Sets ₹3.48/kWh as the National Average Power Purchase Cost for Open Access

<https://mercomindia.com/cerc-sets-%E2%82%B93-48kwh-national-average-power-purchase-cost-open-access/>

Based on above, the considered APPC price for rest 13 years has been appropriate. Later on based on supplementary PPA, Nirosha Power Private Ltd will have to supply power from 13<sup>th</sup> year to 25<sup>th</sup> year at tariff which will be decided by commission taking into account RoE and O&M expenses. It was also noted that interest on loan and depreciation will not be admissible as most loans would have been paid off. Thus it is well understood that tariff from 13<sup>th</sup> to 25<sup>th</sup> year will be lower and in the range of APPC.

The text of supplementary PPA is as below

(c) The above PPA has been approved by Hon'ble Commission as per order dated 06-04-2016 (copy of which is collectively annexed hereto as Annexure-1) with the condition that M/s Nirosha Power Private Limited will have to supply power from 13<sup>th</sup> year to 25<sup>th</sup> year at the tariff as will be decided by the Commission at the appropriate time taking into account the RoE, O&M expenses and the interest on working capital loan. Interest on loan and depreciation will not be admissible as the loans would have been paid off and 90% of the project cost would have been allowed in the first 12 years. The procurers or the sellers can approach the Commission before the end of Eleventh year for determination of tariff for remaining 13 years. M/s Nirosha Power Private Limited vide their letter dated 15-07-2016 has given consent upon the UPERC order dated 06-04-2016.

It is also checked that if we consider the same tariff rate of first 12 years as INR 8.93 per kWh for 13<sup>th</sup> to 25<sup>th</sup> year, the equity IRR is still below the benchmark of the project activity. Even in sensitivity analysis i.e 10% increase in tariff rate is well below the benchmark. Thus the project remain additional with conservative tariff rate.

Considering the above input values, Equity IRRs is given below:

S. No	Project Investor	Equity IRR without CDM	Benchmark (Equity IRR)
1	Nirosha Solar Power Private Limited	9.26%	17.67%

The CDM project activity cannot be considered as financially attractive as the equity IRR for the project activity is less than the Benchmark.

#### Sub-step 2d: Sensitivity Analysis

Addressing Guidance 20 & 21 of EB62, Annex 5, following factors has been subjected to sensitivity analysis:

1. PLF
2. O&M Cost
3. Project Cost
4. Tariff

The rationale of sensitivity is, "The ultimate objective of the sensitivity analysis is to determine the likelihood of the occurrence of a scenario other than the scenario presented, in order to provide a cross-check on the suitability of the assumptions used in the development of the investment analysis."

The results of sensitivity analysis are as follows:

Variation %	-10%	Normal	10%	Breaching Value
PLF	5.80%	9.26%	13.01%	20.78%
O&M	9.65%	9.26%	8.86%	-226.80%
Project Cost	13.00%	9.26%	6.53%	-18.62%
Tariff Rate	6.40%	9.26%	12.64%	22.05%

The results of sensitivity analysis show that even with a variation of +10% & -10% in project cost, O&M cost, PLF and Tariff Rate Equity IRR is significantly lower than the benchmark. And it is evident from the results given above; the project remains additional even under the most favourable conditions.

<b>Probability to breach the benchmark:</b>
---------------------------------------------

<b>Sensitivity Parameter 1 : PLF</b>
--------------------------------------

PLF considered in financials for all PPs is as per “**Guidelines for the reporting and validation of Plant load factors**” stated in **EB48 Annex11**<sup>12</sup>.

Hence, variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third Party Report based on long term data.

#### **Sensitivity Parameter 2 : O&M**

The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.

#### **Sensitivity Parameter 3 : Project Cost**

Project Cost for financial analysis is considered from DPR. The Sensitivity is carried out for +/-10% even then the benchmark is not breached. With actual project cost (which is 10.38% less than DPR cost), equity IRR is well below the benchmark.

#### **Sensitivity Parameter 4 : Tariff Rate**

The tariff is determined by the project is fixed for first 12 years and for rest 13 years APPC price will be applicable. Hence, there is no probability to get variation for the same. However, Sensitivity is carried out for +/-10% even then the benchmark is not breached.

### **Outcome of Step 2:**

This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark Equity IRR) for any of the investor. Thus it can be easily concluded that project activity is additional & is not business as usual scenario.

The project activity still remains additional by considering the default value as per latest methodological tool “Investment Analysis” Version 07 for benchmark determination.

### **Step 3: Barrier analysis**

Barrier analysis has not been used.

### **Step 4: Common practice analysis**

Stepwise approach for common practice analysis has been carried out as per Methodological tool “Common Practice”, version 03.1 EB84, Annex 7:

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

<b>Range</b>	<b>Capacity</b>	<b>Unit</b>
+50%	45	MW
Capacity of the proposed project activity	30	MW
-50%	15	MW

**Step (2):** Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

- (a) The projects are located in the applicable geographical area;
- (b) The projects apply the same measure as the proposed project activity;
- (c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;
- (d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

<sup>12</sup> [http://cdm.unfccc.int/EB/048/eb48\\_repan11.pdf](http://cdm.unfccc.int/EB/048/eb48_repan11.pdf)

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Identification of the similar projects (CDM and non-CDM) is carried out as per sub-steps of Step (2) as follows:

a) As the projects are located in Uttar Pradesh state of India, therefore, projects in the geographical area of Uttar Pradesh have been chosen for analysis. Each state have different policy for tariff , hence Uttar Pradesh state is considered as geographical region for the project activity.

b) The project activity is a green-field solar power project and uses measure (b) “Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies”. Therefore, projects applying same measure (b) are candidates for similar projects.

c) The energy source used by the project activity is solar. Hence, only solar energy projects have been considered for analysis.

d) The project activity produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.

e) The capacity range of the projects is within the applicable capacity range from 15 MW to 45 MW.

f) The start date of the project activity is 05/07/2016. Therefore projects, which have started commercial operation before 05/07/2016, have been considered for analysis.

Numbers of Similar projects identified, which fulfil above-mentioned conditioned are

**$N_{\text{solar}} = 0$**

**Step (3):** Within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number  $N_{\text{all}}$ .

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

**$N_{\text{all}} = 0$**

**Step (4):** Within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number  $N_{\text{diff}}$ .

As per the tool on Common Practice, the project activities have been separated from the different technologies on the basis two criteria:

1. Size of Installation
2. Investment climate on the date of the investment decision

Hence, projects where either of the conditions is satisfied those projects are counted for calculating  $N_{\text{diff}}$  projects.

**$N_{\text{diff}} = 0$**

**Step (5):** Calculate factor  $F=1-N_{diff}/N_{all}$  representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

Calculate  $F=1-N_{diff}/N_{all}$   
 $F = 1-(0/0) = \text{Error}$

As per methodological tool “common practise” version 03.1, 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.

Thus if both conditions are fulfilled, then project activity will be a common practise otherwise, the project activity is treated as not a common practise.

**Outcome of Common Practise Analysis:**

As,

- i.  $N_{all}-N_{diff} = 0$ ; is less than 3

**The proposed project activity is not a “common practice” within a sector in the applicable geographical area.**

The above discussions show that solar power development is not a common practice and the project activity is not financially attractive; hence the project activity is additional.

**Demonstration of Prior CDM consideration for Retroactive GS project**

This CDM PDD is prepared for GS VER project under Gold Standard. The prior consideration of carbon revenue for GS VER projects is demonstrated as below

The start date of the project activity is 05/07/2016 (earliest date when the EPC contracts for solar modules.). The first submission of project activity to GS is on 15/03/2017 which is within one year of start date, thus project activity qualifies as retroactive GS VER project activity. Thus prior consideration of carbon revenue for current project activity is demonstrated being first submission to Gold standard within one year of project start date.

**B.6. Emission reductions**

**B.6.1. Explanation of methodological choices**

**Project Emissions:**

As per the approved consolidated Methodology ACM0002 (Version 17.0, EB 89, Annex 1) para 36:

“For most renewable energy power generation project activities,  $PE_y = 0$ . 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:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \qquad \text{Equation(1)}$$

Where:

$PE_y$  = Project emissions in year y (t CO<sub>2e</sub>/yr)

$PE_{FF,y}$  = Project emissions from fossil fuel consumption in year y (t CO<sub>2</sub>/yr)

$PE_{GP,y}$  = Project emissions from the operation of dry, flash steam or binary geothermal power plants in year y (t CO<sub>2e</sub>/yr)

$PE_{HP,y}$  = Project emissions from water reservoirs of hydro power plants in year y (t CO<sub>2e</sub>/yr)”

As the project activity is the installation of a new grid-connected Solar PV Power plant 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,  $PE_y = 0$ .

### Baseline Emissions:

As per the approved consolidated Methodology ACM0002 (Version 17.0, EB 89, Annex 1) para 44:

Baseline emissions include only CO<sub>2</sub> 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:

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

Where:

$BE_y$  = Baseline emissions in year y (t CO<sub>2</sub>/yr)

$EG_{\text{facility},y}$  = 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)

$EF_{\text{grid},\text{CM},y}$  = Combined margin CO<sub>2</sub> 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<sub>2</sub>/MWh)

**As per methodology, combined grid emission factor as per the** "Tool to calculate the emission factor for an electricity system" version 05 is calculated as below.

CO<sub>2</sub> Baseline Database for the Indian Power Sector, Version 11, April 2016 13, 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 05.0, EB 87, Annex 9), 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**

<b>Northern</b>	<b>Eastern</b>	<b>Western</b>	<b>North-Eastern</b>	<b>Southern</b>
Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar& Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Puducherry
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
<b>Uttar Pradesh</b>				
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 ( $EF_{grid,OM,y}$ ) 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)

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

*Data Source: Central Electricity Authority (CEA) database Version 11, April'2016*

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<sub>2</sub> emissions per unit net electricity generation (t CO<sub>2</sub>/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

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

Net Generation in Operating Margin (GWh) (excl. Imports)			
	2012-13	2013-14	2014-15
INDIAN Grid	6,97,187	7,21,632	8,08,417

Simple Operating Margin (tCO <sub>2</sub> /MWh) (incl. Imports)			
	2012-13	2013-14	2014-15
INDIAN Grid	0.99	1.00	0.99

Weighted Generation Operating Margin	
INDIAN Grid	0.9941

#### 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 05.0, EB 87, Annex 9) para 70:

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.

Build Margin (tCO <sub>2</sub> /MWh) (not adjusted for imports)	
	2014-15
INDIAN Grid	<b>0.9285</b>

**Step 6: Calculate the combined margin (CM) emission factor (EF<sub>grid,CM,y</sub>)**

As per Methodological tool: “Tool to calculate the emission factor for an electricity system” (Version 05.0, EB 87, Annex 9) para 79:

The calculation of the combined margin (CM) emission factor (EF<sub>grid,CM,y</sub>) 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<sub>grid,BM,y</sub> = Build margin CO2 emission factor in year y (t CO2/MWh)

EF<sub>grid,OM,y</sub> = Operating margin CO2 emission factor in year y (t CO2/MWh)

W<sub>OM</sub> = Weighting of operating margin emissions factor (per cent)

W<sub>BM</sub> = Weighting of build margin emissions factor (per cent)

The following default values should be used for W<sub>OM</sub> and W<sub>BM</sub>:

Wind and solar power generation project activities: W<sub>OM</sub>= 0.75 and W<sub>BM</sub>= 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods

Therefore, EF<sub>grid,CM,y</sub> = 0.9941\*0.75 + 0.9285\*0.25  
 = 0.9777 t CO2/MWh

**Baseline emission factor (EF<sub>y</sub>):**

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

Therefore,  $EF_y = EF_{grid,CM,y} = 0.9777 \text{ t CO}_2/\text{MWh}$ .

**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<sub>y</sub> = Emission reductions in year y (t CO<sub>2</sub>e/yr)

BE<sub>y</sub> = Baseline emissions in year y (t CO<sub>2</sub>/yr)

PE<sub>y</sub> = Project emissions in year y (t CO<sub>2</sub>e/yr)

**B.6.2. Data and parameters fixed ex ante**

<b>Data / Parameter</b>	EF <sub>grid,OM,y</sub>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Operating Margin CO <sub>2</sub> emission factor in year y
<b>Source of data</b>	Calculated from CEA database, Version 11, April 2016
<b>Value(s) applied</b>	0.9941
<b>Choice of data or Measurement methods and procedures</b>	Calculated as per "Tool to calculate the emission factor for an electricity system, version 05" as 3-year generation weighted average using data for the years 2012-13, 2013-14, & 2014-15. The data are obtained from "CO <sub>2</sub> Baseline Database for Indian Power Sector" version 11, published by the Central Electricity Authority, Ministry of Power, Government of India.
<b>Purpose of data</b>	For the calculation of the Baseline Emission
<b>Additional comment</b>	This parameter is fixed ex-ante for the entire crediting period.

<b>Data / Parameter</b>	EF <sub>grid,BM,y</sub>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Build Margin CO <sub>2</sub> emission factor in year y
<b>Source of data</b>	Calculated from CEA database, Version 11, April 2016 <sup>13</sup>
<b>Value(s) applied</b>	0.9285
<b>Choice of data or Measurement methods and procedures</b>	Calculated as per "Tool to calculate the emission factor for an electricity system, version 05" as 3-year generation weighted average using data for the years 2012-13, 2013-14, & 2014-15. The data are obtained from "CO <sub>2</sub> Baseline Database for Indian Power Sector" version 11, published by the Central Electricity Authority, Ministry of Power, Government of India.
<b>Purpose of data</b>	For the calculation of the Baseline Emission
<b>Additional comment</b>	This parameter is fixed ex-ante for the entire crediting period.

<sup>13</sup> [http://cea.nic.in/reports/others/thermal/tpece/cdm\\_co2/user\\_guide\\_ver11.pdf](http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf)

<b>Data / Parameter</b>	EF <sub>grid,CM,y</sub>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Combined Margin CO <sub>2</sub> emission factor in year y
<b>Source of data</b>	Calculated from CEA database, Version 11, April 2016 <sup>14</sup>
<b>Value(s) applied</b>	0.9777
<b>Choice of data or Measurement methods and procedures</b>	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 <sub>grid,BM,y</sub> = Build margin CO <sub>2</sub> emission factor in year y (tCO <sub>2</sub> /MWh) EF <sub>grid,OM,y</sub> = Operating margin CO <sub>2</sub> emission factor in year y (tCO <sub>2</sub> /MWh) W <sub>OM</sub> = Weighting of operating margin emissions factor (%) = 75% W <sub>BM</sub> = Weighting of build margin emissions factor (%) = 25%
<b>Purpose of data</b>	For the calculation of the Baseline Emission
<b>Additional comment</b>	This parameter is fixed ex-ante for the entire crediting period.

### B.6.3. Ex ante calculation of emission reductions

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

$$ER_y = BE_y - PE_y$$

Where,

ER<sub>y</sub> = Emission Reduction in tCO<sub>2</sub>/year

BE<sub>y</sub> = Baseline emission in tCO<sub>2</sub>/year

PE<sub>y</sub> = Project emissions in tCO<sub>2</sub>/year

#### **Baseline Emission (BE<sub>y</sub>)**

The baseline emissions are the product of electrical energy baseline EG<sub>PJ,y</sub> expressed in MWh of electricity produced by the renewable generating unit multiplied by an emission factor.

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

Where,

EG<sub>facility,y</sub> = Total quantity of net electricity delivered to the INDIAN grid

EF<sub>grid,CM,y</sub> = Baseline emission factor

= 0.9777 tCO<sub>2</sub>/MWh

$$\begin{aligned} BE_y &= 48,092 * 0.9777 \\ &= 47,019 \text{ tCO}_2/\text{year} \end{aligned}$$

Since PE<sub>y</sub> = 0

$$ER_y = BE_y$$

Therefore, ER<sub>y</sub> = 47,019 tCO<sub>2</sub>/year (for first year)

Project Investor's Name	Capacity (MW)	PLF (%)	Generated Power (MWh) p.a	Baseline Emission Factor (tCO <sub>2</sub> /MWh)	Baseline Emissions (tCO <sub>2</sub> /year)
Nirosha Solar Power Private Limited	30	18.30%	48,092	0.9777	47,019

<sup>14</sup> [http://cea.nic.in/reports/others/thermal/tpece/cdm\\_co2/user\\_guide\\_ver11.pdf](http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf)

The degradation factor of 0.5% per year is applied to estimate the emission reductions. Please refer ER estimation sheet for the same. The annual average ERs over 7 years crediting period is 46,815 tCO<sub>2</sub>/year.

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

Year	Baseline emissions (t CO <sub>2</sub> e)	Project emissions (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	Emission reductions (t CO <sub>2</sub> e)
Year 1	47,019	0	0	47,019
Year 2	46,784	0	0	46,784
Year 3	46,783	0	0	46,783
Year 4	46,782	0	0	46,782
Year 5	46,781	0	0	46,781
Year 6	46,780	0	0	46,780
Year 7	46,778	0	0	46,778
<b>Total</b>	<b>3,27,707</b>	<b>0</b>	<b>0</b>	<b>3,27,707</b>
<b>Total number of crediting years</b>	7			
<b>Annual average over the crediting period</b>	46,815	0	0	46,815

#### B.7. Monitoring plan

##### B.7.1. Data and parameters to be monitored

<b>Data / Parameter</b>	$EG_{\text{facility},y}$
<b>Unit</b>	MWh/y
<b>Description</b>	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y in MWh
<b>Source of data</b>	Monthly joint meter reading reports (30 MW)
<b>Value(s) applied</b>	48,092

<b>Measurement methods and procedures</b>	<p>Data Type: Measured  Monitoring equipment: Energy Meters are used for monitoring  Recording Frequency: Continuous monitoring and Monthly recording from Energy Meters, Summarized Annually  Archiving Policy: Paper &amp; Electronic  Calibration frequency: One in five years</p> <p>Electricity exported/imported to the grid is in kWh. However for the calculation purpose electricity exported is converted in MWh.</p> <p>The Net electricity supplied to the grid by the project activity will be calculated as a difference of electricity exported to the grid, electricity imported from the grid obtained from joint meter reading certificates/credit notes issued by state electricity board as per below equation:</p> $EG_{\text{facility},y} = EG_{\text{Export}} - EG_{\text{Import}}$ <p>The joint reading at metering point is carried out once in a month in presence of O&amp;M officials and state electricity board personnel. The calculations/measurement of net electricity supplied to grid is under purview of state electricity board and the PP/Project activity Instance owner has no role on it. PP/Project activity Instance owner will get value of net electricity supplied to grid and hence this parameter is mentioned as a part of monitoring plan.</p> <p>Cross Checking:  Quantity of net electricity supplied to the grid will be cross checked from the invoices raised by the PP to the State Electricity Board or equivalent.</p>
<b>Monitoring frequency</b>	Continuous measurement & monthly recording
<b>QA/QC procedures</b>	<p>The meters is approved, tested &amp; sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years.<sup>15</sup> The monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness of metering. The accuracy class of meters, calibration frequency of meters is totally under purview of state electricity board and PP do not have any control on it. Thus deviation against the accuracy class, calibration frequency, metering arrangement etc is acceptable for future period.</p>
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Additional comment</b>	Data will be archived in paper & electronic form for two years after the end of crediting period or of the last issuance of CERs for this project activity, whichever occurs later.

### B.7.2. Sampling plan

No sampling is required

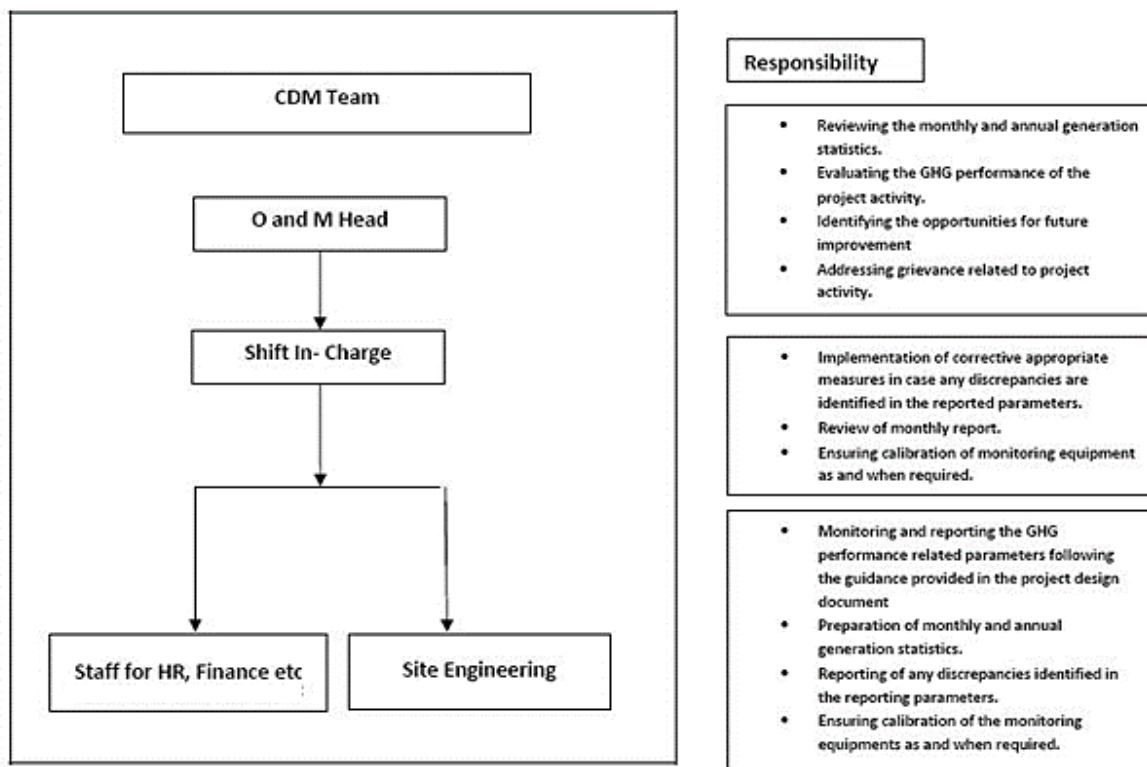
### B.7.3. Other elements of monitoring plan

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

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project participant. PP proposed the following structure for data monitoring,

<sup>15</sup> [http://www.aegcl.co.in/Metering\\_Regulations\\_Of\\_CEA\\_17\\_03\\_2006.pdf](http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf)

collection, data archiving and calibration of equipment for this project activity. The team comprises of the following members:



**Data Measurement**

The export and import energy will be measured continuously using above mentioned Main and Check meters located at the substation. Readings of meters shall be taken on monthly basis by authorized officer of SEB in the presence of PP or representative of PP. Based on the Meter Reading Statement to Nirosha Solar Power Private Limited, invoices will be raised. These invoices can be used for cross checking the meter readings taken for the respective project activity.

**Data collection and archiving**

Readings from meters will be collected in the presence of the plant in-charge. Export and Import data would be recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

**Emergency preparedness**

The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

**Personnel training**

In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff (CDM team) will be trained. The plant helpers will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.

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

07/03/2017 is the date of completion of study on application of the selected methodology (ACM0002 version 17). Further, the standardized baseline is not applicable for this project activity. EKI Energy Services Ltd is responsible for completion of application of methodology and contact information is mentioned in Appendix 1.

**SECTION C. Duration and crediting period****C.1. Duration of project activity****C.1.1. Start date of project activity**

Start date of the project activity is the date of purchase order to EPC contractor as on 05/07/2016.

**C.1.2. Expected operational lifetime of project activity**

25 Years 00 Months

**C.2. Crediting period of project activity****C.2.1. Type of crediting period**

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

**C.2.2. Start date of crediting period**

20/09/2016 i.e date of commissioning or date from day two years back from GS registration date whichever is later.

**C.2.3. Length of crediting period**

07 Years 00 Months

**SECTION D. Environmental impacts****D.1. Analysis of environmental impacts**

The project activity (Solar PV) has no significant impact on the environment<sup>16</sup>.

**D.2. Environmental impact assessment**

Solar PV projects are not included in the Schedule I of the EIA notification S.O.1533 (E) dated 14th September 2006<sup>16</sup> and thus an EIA is not required. Ministry of Environment & forests vide their OM J-11013/41/2006 - IA II (I) dated 13th May 2011<sup>17</sup> has re-affirmed this and exempted Solar PV power plants from EIA and EC requirement.

**SECTION E. Local stakeholder consultation****E.1. Solicitation of comments from local stakeholders**

The Local Stakeholder Meetings were organized for local stakeholder consultation and informed local stakeholder regarding the meeting. The followings are the local stakeholders for the project activity:

- Local community
- Local village administration
- Technology suppliers
- Local vendors

All the stakeholders have been invited through invitation letters (delivered in hand) and public notice to attend the stakeholders meeting.

<sup>16</sup> <http://envfor.nic.in/legis/eia/so1533.pdf>

<sup>17</sup> <http://moef.nic.in/downloads/public-information/OM-SolarPV.pdf>

The details of the Stakeholder Meetings are as follows:

Date of invitation – 03/03/2016

Date of Meeting – 13/03/2016

Location of Meeting –Project Site: Village: Bendo, District: Mahoba, Uttar Pradesh

In the introductory speech, the representatives of Nirosha Solar Power Private Limited welcomed the gathering and given a brief about the CDM project activity. Subsequent to the introductory speech, stakeholders were explained about the electricity generation from solar project is an environmental friendly power generation technology contributing to reduction in GHG emissions. They were also explained about the benefits of the solar power projects like, increasing energy availability and improving quality of power and its assistance to the local population by providing employment opportunities to both skilled & unskilled labours.

The Minutes of meeting with commenting sheet from LSH, invitation letter receipt copy shall be submitted to the DOE.

**E.2. Summary of comments received**

Meeting started with opening speech by representative of project participant. He introduced all guests on dais. The representative of project participant explained Technical aspects of project to stakeholders. He also explained about social, environmental & economical benefits of the project. He also elaborated about CDM & its requirement for the current project. After the presentation, the session was open for questions from stakeholders.

The villagers raised various queries as summarised below:

Name of Stakeholder	Mohit Singh
Occupation	Farmer
1. Can we get free electricity? <b>Answer:</b> Investor cannot sell power directly. The power will be sold to grid.	
2. Will it harm the crops? <b>Answer:</b> It will not harm the crops.	

Name of Stakeholder	Girish
Occupation	Villager
1. Will we get employment opportunity? <b>Answer:</b> Yes, employment opportunities will be developed and village people will be given preference.	
2. Can we get free electricity? <b>Answer:</b> Project investor cannot sell power directly. The power is sold to grid.	
3. Will it harm the farmers? <b>Answer:</b> It will not harm the farmers.	

Name of Stakeholder	Vijendra
Occupation	Villager
1. Will there be any problem to people? <b>Answer:</b> There will be no harm to people due to the project.	

2. Will we get employment opportunity? <b>Answer:</b> Yes, employment will be generated and locals will be given preference.
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Name of Stakeholder	Ashok
Occupation	Teacher
1. Will there be pollution from this project? <b>Answer:</b> There will be no pollution from this project.	
2. Will it reduce the problem of power cut? <b>Answer:</b> The problem of power cut will reduce due to this project.	
3. Will schools be opened? <b>Answer:</b> The investor will develop school for primary education.	

Name of Stakeholder	Vasu
Occupation	Shopkeeper
1. Can Electricity be generated at night from solar plant? <b>Answer:</b> Electricity cannot be generated at night from solar plant.	
2. Will it cause any impact on rainfall? <b>Answer:</b> It will not have any impact on the rainfall.	
3. Will it cause rise in temperature of surrounding? <b>Answer:</b> It will not cause increase in temperature.	

Name of Stakeholder	Ajit
Occupation	Student
1. Will there be employment opportunity? <b>Answer:</b> Employment opportunity will be generated and the locals will be given preference.	
2. Will there be road development? <b>Answer:</b> Roads will be developed near the project site.	
3. Will it cause any problem to the people? <b>Answer:</b> It will not cause any problem to the people.	

Name of Stakeholder	Mohit Kumar
Occupation	Villager
1. Will it harm our crops? <b>Answer:</b> It will not harm the crops	
2. Will this project use coal? <b>Answer:</b> This project will not use coal.	
3. Will it improve the economic condition of the village? <b>Answer:</b> Yes, it will help to develop the economic condition of the village.	

**E.3. Report on consideration of comments received**

All the above queries have been suitably and satisfactorily replied / clarified by project participant's representatives. There were no major comments or protest raised by the stakeholders and they were totally in support for setting up of these kinds of projects in the region.

The meeting was concluded by vote of thanks to all the participants

**SECTION F. Approval and authorization**

Not applicable as project is seeking registration under GS VER stream with Gold Standard.

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

<b>Project participant and/or responsible person/ entity</b>	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
<b>Organization name</b>	Nirosha Solar Power Private Limited
<b>Street/P.O. Box</b>	PLOT NO. 152
<b>Building</b>	SECTOR 44
<b>City</b>	Gurgaon
<b>State/Region</b>	Haryana
<b>Postcode</b>	122001
<b>Country</b>	India
<b>Telephone</b>	+91-124-7117000
<b>Fax</b>	+91-124-7117001 / +91-11-47618484
<b>E-mail</b>	info@acme.in
<b>Website</b>	acme.in
<b>Contact person</b>	Mr. Rajesh Sodhi
<b>Title</b>	Mr.
<b>Salutation</b>	Director
<b>Last name</b>	Sodhi
<b>Middle name</b>	-
<b>First name</b>	Rajesh
<b>Department</b>	-
<b>Mobile</b>	+91-124-7117000
<b>Direct fax</b>	+91-124-7117001 / +91-11-47618484
<b>Direct tel.</b>	+91-124-7117000
<b>Personal e-mail</b>	<a href="mailto:info@acme.in">info@acme.in</a>

<b>Project participant and/or responsible person/ entity</b>	<input type="checkbox"/> Project participant <input checked="" type="checkbox"/> Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
<b>Organization name</b>	EKI Energy Services Limited
<b>Street/P.O. Box</b>	Office No 201, Plot No 48, Scheme 78, Part II, Vijay Nagar
<b>Building</b>	Enking Embassy
<b>City</b>	Indore
<b>State/Region</b>	Madhya Pradesh
<b>Postcode</b>	452 010
<b>Country</b>	INDIA
<b>Telephone</b>	0731-4289086
<b>Fax</b>	0731-4289086
<b>E-mail</b>	<a href="mailto:manish@enkingint.org">manish@enkingint.org</a>
<b>Website</b>	<a href="http://www.enkingint.org">www.enkingint.org</a>

<b>Contact person</b>	Manish Dabkara
<b>Title</b>	CEO
<b>Salutation</b>	Mr.
<b>Last name</b>	Dabkara
<b>Middle name</b>	-
<b>First name</b>	Manish
<b>Department</b>	CDM Services Dept.
<b>Mobile</b>	+91-9907534900
<b>Direct fax</b>	+91-0731-4289086
<b>Direct tel.</b>	+91-0731-4289086
<b>Personal e-mail</b>	<a href="mailto:manish@enkingint.org">manish@enkingint.org</a>

## Appendix 2. Affirmation regarding public funding

No public funding for this project activity was received from annex 1 parties.

## Appendix 3. Applicability of methodology and standardized baseline

Please refer section B of the PDD for the same.

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

Please refer section B.6.3 and B.6.4 for information on emission reduction calculation.

## Appendix 5. Further background information on monitoring plan

Please refer section B.7 for information on monitoring plan.

## Appendix 6. Summary of post registration changes

Not Applicable.

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
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	Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to statement on erroneous inclusion of a CPA;</li> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to local stakeholder consultation;</li> <li>• Provisions related to the Host Party;</li> </ul> Editorial improvement.
05.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• 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));</li> <li>• Include provisions related to standardized baselines;</li> <li>• 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;</li> <li>• Change the reference number from <i>F-CDM-PDD</i> to <i>CDM-PDD-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
04.1	11 April 2012	<ul style="list-style-type: none"> <li>• Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b</li> </ul>
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