72 MWAC RAMNAD RENEWABLE ENERGY PROJECT

Document Prepared By Infinite Solutions

Project Title	72 MWac Ramnad Renewable Energy Project
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1. PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

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. M/s Ramnad Renewable Energy Ltd. is the promoter of the proposed project activity.

The project activity involves installation of 72 MW_{AC} solar power project in Tamil Nadu. The project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 113,246 tCO_2e per year, thereon displacing 119,520 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. Total estimated GHG emission reductions for the chosen 10 year renewable crediting period will be 1,132,463 tonnes of CO2.

The monitoring period is from 18-Sept-2016 to 27-June-2018. The total GHG emission reductions or removals generated in this monitoring period are 2,17,230 tCO2.

In this process there is no consumption of any fossil fuel and hence the project does not lead to any greenhouse gas emissions. Thus, electricity would be generated through sustainable means without causing any negative impact on the environment.
The details of the project are mentioned in the table:

Project Investors' Name	Commissioning Date	Capacity	Location (Village/State)
M/s Ramnad Renewable Energy Ltd	18/09/2016	72MW_{AC}	Pudukottai & Sengappadai village, Kamuthi Taluk, Ramanathpuram Dist., Tamil Nadu

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.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:

Sectoral Scope : 01 - Energy industries (renewable / non-renewable sources)
Project Type : I - Renewable Energy Projects
Methodology : ACM0002: Grid-connected electricity generation from renewable sources - Version 18.1[1]

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	Ramnad Renewable Energy Limited
Contact person	Mr. Dhaval Trivedi
Title	Sr. Manager - Business Development
Address	5B, Sambhav Press Building, Judges Bunglow Road, Bodakdev, Ahmedabad, Gujarat, India.
Telephone	+91 79 2555 7429
Email	dhaval.trivedi@adani.com

1.4 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the project	Project Consultant
Contact person	Mr. Jimmy Sah
Title	Head - Sustainability
Address	611, Chetak Centre Main, 12/2 RNT Marg, Indore- 452001
Telephone	+91-9644130430
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1.5 Project Start Date

Project Start Date: 18-September-2016

The project start date is the date on which Solar Panels were commissioned under the Project activity.

1.6 Project Crediting Period

Crediting Period Start date: 18-September-2016
Crediting Period End date: 17-September-2026

[1] https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP

The project activity adopts renewable crediting period of 10 years.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	√
Large project	

As the estimated annual average GHG emission reductions or removal per year is 1,24,466 t CO2e which is less than 300,000 tonnes of CO2e per year, thus the project falls in the category of Project Scale.

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	115,818
Year 2	115,239
Year 3	114,662
Year 4	114,089
Year 5	113,519
Year 6	112,951
Year 7	112,386
Year 8	111,824
Year 9	111,265
Year10	110,709
Total estimated ERs	1,132,463
Total number of crediting years	10
Average annual ERs	113,246

1.8 Description of the Project Activity

The proposed project activity involves the installation of Solar Power Project. The total installed capacity of the project is 72 MW. The project is promoted by Details of the installation of project in respective state are as follows:

Sl No.	Name of PP	Project Site	Location (State)	Project Capacity (MW_{AC})	Commissioned Capacity (MW_{AC})
1	Ramnad Renewable Energy Limited	Pudukottai, & Sengappadai villages near Kamuthi tehsil in Ramanathapuram district	Tamil Nadu	72	72

The project activity aims to harness solar energy through installation of PV. The solar PV power plant will have solar PV modules, inverters, transformers and other protection system and supporting components as under:

Module Supplier	Module Type	Capacity (p) MW_{AC}

Trina Solar	Poly-Crystalline	72

The Project activity is a new facility (Greenfield) and the electricity generated by the Project will be exported to the Indian Grid. The Project will therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. The Project Proponent plans to avail the VCS benefits for the Project.

In the Pre- project scenario the equivalent amount of electricity, either fetched (under captive cases) or delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected fossil fuel based power plants and by the addition of new generation sources.

The project shall result in replacing anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 113,246 tCO_2e per year, thereon displacing 119,520 MWh/year amount of electricity from the gird.

Solar Power Project Technology Details

The technology employed, converts solar energy to electrical energy. In solar power generation, energy of solar is converted into mechanical energy and subsequently into electrical energy. The technology is an environment friendly technology since there are no GHG emissions associated with the electricity generation. There is no transfer of technology involved in the project activity.

Module Make/Capacity: TRINA Solar /310 Wp	
Inverter Make/ Capacity: ABB /1000 Kw-C	
Model	ABB PVS800-57-1000kW-C
Rated Capacity	1000 KW
No. of Inverters	72
Efficiency	
Maximum Efficiency	98.8%
Euro Efficiency	98.6%
Input Data	
Maximum DC voltage (V)	1200KWp
Maximum input power (PPV, max)	570-850 V
DC voltage range, mpp (UDC, mpp)	1100
Maximum DC current (A)	1710

Transformers	
Specifications	**310Wp**
Module Type	TSM-PD14-310
Nominal Power (PMPP)	**310Wp**
Short circuit current (ISC)	8.85 A
Efficiency (%)	15.98
Power tolerance	+3%
Dimensions (mm)	1956 X 992 X40
Weight (kg)	27.60
Temperature coefficient of PMPP	-0.44%^{O}C

Module area (m2)	1.940 m^2
Maximum load	5400Pa
Power warranty	80% : 25 years

Emission Reductions from anthropogenic sources:

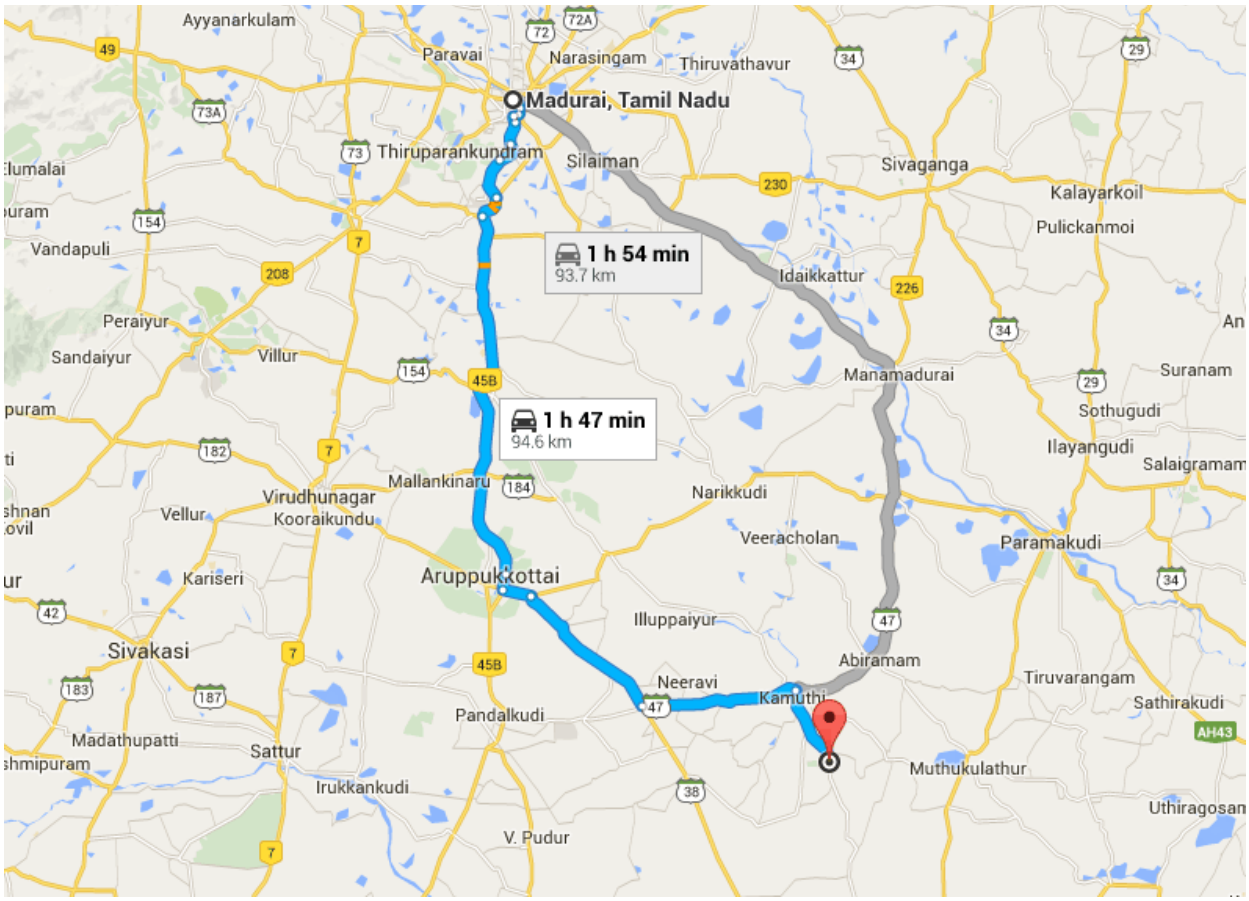
The solar power generated from the Project will be displacing the electricity generated from thermal power stations feeding into Indian grid and will be replacing the usage of diesel generators for meeting the power demand during shortage periods. Since, the solar power is Green House Gas (GHG) emissions free, the power generated will prevent the anthropogenic GHG emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to carbon dioxide (CO2) only.

1.9 Project Location

The proposed 72MW_{AC} solar PV Plant site is located near Pudukottai, & Sengappadai villages near Kamuthi tehsil in Ramanathapuram district.
The site is well connected by state highway state highway (SH) 47 up to *Arruppukottai* and further national highway NH48 connects to Madurai.

The site lies around the coordinates- 9°18'44.21"N, 78°23'48.16"E and at an altitude of approximately 30m, above mean sea level.

The nearest commercial city remains Madurai, which is approximately 90km from the Project site location. The site wise preferred route from Madurai to the Project site location details of the project is given below in the Figure:



1.10 Conditions Prior to Project Initiation

The project is a Greenfield solar power project and does not involve generation of GHG emissions for the purpose of their subsequent reduction, removal or destruction. Prior to the initiation of the project activity, the equivalent amount of electricity would have been drawn from grid connected or new power plants, in Indian Grid. The grid is predominantly coal based and therefore is a major source of carbon di oxide emissions in India. The main emission in the pre project scenario is the power plants connected to the Indian Grid, and main GHG involved is CO2. The baseline identified in section 2.4 is same as the pre-project scenario

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project has received necessary approvals for development and commissioning for solar project from the state Nodal agencies and is in compliance to the local laws and regulations.

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

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

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

- Power generation using solar energy is not a legal requirement or a mandatory option.

- There are state and sectoral policies, framed primarily to encourage solar power projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments.
- The Indian Electricity Act, 2003 (May 2007 Amendment) does not influence the choice of fuel used for power generation.
- There is no legal requirement on the choice of a particular technology for power generation

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The Project is owned by Ramnad Renewable Energy Limited, hence it possess right of use of ER credits. The Ownership is demonstrated through the following documents.

1) Commissioning certificates for 72 MW Solar PV in the name of Ramnad Renewable Energy Limited issued by respective state nodal agencies /authorities of the state Tamil Nadu of India.
2) Power Purchase Agreement with Tamil Nadu Electricity Board for sale of electricity by the Ramnad Renewable Energy Limited.

1.12.2 Emissions Trading Programs and Other Binding Limits

Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits.

1.12.3 Other Forms of Environmental Credit

The Project has no intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.12.4 Participation under Other GHG Programs

The project has applied under CDM mechanism and is currently under development.

1.12.5 Projects Rejected by Other GHG Programs

The Project is not rejected by other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria
This is not a grouped project activity. Thus, this section is not applicable for this project.

Leakage Management
Not applicable to the project activity

Commercially Sensitive Information
No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

Contribution to sustainable development:
Ministry of Environment and Forests, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

- **Social well-being:** The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.
- **Economic well-being:** The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the state. The project activity will generate power using zero emissions solar based power generation which helps to reduce GHG emissions and specific pollutants like SOx, NOx, and SPM associated with the conventional thermal power generation facilities.
- **Technological well-being:** The successful operation of project activity would lead to promotion of solar based power generation and would encourage other entrepreneurs to participate in similar projects
- **Environmental well-being**: Solar being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the Project activity also helps in avoiding significant amount of GHG emissions

Further Information
Not Applicable

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Title **:** Grid-connected electricity generation from renewable sources

Reference **:** ACM0002: - Version 18.1[2]

Methodology Type I : Energy industries (renewable / non-renewable sources)

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

- Tool to calculate the emission factor for an electricity system - Version 06.0 (EB 97, Annex 07) [3]
- Methodological Tool- Tool for the demonstration and assessment of additionality - Version 07.0.0 (EB 70, Annex 08)[4]

2.2 Applicability of Methodology

The project activity involves generation of grid connected electricity from renewable solar energy. The project status is corresponding to the methodology ACM0002 version 18.1 and applicability of methodology is discussed below.

[2] https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP
[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view
[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

Applicability Criterion	Project Case
1. 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 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: (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 emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The option (a) of applicability criteria 2 is applicable as project is renewable energy solar power plant/unit.
3. 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 (3), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the	The project is installation of new solar based electricity generation plants (not a hydro power plant). Hence this criterion is not applicable.

power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project	
4. In the case of integrated hydro power projects, project proponent shall:	The project is solar power project and thus the criterion is not applicable to this project activity.
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	The project is solar power project and thus the criterion is not applicable to this project activity.
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.	The project is solar power project and thus the criterion is not applicable to this project activity.
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	(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. Hence the criteria is not applicable to the project activity
8. In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most	Not applicable, the solar project is a Green field project activity and this

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.	project is not the enhancement or up gradation project.
9. In addition, the applicability conditions included in the tools referred to below apply.	Please refer tables below.

Tool to calculate the emission factor for an electricity system9 - Version 06.0 (EB 97, Annex 07)

Applicability Criterion	**Project Case**
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).	The project is a grid connected Greenfield solar power project and thus the tool is applicable.
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 II.a and option II.b. If option II.a 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.	Steps involved in calculation of Emission Factor are included in section 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 CO2 emission factor of bio fuels is zero.	The project is a solar project and there is no involvement of bio fuels.

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

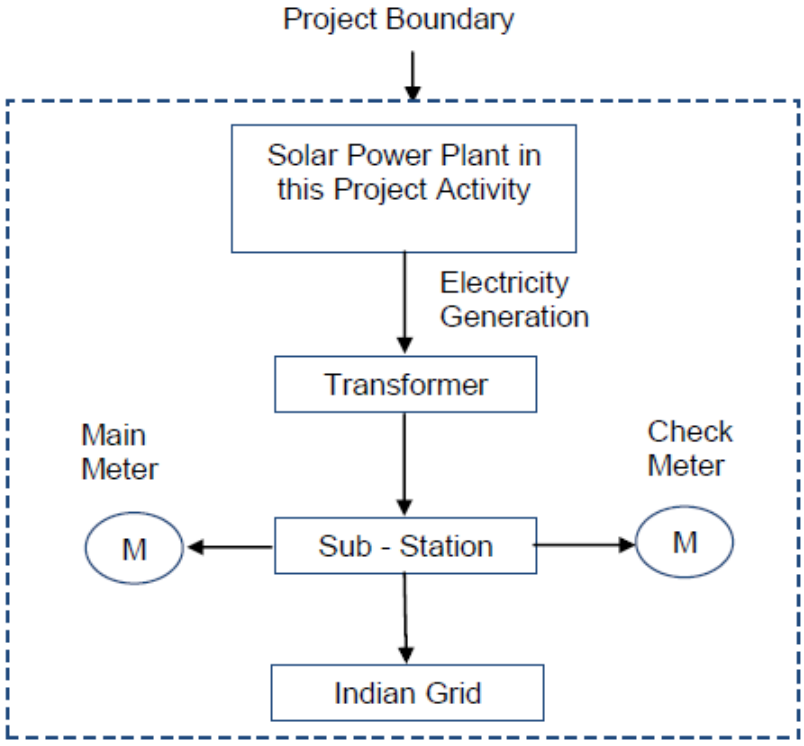
Applicability Criteria has been demonstrated in section on additionality below.

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 72 MW which is applicable as per Project scale project activities methodology ACM0002: Grid-connected electricity generation from renewable sources Version 18.1. The project capacity will be always remain the same and hence the project activity will always be project scale project activities throughout the crediting period and thereafter.

2.3 Project Boundary

As per ACM0002 version 18.1 - "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 VCS project activity.



Source		Gas	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

Source		Gas	Included?	Justification/Explanation
		Other	No	No other GHG emissions were emitted from the project
Project	Greenfield SOLAR Power Project Activity.	CO_2	No	No CO2 emissions are emitted from the project
		CH_4	No	Project activity does not emit CH4
		N_2O	No	Project activity does not emit N_2O
		Other	No	Project activity does not emit other forms of GHG emissions

2.4 Baseline Scenario

As per the approved consolidated methodology ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

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) (having weightage 75%) and build margin (BM) (having weightage 25%). Calculations for this combined margin must be based on data from an official source[5] (where available) and made publicly available.

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

[5] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	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
$EF_{grid,OM,y}$	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
$EF_{grid,BM,y}$	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

2.5 Additionality

The additionality of the proposed project activity is demonstrated using an investment analysis as according to the steps described in the 'Tool for the demonstration and assessment of additionality' (version 07.0.0).

Step 0. Demonstration whether the proposed project activity is the first-of-its-kind.
This step is not applied to the project activity since it is not first-of-its-kind, hence the additionality of the project will be demonstrated in next steps below.

Step1. Identification of alternatives to the proposed project activity consistent with current laws and regulations
As per the applied methodology ACM0002 version 18.1; 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

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 Participants have considered Post-Tax Equity IRR for investment analysis at the time of decision-making. As Project Participants 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 12 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 para 15 of EB62, Annex 5 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:

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%

The Required return on equity (benchmark) was computed in the following manner:
Nominal Benchmark = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where:
- Default value for Real Benchmark = 11.75% (as per Appendix of EB62, Annex 5)
- Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India)

Benchmark estimation:
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%

Inflation Forecast for India as per RBI website:

Project Participants' Name	**Inflation Forecast**		**Benchmark**	
	5 Years	**10 Years**	**5 Years**	**10 Years**
Ramnad Renewable Energy Limited	5.00%	5.00%	17.34%	17.34%

As a conservative approach, benchmark of 17.34% has been selected for this project activity.

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

Considering the input values, Equity IRRs is given below:

Project Participants' Name	Equity IRR without CDM	Benchmark (Equity IRR)
Ramnad Renewable Energy Limited	10.52%	17.34%

The proposed 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:

- PLF
- O&M Cost
- Project Cost
- 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	7.46%	10.52%	14.88%	15.49%
O&M	11.31%	10.52%	10.04%	-105.97%
Project Cost	15.36%	10.52%	7.74%	-13.44%
Tariff Rate	7.46%	10.52%	14.88%	15.49%

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:
Sensitivity Parameter 1 : PLF
PLF considered in financials is as per **"Guidelines for the reporting and validation of Plant load factors" stated in EB48 Annex11**[6]. Variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third Party Report based.
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 and also subject to inflationary

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

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
Estimated Project Cost for financial analysis is considered 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%.
Sensitivity Parameter 4 : Tariff Rate
The tariff is determined by PPA which is fixed for the entire project life of 25 years. Hence, there is no probability to get variation for the same.

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.

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.

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:

- The projects are located in the applicable geographical area;
- The projects apply the same measure as the proposed project activity;
- 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;
- 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;
- The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;
- 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:

- As the project is located in Tamil Nadu state of India, therefore, projects in the geographical area of Tamil Nadu have been chosen for analysis.
- 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.
- The energy source used by the project activity is solar. Hence, only solar energy projects have been considered for analysis.
- The project activity produces electricity; therefore, all power plants that produce electricity are candidates for similar projects.
- The capacity range of the projects is within the applicable capacity range from 36 MW to 108 MW.
- The start date of the project activity is 18-Sep-2016, i.e. the earliest Commissioning Date. Therefore projects, which have started commercial operation before 18-Sep-2016, have been considered for analysis.

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

Nsolar = 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 Nall.

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,
Nall = 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 Ndiff.

As per the tool on Common Practice, the project activities have been separated from the different technologies on the basis of Investment climate on the date of the investment decision.

Hence, projects where this condition is satisfied projects are counted for calculating Ndiff projects.

Ndiff = 0

Step (5): Calculate factor F=1-Ndiff/Nall 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-Ndiff/Nall
F = 1-(0/0) = Undefined

Outcome of Step 4:

As,
i. F = 0; is not less than 0.2
ii. Nall - Ndiff = 0; is less than 3

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.

2.6 Methodology Deviations

Not applicable.

3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

As per the approved consolidated Methodology ACM0002 (Version 18.1) para 42, *Baseline emissions include only CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid- connected power plants. The baseline emissions are to be calculated as follows*:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$ .....(1)

Where:
- BE_y = Baseline emissions in year y (tCO2)
- $EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the GS VER 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" (tCO2/MWh).

The methodology provides following approaches for emission factor calculations:

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

OR

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

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

CO_2 Baseline Database for the Indian Power Sector, Version 12, November 2017[7], 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 06.0, EB 97, Annex 7), 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, all the 5 zones have now been synchronized and called as Indian Grid.

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

Option I:
Only grid power plants are included in the calculation.
Option II:
Both grid power plants and off-grid power plants are included in the calculation.

The Project Participant has chosen only grid power plants in the calculation.

Step 3: Select a method to determine the operating margin (OM)
The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:
(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for

[7] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

calculating operating margin emission factor depends on generation of electricity from low-cost/ must-run sources. In the context of the methodology low cost/mustrun resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

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%

Data Source: Central Electricity Authority (CEA) database Version 13, June '2018

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

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (t CO2/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 (MWh) (incl. imports)		
2014-15	**2015-16**	**2016-17**
8,08,417	**8,71,753**	**9,16,278**

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

Weighted Generation Operating Margin (t CO2/MWh)	**0.9843**

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 06.0, EB 97, Annex 7) para 73:

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_2/MWh) (not adjusted for imports)	
	2016-17
Indian Grid	**0.8723**

Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)
As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 06.0 , EB 97, Annex 7) para 82 :

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:
(a) Weighted average CM; or
(b) Simplified CM.

PP has chosen option (a) i.e., weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emissions factor is calculated as follows:

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

Where:

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

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

Therefore, $EF_{grid,CM,y}$ = 0.9726*0.75 + 0.8723*0.25
= **0.9475** t CO2/MWh

Baseline emission factor (EF_y) :

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

Therefore, EF_y= $EF_{grid,CM,y}$= 0.9653 t CO2/MWh.

3.2 Project Emissions

Project Emissions
For most renewable power generation projects activities PE_y =0. As per applied methodology only emission associated with the fossil fuel combustion, emission from operation of geo-thermal power plants due to release of non-condensable gases, emission from water reservoir of Hydro should be accounted for the project emission. Since the project activity is a solar power project,

Hence PE_y= 0

3.3 Leakage

Leakage Emissions: As per ACM0002 no Leakage emissions are considered. The main emission potentially giving rise to leakage in the context of electrical sector projects is emission arising due to activities arising such as power plant construction and upstream emission from fossil fuel use (e.g. extraction, processing, and transport). These emission sources are neglected.

Hence, LE_y= 0

3.4 Estimated Net GHG Emission Reductions and Removals

As per methodology ACM0002 (version 18.1) net GHG emission reductions are calculated as follows:

ERy = BEy – PEy

ERy = Emission reductions in year y (tCO2e/yr)
BEy = Baseline emissions in year y (tCO2e/yr)
PEy = Project emissions in year y (tCO2e/yr)

Ex-ante calculation (estimate) of net GHG emission reductions:
Ex-ante emission reduction calculations with de-ration of 0.5% in generation are calculated based on current project activity instances to be included in the project activity under consideration. Summary of ex-ante emission reduction calculations is as follows:

.Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1	115,818	0	0	115,818
Year 2	115,239	0	0	115,239
Year 3	114,662	0	0	114,662
Year 4	114,089	0	0	114,089
Year 5	113,519	0	0	113,519
Year 6	112,951	0	0	112,951
Year 7	112,386	0	0	112,386
Year 8	111,824	0	0	111,824
Year 9	111,265	0	0	111,265
Year 10	110,709	0	0	110,709
Total	**1,132,463**	0	0	**1,132,463**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid, CM, y}$
Data unit	t CO_2 /MWh
Description	Combined margin emission factor for Indian grid connected power generation in year y calculated using the latest version of "Tool to calculate the emission factor for an electricity system"
Source of data	CO_2 baseline database (Version 13.0) published by CEA on 01-Jun-2018
Value applied:	0.9475
Justification of choice of data or description of measurement methods and procedures applied	This value is calculated using OM and BM values as per Version 6.0 of methodological tool to calculate the emission factor for an electricity system and using data base of CEA.
Purpose of Data	For the calculation of Emission Factor of the grid
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid, OM, y}$
Data unit	t CO2 /MWh
Description	Simple operating margin emission factor for Indian grid
Source of data	CO2 baseline database (Version 6.0) published by CEA on 01-June-2018
Value applied:	0.9726

Justification of choice of data or description of measurement methods and procedures applied	This value is calculated by taking weighted average of Simple Operating Margin of recent three years for Indian grid as per the "Tool to calculate the emission factor for an electricity system", version 06.0.0
Purpose of Data	For the calculation of Emission Factor of the grid
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid, BM, y}$
Data unit	t CO2 /MWh
Description	Simple build margin emission factor for NEWNE grid
Source of data	CO2 baseline database (Version 6.0) published by CEA on 01-June-2018
Value applied:	0.8723
Justification of choice of data or description of measurement methods and procedures applied	This value is calculated by taking weighted average of Simple build Margin of recent three years for Indian grid as per the "Tool to calculate the emission factor for an electricity system", version 06.0.0
Purpose of Data	For the calculation of Emission Factor of the grid
Comments	This parameter is fixed ex-ante for the entire crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ, y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Monthly Credit Report by TANGEDCO
Description of measurement methods and procedures applied	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 & Electronic Calibration frequency: 5 years 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, electricity imported from the grid obtained from joint meter reading certificates/credit notes issued by Ramnad Electricity Distribution Circle 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 joint meter reading certificates/credit notes, 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 raised by the project participant to the grid.
Frequency of monitoring/recording	Monthly
Value applied:	119,520
Monitoring equipment	The two parameters, import and export to the grid, are measured at the same location near the connection to the grid, through standard electricity metering instrument. The metering instruments will be installed at the grid-connected point to measure the amount of electricity going from and to the grid. The readings of electricity will be continuously measured by metering instrument itself and monthly recorded.
QA/QC procedures applied	This data will be directly used for calculation of emission reductions. Measurement results of electricity supplied to the grid and that delivered from the grid to the project will be crosschecked with records for sold electricity. The meter(s) will be calibrated annually in accordance with national standards and procedures.
Purpose of data	The Data/Parameter is required to calculate the baseline emission.
Calculation method	N/A
Comments	Data will be archived electronically for a period of 2 years beyond the end of crediting period.

4.3 Monitoring Plan

Aim of monitoring:

The monitoring methodology specified in the methodology requires that the project-monitoring plan to consist of monitoring of quantity of net electricity supplied to the grid in the year y. In order to monitor the mitigation of GHG due to the project activity, the total energy exported needs to be

measured. The net energy supplied to grid by the project activity multiplied by emission factor for regional grid, would form the baseline for the project activity.

Since the baseline emission factor is based on an ex-ante determination, monitoring of this parameter is not required. The sole parameter for monitoring is the net electricity exported to the grid.

Monitoring roles and responsibilities

The operational and management structure implemented for data monitoring is as follows:
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 in Tamil Nadu, India. The monitoring plan, which will be implemented by the project proponent 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 proponent. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members:

Responsibilities of O & M Head: Overall functioning and maintenance of the project activity and overall responsibility of compliance with the CDM Monitoring Plan.

Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data. Regularly verifying the monthly energy generation date with energy sales receipt or installed meters reading for identification of any discrepancies in data collection and taking suitable action to rectify them.

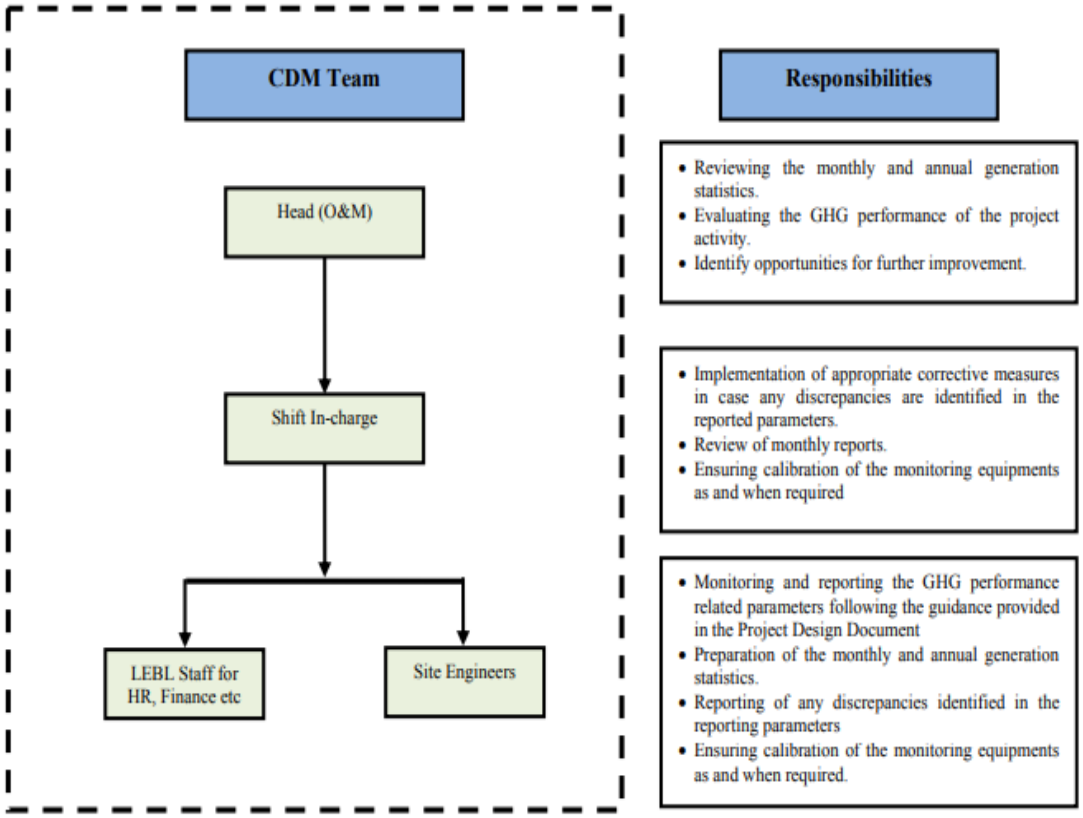
Responsibilities of Shift In-charge:

- Responsibility for day to day data collection and maintains day to day log book for monitored data.
- Responsibility for monthly and annual report generation and quality assurance of the data/reports and preliminary check of data for any discrepancies.

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 to Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO). The meters are calibrated by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) at-least once in five years.

Data Measurement: The export and import energy will be measured continuously using above mentioned Main & Check meters. Export & Import 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. The meter reading will be taken jointly and signed by the representatives of the TANGEDCO and project investors. Based on the readings, 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 got the monthly

credit report from where net electricity supplied to grid is obtained and used for emission reduction calculations.



Operation & Management Structure

Data Archiving:
Monthly data shall be archived electronically and in paper form and stored for the entire crediting period and two years thereafter.

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 event that the main meter, which is used to record the net electricity exported by the project, is found to be faulty it will be repaired or replaced and the data from the check meter will be used in its place. In the unlikely event that the check meter fails it will also be repaired or replaced.

Training and maintenance requirements:
Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the solar plants, it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that O&M team is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. Each and every site personnel is provided with proper training to meet the

requirements of the Operations and maintenance. This ultimately leads to creativity in problem solving.

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.

Apportioning:
In case of mismatch of date between the start date of the billing cycle and the start date of monitoring period the data will be apportioned in line to the daily generation values for the said mismatch period.

5 SAFEGUARDS

5.1 No Net Harm

There were no harm identified form the project and hence no mitigations measures are applicable.

5.2 Environmental Impact

According to Indian regulation, the implementation of the renewable energy power project does not require an Environmental Impact Assessment (EIA). As all the project activity instances involved in the grouped project activity involves installation of the renewable energy power project and as the Indian regulation on the Environmental Impact Assessment is the same for all the renewable energy Power Projects, it is decided to analyze the environmental impacts at the groped project activity Level.

As per the Ministry of Environment and Forests (Government of India) notification dated September 14, 2006 regarding the requirement of environmental Impact Assessment (EIA) studies as per the Environmental Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) Ministry of Environment and Forests), any project developer in India needs to file an application to the Ministry of Environment and Forests (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. The renewable energy power Projects are not included in this list and thus an EIA is not required. Hence, environmental impact analysis is not required for the groped project activity and also for the project activity instances.

5.3 Local Stakeholder Consultation

The stakeholders of the project activity were invited to attend the stakeholder meeting on 05/06/2015. Personal invitations were also sent to the prominent members of the regions in the vicinity along with public display of invitation letters.

A stakeholder meeting was held on 10/06/2015 involving the local stakeholders at the project site. The meeting was attended by local villagers, panchayat members, shopkeepers, suppliers, vendors and representatives of PPs.

The stakeholders were explained about the project activity and the various benefits arising out of the project activity. A discussion was held in which the views of the local stakeholders were addressed.

Summary of comments received
The villagers were happy with the fact that the installation of such a project would bring about development in the region. The queries raised by the local stakeholders were:

- Has the project affected the ground water level?
- Will there be free supply of power to the local people?
- How other sources of power generation lead to pollution?
- Will the project cause any noise & vibration or release of light, heat energy or harmful radiations?
- Are there any safety practices to be adopted for this project?

Report on consideration of comments received
The queries of the stakeholders were answered satisfactorily by the project proponent representatives through scientific and logical explanations. The responses were as below.

- The generated power will be fed in the grid. Project promoter can't supply directly power to the local people. They have to get authorized connection from Govt. body. But due to the project activity the supply of power in the area will increase.
- Responding about the increased possibilities for employment of local youth due to the project activity, it was pointed out that preference would be given for locals in the employment opportunities. Also project will lead to various indirect employment generations due to implementation of project activity.
- Conventionally, power is generated from thermal power plants using fossil fuels. This leads to emission of NOx, CO2 and SO2.
- Carbon Credits helps in promoting renewable energy thereby reducing the emission of GHGs and in sustainable improvement of the country. This will also decrease the further demand of coal for the generation of electricity and will result in financial and environmental benefits.

5.4 Public Comments

The project is version 01 i.e. not webhosted yet.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh/year
Description	Quantity of net electricity supplied (MWh) to the grid as a result of the implementation of the project activity instances in this monitoring period.
Value applied:	2,29,268
Comments	Quantity of net electricity supplied (MWh) to the grid is the difference of export and import

6.2 Baseline Emissions

As per description earlier under this document:

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

$EF_{grid,CM,y}$: Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh) (i.e., 0.9475 tCO_2/MWh).

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

BEy : Baseline emissions in year y (tCO_2e/yr)

Here,

Project Investors' Name	**Total Generated Power (MWh)**	**Baseline Emission Factor (tCO_2/MWh)**	**Total Emission Reduction (tCO_2/ year)**
M/s. Ramnad Renewable Energy Limited	**2,29,268**	**0.9475**	**2,17,230**

Monthly calculations of baseline emissions:

Month*	**Net Generation in MWh**	**Emission Factor (tCO2/MWh)**	**Emission Reduction (tCO2)**
18-09-2016 to 27-09-2016	1,644	0.9475	1,558
Oct-16	8,164	0.9475	7,735
Nov-16	7,836	0.9475	7,425
Dec-16	8,880	0.9475	8,414
Jan-17	10,080	0.9475	9,551
Feb-17	12,332	0.9475	11,685
Mar-17	11,880	0.9475	11,256
Apr-17	11,144	0.9475	10,559
May-17	11,412	0.9475	10,813
Jun-17	11,056	0.9475	10,476
Jul-17	11,772	0.9475	11,154
Aug-17	12,244	0.9475	11,601
Sep-17	12,308	0.9475	11,662
Oct-17	10,776	0.9475	10,210
Nov-17	9,552	0.9475	9,051
Dec-17	9,024	0.9475	8,550
Jan-18	11,768	0.9475	11,150
Feb-18	12,976	0.9475	12,295
Mar-18	13,444	0.9475	12,738
Apr-18	10,528	0.9475	9,975

May-18	9,688	0.9475	9,179
Jun-18	10,760	0.9475	10,195

* The project was commissioned on 18th September 2016 so the first billing cycle is till 27th September 2016. Thereon each month billing is from 28th of the month till 27th of the next month.

6.3 Project Emissions

The project activity involves in harnessing Solar power. So, the emissions from the project are zero.

6.4 Leakage

No leakage emissions have been considered and hence the leakage emission is zero.

6.5 Net GHG Emission Reductions and Removals

As per the applied methodology, emission reductions are calculated as follows:
$ER_y = BE_y - PE_y - LE_y$

Where,
ER_y = Emission Reduction in tCO_2/year
BE_y = Baseline emission in tCO_2/year
PE_y = Project emissions in tCO_2/year
LE_y = Leakage Emissions in tCO_2/year.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2016	25,131	0	0	25,131
2017	126,567	0	0	126,567
2018	65,532	0	0	65,532
Total	**2,17,230**	0	0	**2,17,230**

The Emissions Reductions for the current monitoring period is lesser than the estimated values. This is because of lower PLF observed. The Values are within the sensitivity analysis carried out for the project activity.