Project design document form

(Version 11.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	72 MWac Ramnad Solar Power Project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	04
Completion date of the PDD	10/07/2020
Project participants	Ramnad Solar Power Limited
Host Party	India
Applied methodologies and standardized baselines	ACM0002: Grid-connected electricity generation from renewable sources - Version 20.0
Sectoral scopes	Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)
Estimated amount of annual average GHG emission reductions	110,973 tCO2e per annum

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 for sale of electricity to the grid. Ramnad Solar Power Limited (RSPL) is the promoter of the proposed project activity.

The project activity involves installation of 72 MW_{AC} solar power project. The project is installed in the same project boundary at Village: O. Karisalkulam, Tehsil: Kamuthi, District: Ramanthpuram State: Tamil Nadu.

The electricity generated from project activity will be sold under the Power Purchase Agreement (PPA), signed with Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) wholly owned by the Government of Tamil Nadu. The electricity generated from the project activity will be evacuated through 110 kV sub-station located at Kamuthi for consumption in the Indian Electricity Grid.

The project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 110,973 tCO2e per annum, thereon displacing average 117,122 MWh/year amount of electricity from the generation-mix of power plants connected to the Indian electricity grid, which is mainly dominated by thermal/fossil fuel-based power plant.

The project activity is the installation of a new grid-connected renewable power plant/unit and this is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs.

The details of the project are mentioned in the table:

Project Investors' Name	Capacity in MW AC	Commissioning Date	State
Ramnad Solar Power Limited	72	08-Feb-2016	Tamil Nadu

Scenario existing prior to the implementation of the project activity
As the project activity is the installation of a new grid-connected renewable power plant/unit. The scenario existing prior to the implementation of project activity 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" (Version 07).

Baseline Scenario
Baseline scenario and Scenario existing prior to the implementation of the project activity are both same.

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

- *Social well being*
  The project activity will provide job opportunity to local people during erection, commissioning and maintenance of the Solar power project. Frequency of visiting to villages and nearby areas by skilled, technical and industrialist has increased due to

installation /site visit/operation and maintenance work related to WTGs at plant site. This directly and indirectly positively effects the economy of nearby populace.

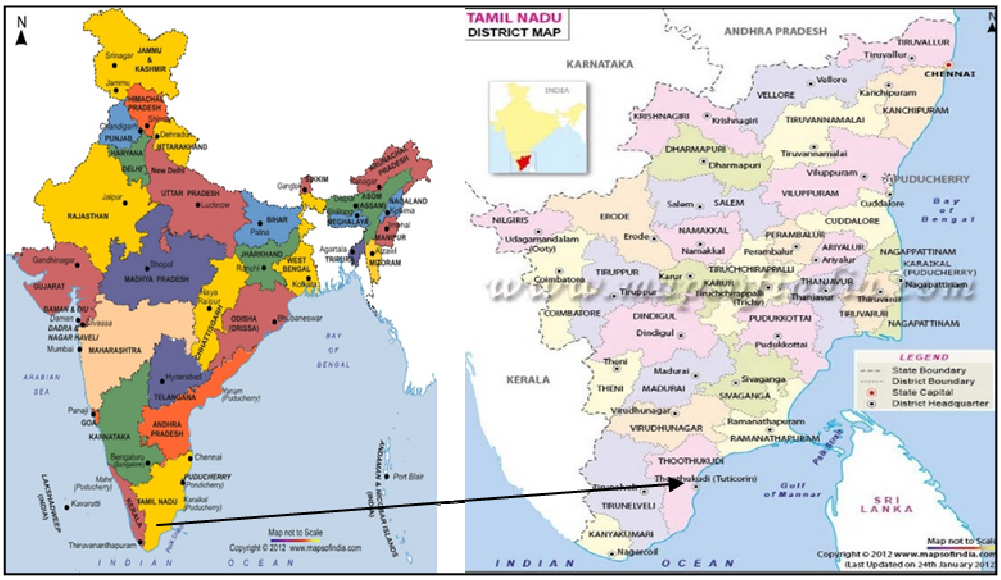
- *Environmental well being*
  Solar power is one of the cleanest renewable energy powers and does not involve any fossil fuel. There are no GHG emissions. The impact on land, water, air and soil is negligible. Thus the project activity contributes to environmental well-being without causing any negative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

In addition to this, the Project Participant will contribute 2% of the CDM revenue realized from the CDM project for sustainable development including society/community development which is in line with DNA of India guideline on commitment of 2% of the CDM revenues towards sustainable development.

The Host Country Approval issued by DNA of India declaring acceptability of the Sustainable Indicators by the project activity is submitted to DOE.

A.2. Location of project activity

Village: O. Karisalkulam,
Tehsil : Kamuthi
District : Ramanthpuram
State : Tamil Nadu
Country: India



The Project is located at Village O. Karisalkulam, Tehsil: Kamuthi, Dist. Ramanthpuram, Tamilnadu. The site is well connected by state highway state highway (SH) 47 up to Arruppukottai and further national highway NH48 connects to Madurai. The nearest commercial city remains Madurai, which is approximately 90km from the Project site location. Nearest railway station is at

Tiruchuli which is 25km form the site and Madurai is the the closest airport approximately 90km form the site. The project coordinates are 9°19'26.90"N and 78°23'40.62"E.

A.3. Technologies/measures

The project activity aims to harness solar energy through installation of PV with total installed capacity of 72 MWac . The solar PV power plant will have solar PV modules, inverters, transformers and other protection system and supporting components.

Technical Specifications at the time of commissioning and during CDM validation and registration of project activity

A. Solar PV modules:

Module Supplier	Module Model	Capacity (p)	Number	Total Capacity (MWp)
Hanwha	Poly C-Si	310	104640	32.44
Hanwha	Poly C-Si	315	33200	10.46
Trina	Poly C-Si	310	53120	16.47
Trina	Poly C-Si	315	23360	7.36
SunTech	Poly C-Si	310	31320	9.71
SunTech	Poly C-Si	315	28960	9.12
Adani	Poly C-Si	325	3840	1.248
		Total Capacity in MWp		86.80

B. Inverters:

S.No.	Make		
1.	Manufacturer	ABB	Hitachi
2.	Model	PVS800	NPi201
3.	Rated Capacity	1000 KW	1250 KW
4.	No. of Inverters	12	48
5	Rated Input Voltage(Max.Input Voltage)	380 V	350 V

C. Transformers

S.No.	Make			
1.	Manufacturer	ABB	SChneider	SChneider
3.	Capacity	40/45 MVA	4 MVA	5 MVA
4.	No. of Transformers	2	3	12
5.	Voltage Ratio	33/110 KV	0.380/33 KV	0.350/33 KV

D. Metering Equipment Details

S.No.	Make	Solar Plant End
1.	Manufacturer	Secure Make
2.	Type	ABT meters
3.	Accuracy Level	0.2s
4.	Total no of meter	3

The solar PV modules have a useful life of 25 years.

In case of degradation / damage / destroy of any equipment in future:

At a given time in the future, the equipment of the same capacity might not be available with the supplier or in the market. So, the equipment of available capacity will be installed keeping the overall output capacity of the project within the project capacity as in registered PDD.

Thus, the changes in project activity specifications information will not affect the design of project activity, the applicability of methodology, additionality of project activity and scale of project activity. And there would be no need to revise PDD in case of equipment configuration changes as the overall output capacity of the project is within the project capacity as in registered PDD. It is to be noted that in case of future replacement, the equipment's replaced or changes made in the project will be transparently reflected in the monitoring report.

For monitoring equipment and their location, refer Section B.7.3. For Plant Load Factor (PLF), please refer Section B.6.3.

Baseline Scenario

As the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following as per applied methodology: "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

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host Party)	Ramnad Solar Power 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.

A.6. History of project activity

1. The PP hereby Confirms that:
   (a) The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA); and
   (b) The proposed CDM project activity is not a project activity that has been deregistered.

2. The PP would like to Declare that:
   (a) The proposed CDM project activity was not a CPA that has been excluded from a registered CDM PoA;
   (b) The project is not "A registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity".

3. Since the declaration on 2(a) or 2(b) above is negative thus no further demonstration required.

A.7. Debundling

Not Applicable

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

Title : Grid-connected electricity generation from renewable sources.
References : Approved Large Scale Consolidated Methodology: ACM0002 "Grid-connected electricity generation from renewable sources" (Version 20.0, EB 105 Annex 3)
https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG

ACM0002 draws upon the following tools which have been used in the PDD:

- Methodological Tool: Tool to calculate the emission factor for an electricity system - Version 07.0, EB 100, Annex 4
  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

- Methodological Tool: Tool for the demonstration and assessment of additionality - Version 07.0.0, EB 70 Annex 8
  https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

B.2. Applicability of methodologies and standardized baselines

As per para 2 of ACM0002 (Version 20.0, EB 105, Annex 3), "This methodology applies to project activities that include retrofitting, rehabilitation (or refurbishment), replacement or capacity addition of an existing power plant or construction and operation of a Greenfield power plant". The project activity meets the applicability conditions of the approved consolidated baseline and monitoring methodology ACM0002, Version 20.0, Sectoral Scope 1, EB 105 for Greenfield projects as described below:

Applicability	Project activity vis-à-vis applicability Conditions
This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity is installation of a new grid connected Solar power plant/ unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant) and hence this criterion is applicable.
The methodology is applicable under the following conditions: (a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, solar power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for solar, 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	The proposed project activity is an installation of a new grid connected solar power plant/ unit and hence criteria under point (a) is met. The project does not involve any capacity additions, retrofits or replacements and therefore this criteria under point (b) is not applicable.

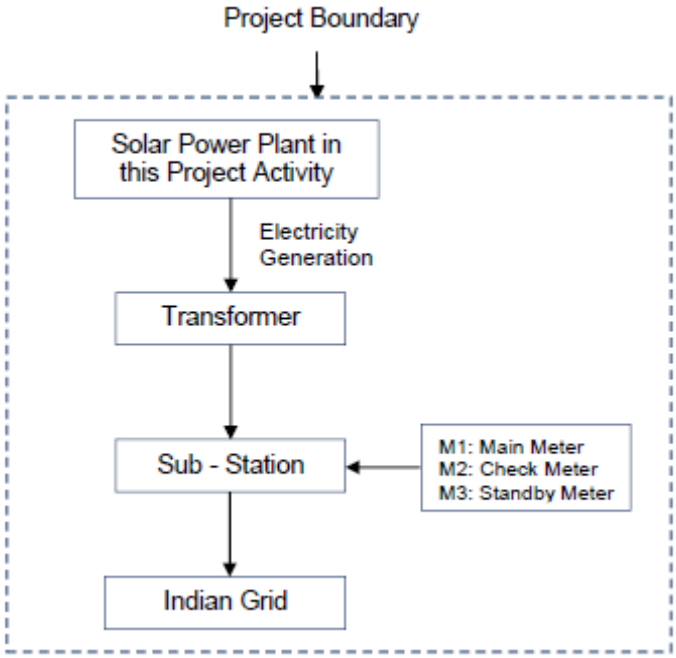
emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (7), is greater than 4 W/m^2 ; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m^2 ; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m^2 , all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m^2 ; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	The proposed project activity is an installation of a new grid connected solar power plant/ unit and not Hydro power plant, therefore this criteria is not applicable for this project activity.
In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The proposed project activity is an installation of a new grid connected solar power plant/ unit and not Hydro power plant, therefore this criteria is not applicable for this project activity.
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	The project activity is installation of a new grid connected solar power project/ unit and does not involve switching from fossil fuel to renewable energy, therefore criterion described in point (a) is not relevant to the project activity. This is a solar power plant/ unit

	and not a biomass fired plant, therefore criterion described in point (b) is not applicable to the project activity.
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".	The project activity is a new grid connected solar power plant/ unit and not a retrofits, replacement or capacity additions and therefore this criterion is not applicable to the project activity.
Applicability conditions of "Tool to calculate the emission factor for an electricity system", - Version 07.0	
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).	This condition is applicable. OM, BM and CM are estimated using the tool under section B.6.3 for calculating baseline emissions.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, 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: be met. Namely, the total capacity of off-grid Procedures related to off-grid power generation" should 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.	Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity.
Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	The project activity is a grid connected solar power project/ unit and does not involve emission from biofuels. Therefore, this criterion is not applicable.

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

Project boundary has ascertained using para 20 of ACM0002 (Version 20.0, EB 105, Annex 3) - "*The spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to*".

Hence the project boundary includes the Solar Project activity, sub-station, grid and all power plants connected to grid. The proposed project activity will evacuate power to the Indian grid.



Source		GHG	Included?	Justification/Explanation
Baseline	Grid connected electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	Greenfield Solar Power Project Activity	CO_2	No	No CO2 emissions are emitted from the project activity
		CH_4	No	No, Project Activity does not emit CH4
		N_2O	No	No, Project Activity does not emit N2O

B.4. Establishment and description of baseline scenario

As per the approved consolidated Methodology ACM0002 (Version 20.0, EB 105 Annex 3) para 22 "If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

The project activity involves setting up of solar panels 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.

The combined margin (EFgrid,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), in accordance with the Tool to calculate the emission factor for an electricity system - Version 07 Calculations for this combined margin must be based on data from an official source[1] (where available) and made publically available. In India, Central Electricity Authority (CEA), Government of India provides this data, and accordingly the same has been used.

[1] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

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

Parameter	Value	Nomenclature	Source
EFgrid,CM,y	0.9475 tCO2/MWh	Combined margin CO2 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 CO2 Emission Database, Version 13 published by Central Electricity Authority (CEA), Government of India in the month of June 2018.
EFgrid,OM,y	0.9726 tCO2/MWh	Operating margin CO2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2014-15, 2015-16, 2016-17) generation-weighted average, sourced from Baseline CO2 Emission Database, Version 13, published by Central Electricity Authority (CEA), Government of India.
EFgrid,BM,y	0.8723 tCO2/MWh	Build margin CO2 emission factor for the project electricity system in year y	Baseline CO2 Emission Database, Version 13, published by Central Electricity Authority (CEA), Government of India.

B.5. Demonstration of additionality

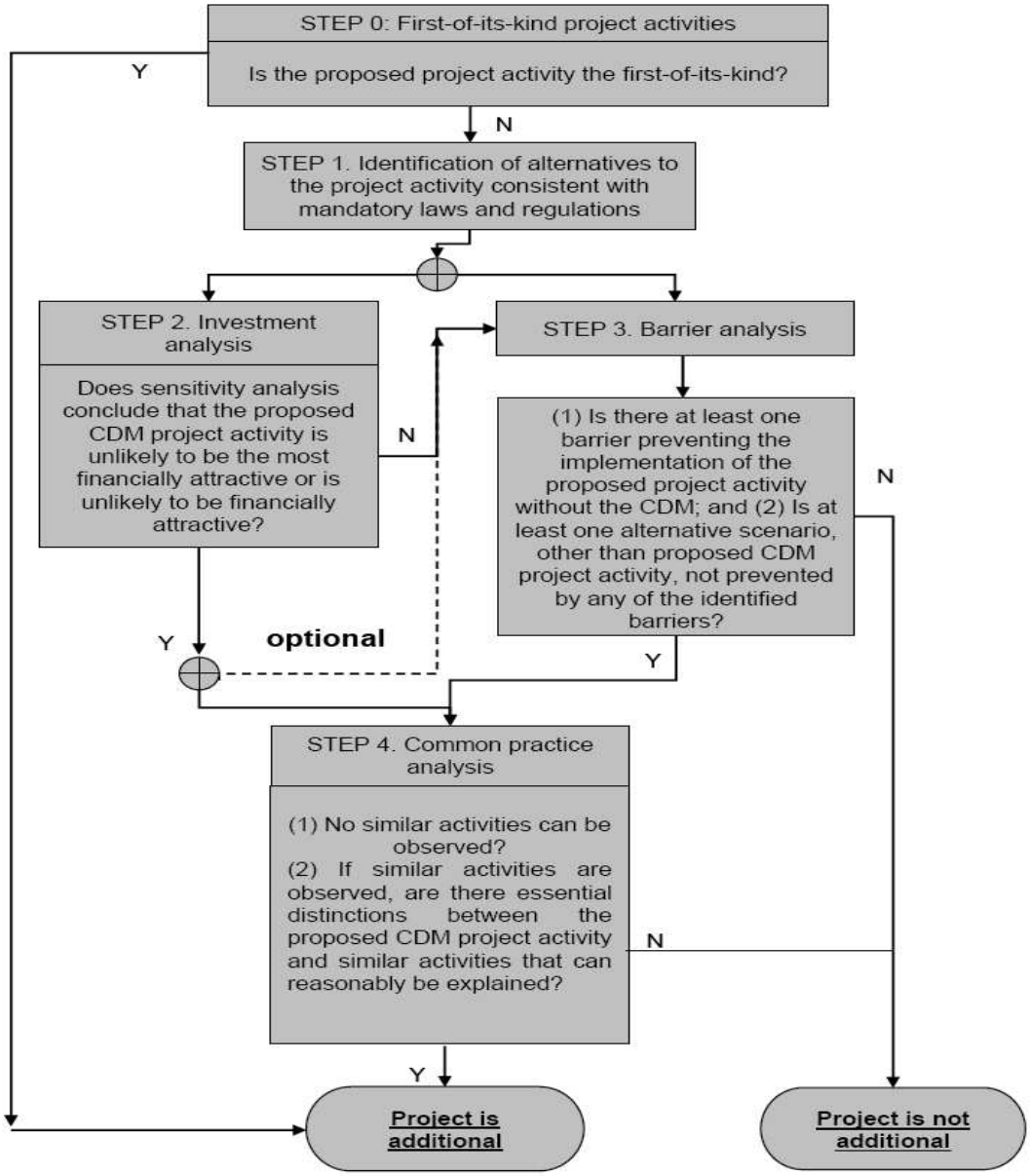
The table below is only applicable if the proposed project is deemed additional, as defined by the applied approved methodology or activity requirement or product requirement.

Specify the methodology or activity requirement or product requirement that establish deemed additionality for the proposed project (including the version number and the specific paragraph, if applicable).	Not Applicable
Describe how the proposed project meets the criteria for deemed additionality.	Not Applicable

The proposed CDM project generates power using solar energy which is a renewable, zero emission source of energy. Baseline considerations for the project are based on approved consolidated baseline methodology ACM0002 (Version 20).

Thus the project follows section 5.3.2 of the applied methodology which requires the project proponent to determine the additionality based on “Tool for the demonstration and assessment of additionality”, Version 07.0.0.

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 solar project; hence 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 20; Para 22, "*If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power 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
As per para 29 of "Tool for the demonstration and assessment of additionality" v7.0.0, it is determined that the proposed project activity is not an economically or financially feasible option.

To conduct the investment analysis, Methodological tool: Investment analysis, version 10.0 (EB 105 annex 06) has been referred.

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 in line with para 32 of the Methodological tool: "Tool for the demonstration and assessment of additionality" (version 07.0.0)
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 proponent 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.

As per Para 15 of EB105, Annex 06 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 para 19 of EB105, Annex 06 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:

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

Nominal Benchmark[2] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where:

- Default value for Real Benchmark is the default value of expected return on equity in real terms for Energy Industries (Group 1) in India as provided in the Appendix

Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India) for India.

Benchmark estimation

The Cost of Equity has been considered using the "Methodological tool: Investment analysis" available at the time of decision making as well as the latest available value. As a conservative approach, the minimum value of benchmark has been considered as calculated using these 2 approaches.

Default Value at the time of investment decision:
Appendix A in EB62, Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 11.75%

Default Value as per latest version of Investment Analysis Tool version 10:

[2] As per Pg. 320 of Corporate Finance, Second Edition of Aswath Damodaran

Table under EB 105 annex 06[3] specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 10.24%

Thus, minimum Default Value considered for calculation of Benchmark = 10.24%

Inflation Forecast for India as per RBI website[4] and corresponding benchmark values:

Project Promoters' Name	Inflation Forecast		Benchmark	
	5 Years	10 Years	5 Years	10 Years
Ramnad Solar Power Limited	5.20%	4.90%	15.97%	15.64%

As a conservative approach, benchmark of 15.64% has been selected for this project activity.

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

Input values used in the investment analysis:

Details of the project		Source
State where the project is situated	Tamil Nadu	
Total Capacity in AC (MW)	72.0	As per DPR
Expected Date of Commissioning	30-Sep-16	As per DPR
Life of the plant (Yrs.)	25	As per Technical Specifications
Generation and sale of electricity		
PLF @ P90(%)	18.85%	As per Third Party Report in accordance to EB 48 Annex 11
Annual generation (MWh)	118,891	Calculated Value
Annual degradation from 2nd year onwards (%)	0.50%	As per DPR
Tariff rate at the decision making (INR/kWh)	7.01	As per DPR
Operation and maintenance cost and Insurance		
O & M Expenses (INR Mn.)	81.08	As per DPR
Escalation in the operational expenses (%)	5.72%	As per DPR
O & M free for (Yr.)	-	As per DPR
Insurance (INR Mn.)	20.27	As per TNERC Order dated 12-Sep-2014[5]
Financial parameters		
TOTAL COST (INR Mn.)	5,080.00	As per DPR
Equity Investment (INR Mn.)	1,524.00	Calculated Value
Loan Amount (INR Mn.)	3,556.00	Calculated Value
Term loan		
Margin (%)	30.00%	As per DPR
Loan Amount (INR Mn.)	3,556.00	Calculated Value
Interest rate (%)	11.00%	As per DPR
Loan Tenure (Qtr.)	80	As per DPR
Moratorium Period (Qtr.)	4	As per DPR
Repayment Period (Qtr.)	76	Calculated Value
Repayment instalments value (INR Mn.)	46.789	Calculated Value

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v10.0.pdf

4 https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=16217

5 http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2014/solar%20order/Order%20No%204%20of%202014%20dated%2012-09-2014.pdf

1st instalment from (Qtr. end)	30-Sep-17	Considered from the next Quarter End
Working Capital		
No. of Days Receivables	60	As per TNERC Order dated 12-Sep-2014
O&M Expenses (Days)	30	As per TNERC Order dated 12-Sep-2014
Interest on Working Capital Debt	13.20%	As per DPR
Book Depreciation (SLM Method)		
Land Cost (INR Mn.)	420.00	Calculated Value
Gross Depreciable Value (INR Mn.)	4,660.00	Calculated Value
Salvage Value (%)	10.00%	As per TNERC Order dated 12-Sep-2014
Salvage value (INR Mn.)	466.00	Calculated Value
Net Depreciable Value (INR Mn.)	4,194.00	Calculated Value
Residual Value (INR Mn.)	886.00	Calculated Value
IT Depreciation (SLM Method)		
IT Depreciation Rate (%)	7.69%	As Per Income Tax , Depreciation rates for power generating units[6]
Income Tax		
Financial Year	FY 2015-16	
Income tax rate (%)	30.00%	Tax rates applicable to a domestic company[7]
MAT (%)	18.50%	Tax rates applicable to a domestic company
Service Tax (%)	14.00%	As Per Service Tax Rule[8]
Surcharge (%)	12.00%	Tax rates applicable to a domestic company[9]
Education cess (%)	3.00%	
Final Tax rates		
Income tax rate (%)	34.61%	Calculated Value
MAT (%)	21.34%	Calculated Value
Service Tax (%)	14.00%	Calculated Value

Considering the input values, Equity IRR is given below:

Project Promoters' Name	Equity IRR without CDM	Benchmark (Equity IRR)
Ramnad Solar Power Limited	9.82%	15.64%

The 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 27 & 28 of EB105, Annex 06, following factors has been subjected to sensitivity analysis:

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

[6] http://www.incometaxindia.gov.in/charts%20%20tables/depreciation%20rates.htm

[7] https://taxguru.in/income-tax/income-tax-rate-chart-assessment-year-201516-financial-year-201415.html

[8] https://www.taxdose.com/comparative-service-tax-chart-with-service-tax-rate-of-14-14-5-and-15/

[9] https://taxguru.in/income-tax/income-tax-rate-chart-assessment-year-201516-financial-year-201415.html

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	6.89%	9.82%	13.70%	14.54%
O&M	10.41%	9.82%	9.22%	-95.21%
Project Cost	14.16%	9.82%	7.16%	-12.72%
Tariff Rate	6.89%	9.82%	13.70%	14.54%

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.

	Probability to breach the benchmark
PLF	PLF considered in financials is as per "Guidelines for the reporting and validation of Plant load factors" stated in EB48 Annex11[10]. Variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third Party Report based. Moreover, The breaching point come at a PLF of 21.59%, which represents 14.54% increase in the PLF value from the considered PLF.
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 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. For IRR to reach the Benchmark O&M Cost has to be reduced by 95.21% i.e. the O&M Cost come down to INR 3.89 Mn. which is not possible
Project Cost	Estimated Project Cost for financial analysis is considered from DPR as available at the time of decision making. However, even if we consider the actual cost of the project even then the benchmark is not breached. Moreover the Sensitivity is carried out for +/-10%. The breaching point will come at a Project Cost of INR 4443.77 Mn., which represents 12.72% decrease in Project Cost. Whereas when we compare Actual Project Cost with the Estimated Project Cost, actual cost is INR 4780.3 Mn. which is 5.90% lower than the estimated cost. So even if we use actual cost project is additional.
Tariff Rate	For investment analysis Tariff considered is INR 7.01/kWh and the Actual tariff i.e. INR 7.01/kWh is determined by PPA which is fixed for the entire project life of 25 years, both are same. Hence, there is no probability to get variation for the same. The breaching point will come at a tariff of INR 8.03 per unit, which represents 14.54% increase in the tariff.

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). Thus it can be easily concluded that project activity is additional & is not business as usual scenario.

Step 3: Barrier analysis
Barrier analysis has not been used.

[10] http://cdm.unfccc.int/EB/048/eb48_repan11.pdf

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.

Range	Capacity	Unit
+50%	108	MW
Capacity of the proposed project activity	72	MW
-50%	36	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;
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[11] (CDM and non-CDM) is carried out as per sub-steps of Step (2) as follows:

a) As the project is located in Tamil Nadu state of India, therefore, the applicable geographical area of Tamil Nadu has been chosen for analysis.
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, all projects applying same measure (b) as the proposed project activity 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 36 MW to 108 MW.
f) The start date of the project activity is 13-June-15. As Kyoto Protocol was ratified by India on 26-Aug-2002[12], therefore projects which had started commercial operation between 26-Aug-2002 to 13-June-15, have been identified.

Numbers of Similar projects identified, which fulfil above-mentioned conditioned are
$N_{solar} = 0$

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_{all}.

11 MNRE, Details of State Wise Commissioned Gird Connected Solar Power Projects in Tamil Nadu published as on 31-03-2017

12 http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php

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,
$N_{all} = 0$

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_{diff}.

As per the tool on Common Practice, para 12; the project activities have been separated based on different technologies; point (d) Investment climate on the date of the investment decision, (iv) Legal regulations.

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

Since the project activity is located in Tamil Nadu and has signed Power Purchase Agreement (PPA) with Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) which is wholly owned by the Government of Tamil Nadu. The policies and tariff are regulated/governed by the respective Tamil Nadu Electricity Regulatory Commission.

So, projects in Tamil Nadu that have been allocated under Solar Park or National Solar Mission or through Bidding process and have PPA with NTPC or SECI can be assumed that such projects are governed by different investment climate. Therefore, these projects come under different investment climate and have been considered under N_{diff}.

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

Thus:
$N_{diff} = 0$

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

Outcome of Step 5:
As,

i. F = Undefined, and
ii. $N_{all}-N_{diff} = 0$; is less than 3, thus:

As the project activity does not satisfy condition (i) and (ii) both, 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 Parallel and continuing actions
CDM Project Standard Version 02.0, Section 7.1 states that "For a proposed CDM project activity with a start date on or after 2 August 2008, the project participants shall notify the designated national authority (DNA) of the host Party of the project activity, if such DNA exists, and the UNFCCC secretariat (hereinafter referred to as the secretariat), in writing of the commencement of the project activity and their intention to seek the CDM status for the project activity, or, through a

DOE, publish the PDD for global stakeholder consultation, within 180 days of the start date in accordance with the "CDM project cycle procedure for project activities".

In line with the above guidance, all the project investors have intimated the UNFCCC and host party DNA i.e. National CDM Authority (NCDMA) of its intention to seek CDM for the proposed project activity in a defined F-CDM form within 180 days (refer table below). Hence, it can be clearly established that CDM was also seriously considered in the decision to proceed with the proposed project activity.

Project Participants' Name	Board Decision Date	Start date	F-CDM Date (Initial Notification)	F-CDM Date (Status Update)
Ramnad Solar Power Limited	04/06/2015	13/06/2015	03/10/2015	28/09/2017

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

As per the approved consolidated Methodology ACM0002 (Version 20.0, EB 105 Annex 3), 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)

Baseline Emissions:

Baseline Emissions for the amount of electricity supplied by project activity, BE_y is calculated as

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

Where:

BE_y = Baseline emissions in year y (t CO2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO2/MWh)

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for

a) Greenfield plants,
b) Retrofits and replacements, and
c) Capacity additions

The project activity is the installation of solarmills and it is a green field project. So the formula in option (a) i.e., greenfield plants is used to calculate the value of $EG_{PJ,y}$. In accordance with para 46 of the applied methodology:

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

Where:

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

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

The proposed project activity falls under Indian grid, which constitutes of both fossil fuels and non-fossil fuels sources of electricity generation. Emission reductions due to the project activity are considered to be equivalent to the baseline emissions, since the solar project would not lead to any project emission and leakage emissions. Emission reductions are related to the electricity exported by the project and the emission coefficient of the grid system.

Baseline emission factor is calculated as combined margin, consisting of a combination of operating margin and build margin factors according to the procedures prescribed in the latest tool for calculating the emission factor for an electricity system. The steps of calculation are as follows:

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, 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)
Option I is opted for the project activity i.e. only grid connected power plants are included in the calculation.

Step 3: Select a method to determine the operating margin (OM)
According to the tool, the calculation of the operating margin emission factor is based on one of the following methods:

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

Any of the four methods can be used for calculating OM. However, the simple adjusted OM and dispatch data analysis OM cannot be currently applied in India due to lack of necessary data however, the simple OM method (option a) can only be used if low cost/must-run resources constitute less than 50% of total grid generation in:

1) average of the five most recent years, or
2) based on long-term averages for hydroelectricity production.

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the different grids in India in the last five years is as follows:

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

	2012-13	2013-14	2014-15	2015-16	2016-17
India	16.9%	18.6%	16.8%	15.1%	14.6%

Source: CO2 Baseline Database for the Indian Power Sector - Central Electricity Authority (CEA)

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 regional grid is less than 50% of the total generation. Hence the Simple OM method can be used to calculate the Operating Margin Emission factor. The average operating margin method cannot be applied, as low cost/ must run resources constitute less than 50% of total grid generation.

The project proponent has chosen an ex ante option for calculation of the OM with a 3-year generation weighted average, based on the most recent data available, without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 4: Calculate the operating margin emission factor according to the selected method
The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

- Based on the net electricity generation, and a CO2 emission factor of each power unit. (Option A), or
- Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option B)

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO2 Baseline Database provides information about the Combined Margin Emission Factors of the Indian grid. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the "Tool to calculate the emission factor for an electricity system". We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

The CEA database uses the option A i.e. data on net electricity generation and CO2 emission factor for each power unit, the average efficiency of each power unit and the fuel type(s) used in each power unit, to calculate the OM of the different regional grids.

$EF_{grid,OMsimple,y} = \Sigma (EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}$

Where:
$EF_{grid,OMsimple,y}$: Simple operating margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$: CO2 emission factor of power unit m in year y (tCO2/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

In India, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. This data has also been endorsed by the DNA and is the most authentic information available in the public domain.

Following tables shows the simple OM and Net generation[13] respectively for the recent three years:

Simple Operating Margin Emission Factors (tCO2/MWh) (incl. Imports)		
2014-15	2015-16	2016-17
0.9903	0.9655	0.9636

Net Generation in Operating Margin (MWh) (incl. imports)		
2014-15	2015-16	2016-17
808,417	871,753	916,278

Therefore the 3 years net generation weighted OM average for Indian grid comes out to be **0.9726 tCO2/MWh**.

13 CO2 Baseline Database for the Indian Power Sector, Version 13, June 2018

The emission factor of each power unit m has been determined as follows:
$EF_{EL,m,y} = (\Sigma\ FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}) / EG_{m,y}$

Where:
$EF_{EL,m,y}$: CO2 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)
$EF_{CO2,i,y}$: CO2 emission factor of fossil fuel type i in year y (tCO2/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

Step 5: Calculate the build margin (BM) emission factor
The sample group of power units m used to calculate the build margin consists of either:

a) The set of five power units that have been built most recently, or
b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use the set of power units that comprises the larger annual generation. Accordingly, the CEA database calculates the build margin as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation. The build margin emission factor has been calculated ex-ante based on the most recent information available on units already built for sample group m at the time of PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period.

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

$EF_{grid,BM,y} = (\Sigma\ EG_{m,y} \times EF_{EL,m,y}) / \Sigma\ EG_{m,y}$

Where:
$EF_{grid,BM,y}$ Build margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ CO2 emission factor of power unit m in year y (tCO2/MWh)
m Power units included in the build margin
y Most recent historical year for which power generation data is available

The CO2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 4 (a) for the simple OM, using option A1 for y most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

Build margin emission factor is calculated, ex-ante as per the most recent data available[13]. So, build margin emission factor for Indian grid for 2016-2017 is **0.8723 tCO2/MWh**.

Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)
The emission factor EF_y of the grid is represented as a combination of the Operating Margin (OM) and the Build Margin (BM). Considering the emission factors for these two margins as $EF_{OM,y}$ and $EF_{BM,y}$ then the EF_y is given by:

$EF_y = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$

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)

According to "Tool to calculate the emission factor for an electricity system" the weights for OM and BM are 0.75 and 0.25 respectively.

Using the values for operating and build margin emission factor provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) is **0.9475 tCO2e/MWh**.

Project Emission
As per the ACM0002 ver-20.0, Project Emission 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:

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

Where:
PE_y = Project emissions in year y (tCO2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO2/yr)
$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non condensable gases in year y (tCO2e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO2e/yr).

The project activity involves the generation of electricity from the installation of solar project. Hence, as per ACM0002, Version 20.0, there is no project emission for solarmill projects. Therefore, project emissions are zero.

Leakage Emissions
No leakage emissions are considered in the project activity. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). Since the emissions sources are small, it is neglected.

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EF_{OM,y}$
Data unit	tCO2e/MWh
Description	Operating Margin Emission Factor of Indian Grid
Source of data	Calculated from CEA database, Version 13, June 2018[13]
Value(s) applied	0.9726
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system," as 3-year generation weighted average using data for the years 2014-2015, 2015-2016 & 2016-17. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 13.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{BM, y}$
Data unit	tCO2e/MWh
Description	Build Margin Emission Factor of Indian Grid
Source of data	Calculated from CEA database, Version 13, June 2018[13]
Value(s) applied	0.8723
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system," as most recent year 2016-17 for which data is available. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 13.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{CM, y}$
Data unit	tCO2e/MWh
Description	Combined Margin Emission Factor of Indian Grid
Source of data	Calculated from CEA database, Version 13, June 2018[13]
Value(s) applied	0.9475
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 CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%
Purpose of data	The data is used to calculate baseline emission reductions.
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

Baseline emissions

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

$BE_Y = EG_{PJ,y} * EF_{grid,CM,y}$

Where,

$EG_{PJ,y}$ = Total quantity of net electricity delivered to the Indian grid.

$EF_{grid,CM,y}$ = Combined margin CO2 emission factor for grid connected power generation in year y

= 0.9475 t CO2/MWh.

Project Participant	Capacity	PLF (%)	Average Annual Generated Power in the 1st crediting period (MWh/year)	Baseline Emission Factor (tCO2/MWh)	Baseline emissions (tCO2/ year)

Ramnad Solar Power Limited	72 MW	18.85%	117,122	0.9475	110,973

BE_y = 117,122 * 0.9475 t CO2/ year = 110,973 tCO2/year (average value after considering degradation from 2nd year onwards)

Project emissions
$PE_y = 0$

Leakage
No leakage emissions are applicable.

Emission reductions
$ER_y = BE_y - PEy = 110,973 - 0 = 110,973$ tCO2/year

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 1	112,649	0	0	112,649
Year 2	112,086	0	0	112,086
Year 3	111,525	0	0	111,525
Year 4	110,968	0	0	110,968
Year 5	110,413	0	0	110,413
Year 6	109,861	0	0	109,861
Year 7	109,311	0	0	109,311
Total	776,813	0	0	776,813
Total number of crediting years	7			
Annual average over the crediting period	110,973	0	0	110,973

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity supplied to the grid
Source of data	Monthly Statement of Solar Power Generation by TANGEDCO
Value(s) applied	117,122 MWh

Measurement methods and procedures	Data Type: Measured Monitoring equipment:Energy Meters of accuracy class 0.2s Recording Frequency: Continuous monitoring and Monthly recording from Energy Meters, Summarized Annually. Archiving Policy: Paper &/or Electronic Calibration frequency: Once in 5 years as per CEA guidelines[14] Electricity exported/imported to the grid is in kWh. However for the calculation purpose electricity exported is converted in MWh. The Net electricity supplied to the grid by the project activity will be calculated as a difference of electricity exported to the grid and electricity imported from the grid obtained from Monthly Meter reading reports provided by TANGEDCO (Ramnad Electricity Distribution Circle0 as per below equation: $EG_{PJ,y} = EG_{Export} - EG_{Import}$ The calculation is done by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) and the PP has no say in the calculation. Based on the Monthly generation Statement issued by TANGEDCO, the project shall raise the invoice. The electricity exported to the grid by the project activity connected to the sub-station is measured by electronic trivector meters of accuracy class 0.2s. The electricity exported will be measured continuously using Main & Check meters. Export readings of Main & Check meters shall be taken on monthly basis by authorized officer of TANGEDCO in the presence of PP or representative of PP. Cross Checking: Quantity of net electricity supplied to the grid will be cross checked from the Invoices/ Monthly Bill raised by the Project Participant to Ramnad Electricity Distribution Circle, TANGEDCO.
Monitoring frequency	Monthly
QA/QC procedures	Calibration of all the meters will be undertaken once every five year and faulty meters will be duly replaced immediately. The meters will be of accuracy class 0.2s.
Purpose of data	The Data/Parameter is required to calculate the baseline emission
Additional comment	Data will be archived electronically for a period of 2 years beyond the end of crediting period.

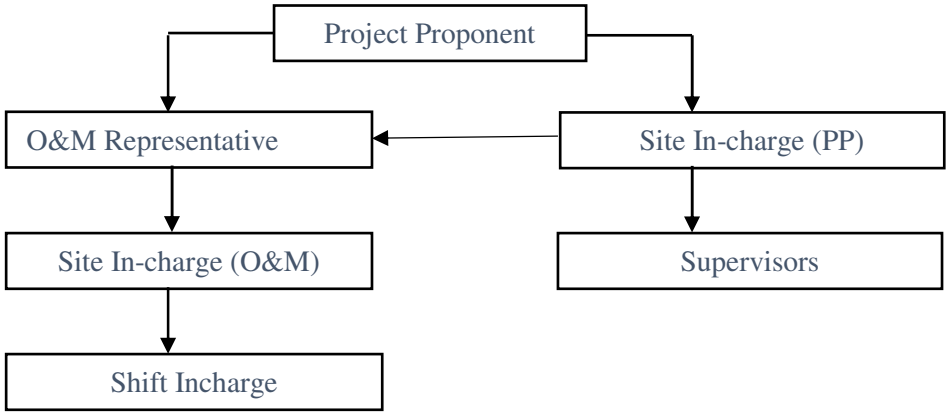
B.7.2. Sampling plan

Sampling is not required for the given project activity.

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/ unit being implemented in Tamil Nadu, India. 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.

14 http://www.cea.nic.in/reports/regulation/meter_reg.pdf, page 12



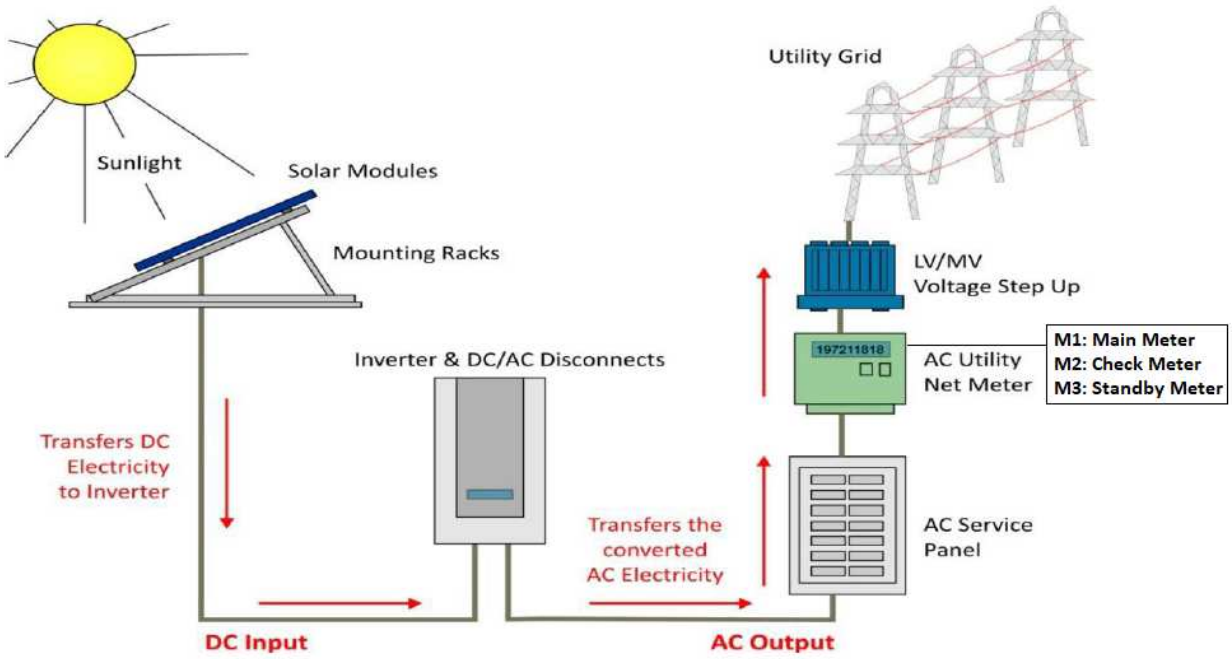
Responsibilities of Site Incharge (PP): Overall functioning and maintenance of the project activity, the Site incharge shall coordinate with the O&M operator as well as the site supervisors.
Responsibilities of O&M Representative: Co-ordination between Site incharge of the O&M operator as well as the project participant and further report to PP head office.
Responsibilities of Site In-charge (O&M Operator): Responsibility for maintaining the data records, ensures completeness of data, and reliability of data (calibration of equipment) as well as data recording for all the parameters.
Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day monitored data.

QA/QC procedures: The energy meters at the feeders are maintained and owned by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO). Neither the project proponent nor the site personnel have any control over it. The records will be cross-checked with the records of sold electricity TANGEDCO. The meters are calibrated by TANGEDCO at-least once in five years.

Data Measurement

Metering arrangements comprises of installation of 3 Energy meters (1 main meter, 1 check meter, 1 standby meter) sealed and under control of TANGEDCO used for joint metering and billing purpose and are installed at interconnection point of the Grid at project site.

The export and import energy will be measured continuously using above mentioned Main & Check meters. Export & Import readings of Main & Check meters installed at the project site shall be taken on monthly basis by authorized officer of TANGEDCO in the presence of PP or representative of PP. The meter reading will be taken jointly and signed by the representatives of the TANGEDCO and project investors. Based on the readings provided by TANGEDCO, invoices will be raised by project investors. These invoices can be used for cross checking the meter readings taken for the project activity. It is to be noted though PP or PP representative is available during meter reading, the calculations of net electricity supplied to grid is completely under purview of TANGEDCO officer and PP do not have any control on it. Also accuracy class of meters and calibration frequency is under purview of TANGEDCO officer and PP do not have any control on it. PP get the monthly generation report from where net electricity supplied to grid is obtained and used for emission reduction calculations.



Data collection and archiving
Export & Import readings from the meters will be collected under the supervision of the authorized representatives of PP. The net electricity supplied to grid would be calculated based on export & import readings. Export and Import data would be recorded and stored in electronic &/or Paper format. The records are checked periodically by the Head (Operations) and discussed thoroughly with the O&M Team. 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.

Mismatch in Monitoring Period and the Billing Period
In case the dates of a particular monitoring period do not match with the dates of the billing period, the net electricity exported to the grid would be calculated from:

D = (A/B)*C

Where,
A = Difference of number of days which are not matching of billing period and monitoring period.
B = Number of days of the billingperiod/ month which was not matched with the monitoring period.
C = Net Electricity supplied to the grid for that given billing period/ month.

The calculated value after apportioning would be used for calculation of emission reductions during that period.

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.

In the unlikely event of failure of both Main, Check meter installed at the inter-connection point at the project site, the export & import readings from Standby Meters installed at the inter-connection point at the project site will be used for monitoring of net electricity exported to the grid and all the faulty meters are required to be repaired or replaced simultaneously.

Personnel training
In order to ensure a proper functioning of the project activity and a proper 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.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

13/06/2015 as per the date of earliest purchase order by Ramnad Solar Power Limited for supply of Balance of System (BOS).

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

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.3.2. Start date of crediting period

01/08/2020 or Date of submission of complete request for registration by the DOE whichever is later.

C.3.3. Duration of crediting period

7 Years 00 Months (First Crediting Period)

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The proposed project activity is using renewable energy generation technology (Sun's Radiation) which is free from any kind of anthropogenic emission. Project activity is not having any negative environmental impacts.

D.2. Environmental impact assessment

Not applicable. As per the notification from MoEF dated September 14, 2006[15] and its amendment notification S.O.-3067(E) dated 1/12/2009[16], the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed project activity type as it involves solar power generation. Hence the proposed project activity does not require any Environmental impact analysis. Project activity has no significant emissions. Hence no environmental impact analysis was conducted.

[15] http://envfor.nic.in/legis/eia/so1533.pdf
[16] http://moef.nic.in/downloads/rules-and-regulations/3067.pdf

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The process of the local stakeholder consultation undertaken, complies with the relevant requirements in the project standard regarding:

(a) The scope of local stakeholder consultation;
Local stakeholder consultation was carried out in line with CDM requirements. The scope of local stake holder consultation was to understand the potential direct positive and negative impacts that the proposed CDM project activity may have

(b) The minimum group of stakeholders to be involved;
- Local community
- Local village administration
- Technology suppliers
- Local vendors

(c) The means for inviting stakeholders' participation;
All the stakeholders have been invited through public notice (dated 05/06/2015) which were displayed/ placed to the nearby areas. Further, few stakeholders were invited individually to attend the stakeholders meeting and the meeting was held on 10/06/2015.

(d) The information to be made available to stakeholders;
A summary of the proposed CDM project activity, explaining the project activity in simple, non-technical terms, information on the projected scope, lifetime and a description of the direct impacts of the proposed CDM project activity. The means to provide comments about the proposed CDM project activity.

(e) The conduct of consultation.
Meeting was conducted was held on 10/06/2015 at Location Project Activity Site Office at O. Karisalkulam Village, Kamuthi Tehsil, Ramanathpuram District, Tamil Nadu State.

In the introductory speech, the representatives of Project Participant 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.

E.2. Summary of comments received

Meeting started with opening speech by representative of project participant. The representative of project participant explained Technical aspects of project to stakeholders. He also explained about social, environmental & economic benefits of the project. He also elaborated about CDM & its requirement for the current project. After the presentation, the session was open for questions/ comments/ feedback from stakeholders.

The villagers raised various queries as summarised below:
- What are the fuels used in the operation of the project activity or any boiler will be installed on-site?

- Does the project activity have any negative impact on local climate conditions like air, land and soil quality, rain and agriculture scenario of the area?
- Will the project help in improving the electricity supply to the villagers or the neighbourhood areas?
- What will be the operational lifetime of the project activity?
- Does the project provide employment opportunities to local populace?
- What will be the other advantages associated with the Project activity?

All the above queries have been suitably and satisfactorily replied / clarified by project participant's representatives. The clarifications provided by the representatives of PP are as follows:

- The project activity does not uses any fuel, instead it uses potential of solar energy to generate Electricity, and there is no installation of boilers on-site.
- The project activity does not have any negative impact on local climate conditions like air, land and soil quality, rain and agriculture scenario of the area, as already told motive of this project activity is to reduce future anthropogenic emission caused by conventional power generating unit like thermal power plants. The project activity will result in improvement in climate conditions, improve quality of air, land, water, and agriculture scenario.
- Project proponents informed him that as the project exports the electricity to local substation first, there is clear possibility that the local electricity supply situation will be better and local populace will get benefited as a result of it. However, they have also mentioned the preference of supply of electricity is not under the control of project. Since, the electricity is generated in the region, we sincerely hope that the local requirements of electricity are given due consideration by the Discom.
- The Operational lifetime of the Project activity is of 25 years.
- They were informed that except technical staff, preference will be given to local population in employment, who have desired skills and qualifications. Possibility of imparting training to the educated unemployed youth will also be considered.
- In addition with the employment opportunities to the local populace, with increase in visit of outside people there will be social and economical wellbeing, Also Due to project activity there will be enhancement in Trade scenario of the area, social and cultural scenario of the area.

Local stakeholders welcomed and expressed their support to the project. The meeting was concluded by vote of thanks to all the participants.

E.3. Consideration of comments received

There were no negative comments raised by the stakeholders and they were totally in support for setting up of these kinds of projects in the region.

SECTION F. Approval and authorization

The letter of approval from the Host party India has been received on Date 15/04/2019 and a copy of LOA is provided to the validating DOE.

Appendix 1. Contact information of project participants

Organization name	Ramnad Solar Power Limited
Country	India
Address	5B, Sambhav Press Building, Judges Bunglow Road, Bodakdev, Ahmedabad
Telephone	+91-79-25557268
Fax	NA
E-mail	dhaval.trivedi@adani.com
Website	http://www.adanigreenenergy.com/
Contact person	Dhaval Trivedi

Appendix 2. Affirmation regarding public funding

The details regarding public funding for the project activity is provided in section A.5

Appendix 3. Applicability of methodologies and standardized baselines

The details regarding applicability of selected methodology are provided in Section B.2

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

The background information on the ex-ante calculation of emission reductions is detailed in section B.6.3.

Source:
1. Feasibility Project Report
2. CO2 Baseline Database for the Indian Power Sector version 13.0 June 2018 published by Central Electricity Authority.

Link: http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver13.pdf

Appendix 5. Further background information on monitoring plan

The detailed monitoring plan is as provided in Section B.7.

Appendix 6. Summary report of comments received from local stakeholders

The detailed monitoring plan is as provided in Section E.3.

Appendix 7. Summary of post-registration changes

Not Applicable

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.

Version	*Date*	*Description*
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
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