SOLAR ENERGY PROJECT(S) BY SB ENERGY PRIVATE LIMITED

Document Prepared By EKI Energy Services Limited

Project Title	Solar Energy Project(s) by SB Energy Private Limited
Version	1
Date of Issue	19-09-2018
Monitoring Period	27-02-2017 to 31-08-2018 (inclusive of both dates)
Prepared By	Bhaskar Dutta, EKI Energy Services Ltd.
Contact	Office No 201, Plot No 48, Scheme 78, Part 2, Vijay Nagar, Indore, Madhya Pradesh 452010 , Telephone +91-0731-4289086, e mail bhaskar@enkingint.org

Table of Contents

1 PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

The proposed project activity is a step towards supporting the implementation and installation of grid connected renewable energy power plants in India. The implementation of project activity ensures energy security, diversification of the grid generation mix and sustainable growth of the electricity generation sector in India by means of Solar PV technology.

The main goal of project activity is to implement renewable energy projects in the country and the significant importance of revenues from sale of Verified Carbon Units (VCUs) to achieve this goal forms the basis of the implementation of this project activity. The project activity is a voluntary action and SB Energy Private Limited is the Project Proponent for their project activity. There are no mandatory laws or regulations existing in India requiring PP or any other party to develop a programme for renewable generation plants.

The project activity will support the development of new grid-connected renewable energy power plants in India and will cover the solar energy technologies. It seeks to enable investment in large scale grid connected plants that export their generated output to the regional / national electricity grid in India.

The electricity generated by renewable technology (solar PV) installed as part of the project activity will be supplied to the regional grid there by displacing the consumption of electricity from the regional grid electricity distribution system.

The objective of the project activity is to develop a platform for reducing VCS Registration timelines and process costs for registration of individual projects under VCS.

The proposed project activity involves the installation of Solar PV Power Projects. The total installed capacity of the project is 2,250 MW; which involves operation of Solar PV projects in multiple states of India. The project is promoted by following project owners which are as follows:

Sr No.	Owner of Project/SPV	Project Location	State	Project Capacity (MW)	Commissioning Date
1	SBG Cleantech Two Ltd.	Kurnool	Andhra Pradesh	182	27/02/2017
				68	22/03/2017
				100	28/03/2017
2	SB Energy One Private Limited	Bhadla	Rajasthan	300	Yet to be commissioned
3	SB Energy Three Private Limited	Bhadla	Rajasthan	100	Yet to be commissioned
4	SB Energy Four Private Limited	Bhadla	Rajasthan	200	Yet to be commissioned
5	SB Energy Solar Private Limited	Ananthapur	Andhra Pradesh	250	Yet to be commissioned
6	SB Energy Six Private Limited	Phalodi, Jaisalmer	Rajasthan	600	Yet to be commissioned
7	SB Energy Seven Private Limited	Kadappa	Andhra Pradesh	250	Yet to be commissioned

8	SBG Cleantech Project Co Five Private Limited	Pavagadaa	Karnataka	200	Yet to be commissioned

These are the SPVs of SB Energy Private Limited and the project is promoted by SB Energy Private Limited. As on date, 350 MW capacity has been commissioned out of the total 2250 MW capacity.

The location and geographical boundary of the project can be defined as India. The estimated annual emission reductions from the project activity are 39,55,847 tCO_2e/year. The total emission reductions for 10 years crediting period will be 39,558,465 tCO_2e.

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 applied methodology is the following:

The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

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

1.2 Sectoral Scope and Project Type

Title: ACM0002 Grid-connected electricity generation from renewable sources --- Version 19
Reference: ACM0002 Version 19[1]

1.3 Project Proponent

Organization name	SB Energy Private Limited
Contact person	Mr M. Sinha
Title	Administrator
Address	5th Floor, NH-8, New Delhi- 110036, India.

[1] http://cdm.unfccc.int/methodologies/DB/VJI9AX539D9MLOPXN2AY9UR1N4IYGD

Telephone	+91 99 07 53 4900
Email	-

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Ltd.
Role in the project	Project Consultancy
Contact person	Mr. Bhaskar Dutta
Title	Manager- Operations
Address	Office No 201, Plot No 48, Scheme 78, Part 2, Vijay Nagar, Indore, Madhya Pradesh 452010, India
Telephone	+919907534900
Email	bhaskar@enkingint.org

1.5 Project Start Date

The first project activity under consideration was commissioned and power generation started on 27/02/2017. Hence the project start date is considered as 27th Feb 2017.

1.6 Project Crediting Period

Project crediting period for project activity is taken as 10 years renewable twice. Accordingly the start date of the first crediting period is 27/02/2017 and end date will be 26/02/2027.

First crediting period is from 27/02/2017 to 26/02/2027.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

The project is a large scale project that involves setting up of 2,250 MW of Solar power project.

Project Scale	
Project	
Large project	✓

As the estimated annual average GHG emission reductions or removal per year is 39,55,847 tCO_2e which is more than 300,000 tonnes of CO_2e per year, thus the project falls in the category of Large Project.

Total emission reductions for project activity being included in the project are as below

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	39,74,092
Year 2	39,54,221
Year 3	39,54,122
Year 4	39,54,022
Year 5	39,53,922
Year 6	39,53,821
Year 7	39,53,720
Year 8	39,53,618
Year 9	39,53,515
Year 10	39,53,412
Total estimated ERs	**39,558,465**
Total number of crediting years	10
Average annual ERs	39,55,847

1.8 Description of the Project Activity

The proposed project activity involves the installation of Solar PV project. The total installed capacity of the project is 2,250 MW; which involves installation of Solar PV projects of different capacities located in different states of India. The project is promoted by SB Energy Private Limited, who will act as project proponent on behalf of all the individual SPV's.

The Project activity is a new facility (Greenfield) and the electricity generated by the Project will be exported to the Indian electricity 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 entire 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.

The project shall result in replacing anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 39,55,847 tCO_2e per year, thereon displacing 41,93,850 MWh/year amount of electricity from the gird over the 10 years crediting period.

Solar PV Project Technology Details –

The project activity aims to harness solar energy through installation of PV with total installed capacity of 2,250 MW.

Section **Error! Reference source not found.** and Section **Error! Reference source not found.** mentions information related to metering & monitoring 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 applied methodology is the following:

The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

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

The estimated lifetime of the project activity is considered as 25 years for solar technology. This may increase depending on the operation & maintenance of the plant.

1.9 Project Location

The solar plants are located at various states of India and respective location is given below

Sr No.	Owner of Project	Project Location	State	Project Capacity (MW)	Geographical Coordinates
1	SBG Cleantech Two Ltd.	Kurnool	Andhra Pradesh	182 68 100	15.683618° N 78.283456° E
2	SB Energy One Private Limited	Bhadla	Rajasthan	300	27.465261° N 71.994157° E
3	SB Energy Three Private Limited	Bhadla	Rajasthan	100	27.531652° N 71.963053° E
4	SB Energy Four Private Limited	Bhadla	Rajasthan	200	27.484473° N 72.023639° E
5	SB Energy Solar Private Limited	Ananthapur	Andhra Pradesh	250	13.992247° N 78.424146° E
6	SB Energy Six Private Limited	Phalodi, Jaisalmer	Rajasthan	600	26.953449° N 72.059720° E
7	SB Energy Seven Private Limited	Kadappa	Andhra Pradesh	250	14.949610° N 78.220235° E
8	SBG Cleantech Project Co Five Private Limited	Pavagadaa	Karnataka	200	14.224012° N 77.429953° E

The map of project site is as indicated in the following figure:

1.10 Conditions Prior to Project Initiation

The project activity is a Greenfield renewable power generation projects. These will be installed at locations where there was no power generation activity at the site. In the absence of the project activity, the equivalent amount of electricity would have been generated from the existing/new power plants connected to the grid.

Therein, the main emission source in the pre-project scenario are the grid connected power plants and the primary GHG involved is CO_2.

The project has not been implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

For this project activity, the baseline scenario is the same as conditions existing prior to project initiation. Please refer section 2.4 of joint VCS PD and MR for baseline scenario for the project activity.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project has received all the necessary approvals for development and commissioning for the 350 MW out of the proposed 2,250 MW Solar PV project from the respective State Nodal Agencies and is in compliance to the local laws and regulations. The remaining 1900 MW capacity solar project is yet to be commissioned and it is under the process of receiving all the required statutory approvals from the respective State Nodal Agency.

Compliance related to following aspects will be provided for each of the project activity to be included:

- Commissioning certificates
- Power Purchase agreement with state electricity board

Apart from above, as per Central pollution Control Board directions No. B-29012/ESS (CPA) /2015-16 dated 07/03/2016, the wind/solar projects, the category of industries has been changes from Green to White. As per this re-categorisation exercise," There shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice". As per this rule, No necessity of consent for non-polluting industries.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The Project is owned by each SPV of SB Energy Private Limited, hence it possess right of use of ER credits. The Ownership is demonstrated through the following documents.

1) Commissioning certificates for Solar PV Project in the name of each SPV issued by respective state nodal agencies /authorities

2) Power Purchase Agreement of each SPV with respective State Electricity Board

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.

However it can be crosschecked that PP is not claiming REC benefits, the same can be verified with the REC accreditation body of India[2].

1.12.4 Participation under Other GHG Programs

The proposed project activity has not been registered and is not seeking registration at moment under any other GHG programs.

The project is seeking registration only in VCS program.

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

Not applicable. No any commercially sensitive information has been excluded from the public version of the project description. There is no commercially sensitive information.

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.

[2] https://recregistryindia.nic.in/index.php/general/publics/accredited_regens_pdf

The project activity will generate power using zero emissions Solar PV 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 : The project activity meets the eligibility criteria of large scale project as it is more than 15 MW
Methodology : ACM0002: Grid-connected electricity generation from renewable sources - Version 19[3]
Type I : Energy industries (renewable / non-renewable sources)
Category : Approved Consolidated Methodology (ACM0002)

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

- Tool to calculate the emission factor for an electricity system[4] - Version 07.0 (EB 100, Annex 04)
- Methodological Tool- Tool for the demonstration and assessment of additionality[5] - Version 07.0.0 (EB 70, Annex 08)

2.2 Applicability of Methodology

The project activity involves generation of grid connected electricity from renewable solar energy. The project activity has capacity of 2,250 MW which will qualify for a large scale CDM project activity under Type-I of the large scale methodologies. The project status is corresponding to the methodology ACM0002 version 19 and applicability of methodology are discussed below.

[3] http://cdm.unfccc.int/methodologies/DB/VJI9AX539D9MLOPXN2AY9UR1N4IYGD

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

[5] http://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, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The 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:[6] (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/m^2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater	The project is installation of new solar based electricity generation plants (not a hydro power plant). Hence this criteria is not applicable.

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

	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 (3), 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 (4), 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.	
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 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".	Not applicable, the solar project is a Green field project activity and this project is not the enhancement or up gradation project.
9.	In addition, the applicability conditions included in the tools referred to below apply.[7]	Please refer tables below.

Tool to calculate the emission factor for an electricity system[8] - Version 07.0 (EB 100, Annex 04)

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 IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW)	Steps involved in calculation of Emission Factor is included in section B.6.3 of the PDD as per the requirement of the tool

[7] The condition in the "Combined tool to identify the baseline scenario and demonstrate additionality" that all potential alternative scenarios to the proposed project activity must be available options to project participants; does not apply to this methodology, as this methodology only refers to some steps of this tool.

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

Applicability Criterion	Project Case
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.	
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Project is located in non-Annex I country and hence the tool is applicable
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project is a Solar project and there is no involvement of biofuels.

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

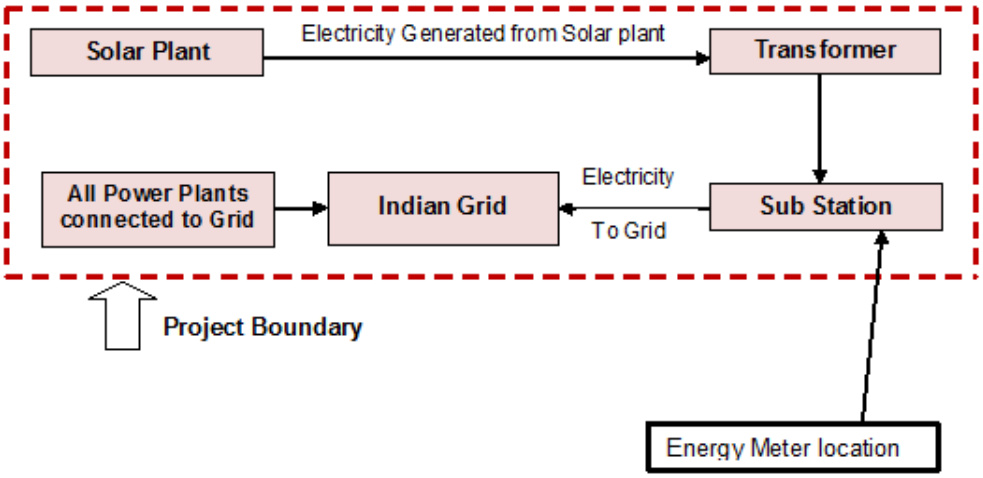
  Applicability Criteria has been demonstrated in section on additionality below.

  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 proposed capacity of project activity is 2,250 MW which is applicable as per large scale project activities methodology ACM0002: Grid-connected electricity generation from renewable sources Version 19. The project capacity will be always remain the same and hence the project activity will always be large scale project activities throughout the crediting period and thereafter.

2.3 Project Boundary

As per ACM0002 version 19 - “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.



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

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project	Greenfield Solar PV Power Project Activity.	CO_2	No	No CO_2 emissions are emitted from the project
		CH_4	No	Project activity does not emit CH_4
		N_2O	No	Project activity does not emit N_2O

2.4 Baseline Scenario

As per the approved consolidated Methodology ACM0002 (Version 19) 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 projects to harness the power of sun to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the Indian grid, which is fed mainly by fossil fuel fired plants.

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

The combined margin ($EF_{grid, CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 13[9] is the latest available data at the time of PD submission to DOE for validation, hence same is considered for emission factor calculations.

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

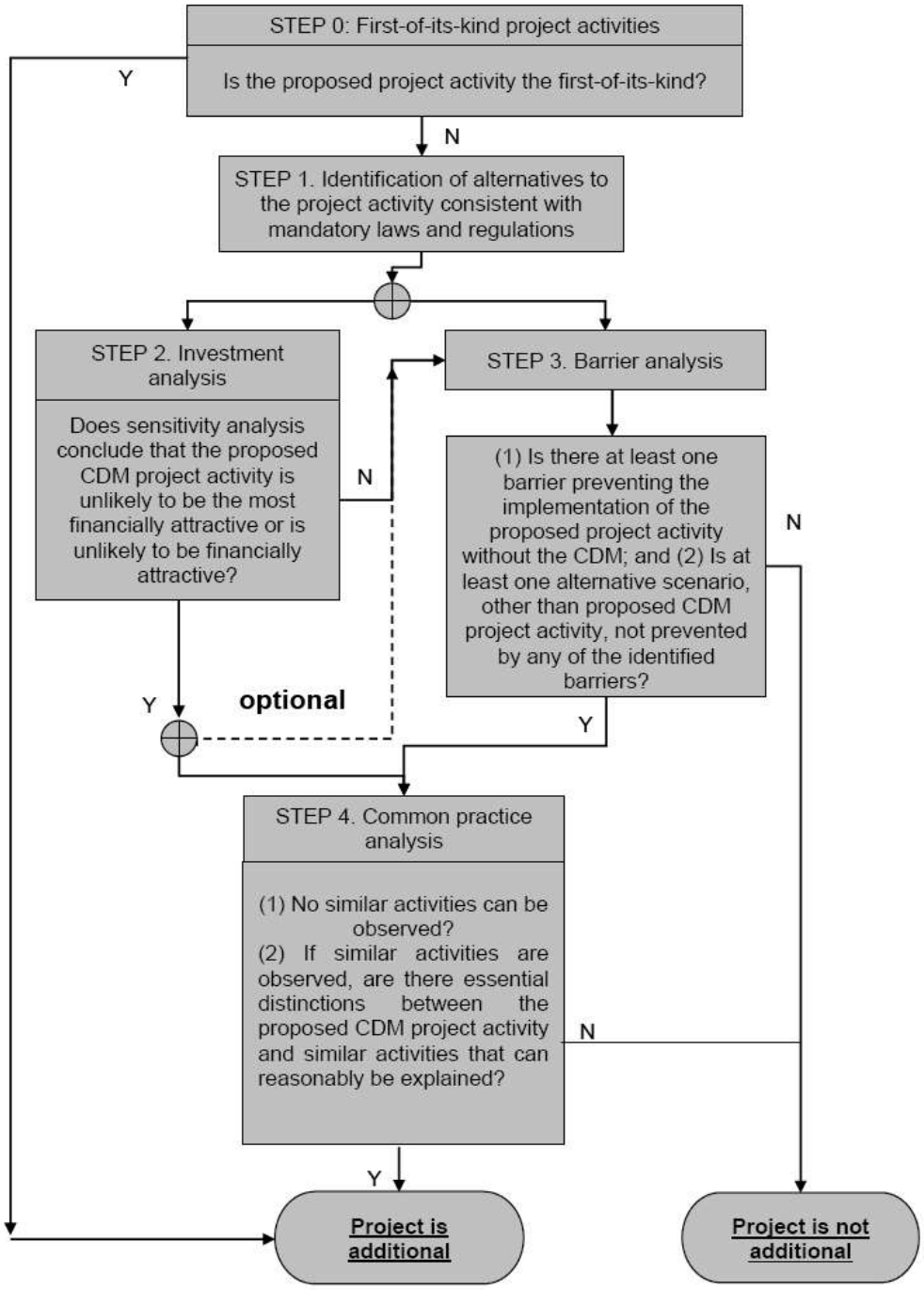
Parameter	Value	Nomenclature	Source
$EF_{grid,CMy}$	0.9476 tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline CO_2 Emission Database, Version 13.0, June 2018 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9727 tCO_2/MWh	Operating margin CO_2 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 CO_2 Emission Database, Version 13.0, June 2018 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8723 tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Baseline CO_2 Emission Database, Version 13.0, June 2018 published by Central Electricity Authority (CEA), Government of India

2.5 Additionality

The present VCS project generates power using Solar PV energy which is a renewable, zero emission source of energy. Baseline considerations for the project are based on approved

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

consolidated baseline methodology ACM0002 (Version 19). The methodology requires the project investor to determine the additionality based on "Methodological Tool- Tool for the demonstration and assessment of additionality", Version 7.0.0. The step-wise approach to establish additionality of the project activity has been followed, details of which are provided in the following paragraphs:



In line with VCS Standard version 3.7, the additionality of the Project activity is ascertained in line with the applicable guidance from the UNFCCC. The demonstration of additionality for the proposed Project activity is being carried out in accordance with the additionality tool provided by the UNFCCC i.e. "Tool for

demonstration and assessment of Additionality" Version 07.0.0,. The tool provides a step-wise approach to demonstrate additionality which is displayed below:

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind
The proposed project activity is not the first-of-its-kind. Hence not applicable.

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

Sub-step 1a: Define alternatives to the project activity:

Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed VCS project activity.

The purpose of the project activity is to generate electrical power using solar energy and feed the electricity generated to the grid. Hence, the following alternatives are considered:

Alternative 1: The proposed project activity not undertaken as a VCS project activity.

The PP could proceed with the implementation of the project without Carbon credit benefits. The electricity produced from the renewable energy project would have been sold to the grid. This is in compliance with all applicable legal and regulatory requirements and can be a part of the baseline. However, the Project activity is not feasible without revenues from sale of Carbon Credits. This argument has been discussed in step 2 of the Additionality section.

Alternative 2: No proposed project activity and equivalent amount of energy would have been produced by the grid electricity system through its currently running power plants and by new capacity addition to the grid i.e. Continuation of the present situation.

The PP would have continued without investment in Project activity with usual business activities. The grid would continue with the fossil fuel based power projects and this would result in GHG emissions. Hence, the new capacity add-on from a fossil fuel based power plant is appropriate, realistic & credible baseline alternative for the project activity.

Outcome of Sub-step 1a: All the realistic alternatives for the project activity have been enlisted above.

Sub-step 1b: Consistency with mandatory laws and regulations:
The alternative(s) shall be in compliance with all applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This sub-step does not consider national and local policies that do not have legally-binding status.).

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

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

Default Value Benchmark:

As per para 20 of EB 85, Annex 12 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 in EB 85, Annex 12 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.10%**

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

Nominal Benchmark[10] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where:
- Default value for Real Benchmark = 11.10% (as per Appendix of EB 85, Annex 12)

- Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India) for India & in case where RBI Inflation forecast was not available Average Inflation rate forecast for India has been sourced from IMF web site.

Benchmark estimation:

Appendix in EB 85, Annex 12 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.10%**

Inflation Forecast for India as per RBI website[11]:

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

Thus benchmark of **15.10%** has been selected for this project activity.

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

The Post tax Equity IRR is evaluated for the entire lifetime of the project activity, i.e. 25 years. It is calculated based on the cash outflows from and cash inflows into the project activity.

Additionality Assessment

In line with VCS Standard version 3.5, the additionality of the Project activity is ascertained in line with the applicable guidance from the UNFCCC. The demonstration of additionality for the proposed Project activity is being carried out in accordance with the additionality tool provided by the UNFCCC i.e. “Tool for demonstration and assessment of Additionality” Version 07.0.0,. The tool provides a step-wise approach to demonstrate additionality which is displayed below:

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

The proposed project activity is not the first-of-its-kind. Hence not applicable.

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

[10] As per Fisher Equation, https://en.wikipedia.org/wiki/Fisher_equation

[11] https://rbi.org.in/Scripts/PublicationsView.aspx?id=16696

Sub-step 1a: Define alternatives to the project activity:
Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed VCS project activity.

The purpose of the project activity is to generate electrical power using solar energy and feed the electricity generated to the grid. Hence, the following alternatives are considered:

Alternative 1: The proposed project activity not undertaken as a VCS project activity.
The PP could proceed with the implementation of the project without Carbon credit benefits. The electricity produced from the renewable energy project would have been sold to the grid. This is in compliance with all applicable legal and regulatory requirements and can be a part of the baseline. However, the Project activity is not feasible without revenues from sale of Carbon Credits. This argument has been discussed in step 2 of the Additionality section.

Alternative 2: No proposed project activity and equivalent amount of energy would have been produced by the grid electricity system through its currently running power plants and by new capacity addition to the grid i.e. Continuation of the present situation.

The PP would have continued without investment in Project activity with usual business activities. The grid would continue with the fossil fuel based power projects and this would result in GHG emissions. Hence, the new capacity add-on from a fossil fuel based power plant is appropriate, realistic & credible baseline alternative for the project activity.

Outcome of Sub-step 1a: All the realistic alternatives for the project activity have been enlisted above.

Sub-step 1b: Consistency with mandatory laws and regulations:
The alternative(s) shall be in compliance with all applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This sub-step does not consider national and local policies that do not have legally-binding status.).

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.

Outcome of Sub-step 1b: Hence, both the alternatives enlisted above are found to comply with the mandatory laws and regulations taking into account the enforcement of the legislations in the region or country and EB decisions on national and/or sectoral policies and regulations. However, Alternative 2 has been selected as the appropriate baseline alternative for this project activity.

Step 2: Investment analysis

Determine whether the proposed project activity is economically or financially less attractive than at least one other alternative, identified in step 1, without the revenue from the sale of emission reductions credits. To conduct the investment analysis, use the following sub-steps:

Sub-step 2a: Determine appropriate analysis method

As per Tool for demonstration and assessment of Additionality; Sub-step 2a, Paragraph (1), as the project activity is selling the generated electricity & getting financial benefits other than CDM benefits hence, Option- I (Apply simple cost analysis) is not applicable under this situation. Also as per EB-85, Annex 12, Methodological Tool of "Investment Analysis" version 7, clause no.18 "In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market". Hence Option-II (Apply investment comparison analysis) is also not applicable under this situation. So the project promoter has chosen Option- III or benchmark analysis as an appropriate analysis method to demonstrate the investment barrier.

This method determines the attractiveness of the project activity for the investors, as well as provides a measure of the viability of the investment to generate revenues during its operation, as compared with other avenues and investment options. Hence, the Benchmark analysis method is to be employed for analysis of the said project.

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

The investment analysis using Benchmark analysis approach (Option III) has been chosen. Further, this method illustrates the evaluation of the Project by the PP before the decision to undertake the project was taken and management approval granted.

Choice of Financial Indicator:

According to the "Tool for demonstration and assessment of Additionality", *the financial indicator can be based either on (1) project IRR or (2) equity IRR. There is no general preference between the approaches (1) or (2). The benchmark chosen for analysis shall be fully consistent with the choice of approach.* Therefore in accordance with the guidance, the relevant financial indicator for project activity has been chosen as Equity IRR.

Choice of Benchmark:

As per para 16 of Guidelines on the methodological Tool of the investment analysis (Annex 12, EB 85),

The applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR.

In the project activity, PP has considered the cost of equity as the benchmark for the project as per Appendix of methodological Tool "Investment Analysis" based on date of decision made for the project activity. Thus earlier guidelines of Investment Analysis default values are used for Benchmark determination. The default value of Return on Equity for Group-1 projects in India is 11.10% as per EB 85 Annex 12

As per paragraph 17 of the above mentioned document, "*In situations where an investment analysis is carried out in nominal terms and the available IRR benchmarks are in real terms, project participants shall convert the real term values of benchmarks to nominal values by adding the inflation rate. The inflation rate shall be obtained from the inflation forecast of the central bank of the host country for the duration of the crediting period. If this information is not available, the target inflation rate of the central bank shall be used. If this information is also not available, then the average forecasted inflation rate for the host country published by the IMF (International Monetary Fund World Economic Outlook) or the World Bank for the next five years after the start of the project activity shall be used".*

The investment analysis has been carried out in Nominal terms. Accordingly, Default value has been adjusted by adding suitable forecasted inflation rate taken from RBI (Central Bank, India).
PP has calculated Benchmark based on WPI mean inflation rate. As per Para 17 of Appendix of EB 85, Annex 12, the inflation forecast should be for the duration of the crediting period. However, since RBI provides forecast inflation only for 5 & 10 years, the project investor has calculated benchmark using 10 years durations and the same is considered as Benchmark for the project activity.

The benchmark has been computed in the following manner:

Nominal Benchmark[12] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where,
Real Benchmark = 11.10% (as per Appendix of Annex 12, EB 85)
Inflation rate = Projected Inflation Rate for India in next 10 years (RBI Forecast)

The calculations of benchmark and IRR calculations are prepared in excel spreadsheet and same is submitted to DOE.

Sub-step 2c: Calculation and comparison of financial indicators

The Post tax Equity IRR is evaluated for the entire lifetime of the project activity, i.e. 25 years. It is calculated based on the cash outflows from and cash inflows into the project activity.

The Appendix 2 mentioned the result of IRR, Benchmark and sensitivity analysis.

2.6 Methodology Deviations

Not applicable

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

3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

According to the approved baseline methodology ACM0002 Version 19

Baseline emissions:

The baseline emission calculation for the project activity is attributable to the CO_2 Emission that could have been produced by the fossil fuel based power plants in absence of the proposed project activity. Therefore the amount electricity supplied to the Indian grid will be multiplied by the grid emission factor of Indian grid to calculate the baseline emissions reduced by the proposed project activity.

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

Where,

$\mathbf{BE_y}$	=	Baseline Emissions in year y; tCO_2
$\mathbf{EG_{facility,y}}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$\mathbf{EF_{grid,CM,y}}$	=	CO_2 emission factor of the grid in year y; tCO_2/MWh

As per the approved consolidated Methodology ACM0002 (Version 19):

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

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

Where:

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

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

$EF_{grid,CM,y}$ = 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" (t CO_2/MWh)

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

CO_2 Baseline Database for the Indian Power Sector, Version 13, June 2018[13] published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

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

As per the "Tool to calculate the emission factor for an electricity system" Version 07.0, EB 100, Annex 4[14], the following steps have been followed.

STEP 1: Identify the relevant electricity systems;
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3: Select a method to determine the operating margin (OM);
STEP 4: Calculate the operating margin emission factor according to the selected method;
STEP 5: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emission factor.

STEP 1: Identify the relevant electricity power systems

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

However since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this CO_2 Baseline Database. As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

Table: Geographical Scope of Indian Electricity Grid

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

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

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

Project participants have the option of choosing 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) method

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

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

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
India	19.6%	16.9%	18.6%	16.8%	15.1%	14.6%

Data Source: Central Electricity Authority (CEA) database Version 13, June'2018[15]

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 emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

The "Simple operating margin" has been calculated as per the weighted average emissions (in tCO_2/MWh) of all generating sources serving the system, excluding hydro, geo-thermal, wind, low-cost biomass, nuclear and solar generation;

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:

- **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**

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

- **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 the calculation of OM with 3 years generation weighted average of the most recent years available at the time of submission of VCS PD to the DOE for validation.

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

STEP 4: Calculate the operating margin emission factor according to the selected method

The operating margin emission factor has been calculated using a 3 year data vintage. The CEA database has followed the approach of simple OM in line with tool to calculate emission factor for an electricity system.

Option A of tool has been selected. The operating margin, therefore, can be calculated by dividing the grid's total CO_2 emissions by the net generation of all thermal stations. In other words, it represents the weighted average emissions rate of all thermal stations.

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

Net Generation in Operating Margin (GWh) (incl. Imports)			
	2014-15	2015-16	2016-17
INDIAN Grid	9,73,636	1,027,028	1,072,839

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2014-15	2015-16	2016-17
INDIAN Grid	0.9903	0.9655	0.9636

Weighted Generation Operating Margin	
INDIAN Grid	**0.9727**

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

Option 1 as described above is chosen 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**

(With sample group constituting most recent capacity additions to the grid comprising 20% of the system generation)

STEP 6: Calculate the combined margin (CM) emissions factor

Combined Margin – The combined margin is the weighted average of the simple operating Margin and the build margin. In particular, for intermittent and non-dispatchable generation types such as wind and solar photovoltaic, the Tool to calculate the emission factor for an electricity system, Version 07.0.0, EB 100, Annex 4, allows to weigh the operating margin and Build margin at 75% and 25%, respectively for wind and solar projects and 50% and 50%, respectively for hydro and biomass projects.

The baseline emission factor is calculated using the combined margin approach as described in the following steps:

Calculation of Baseline Emission Factor EF_y

The baseline emission factor $\mathbf{EF_y}$ is calculated as the weighted average of the Operating Margin emission factor $\mathbf{(EF_{OM,y})}$ and the Build Margin emission factor $\mathbf{(EF_{BM,y})}$:

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

Where,

$\mathbf{w_{OM}}$	75% weight for solar energy projects
$\mathbf{w_{BM}}$	25% weight for solar energy projects
$\mathbf{EF_{OM,y}}$	calculated as described in Steps 3&4 above (tCO_2/MWh)
$\mathbf{EF_{BM,y}}$	calculated as described in Steps 5 above (tCO_2/MWh)

Baseline Emission factor (INDIAN Grid) = 0.75*0.9727 + 0.25*0.8723
= 0.9476 tCO_2/MWh

The baseline emission factor is ex-ante parameter and will remain constant throughout the crediting period.

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 not geo-thermal or solar thermal, project emissions are not applicable for solar power projects.

Hence PE_y= 0

3.3 Leakage

Leakage Emissions: As per methodology, 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.

As per methodology, For renewable energy projects, there is no any leakage emissions occurred.

Hence, LEy= 0

3.4 Estimated Net GHG Emission Reductions and Removals

As per methodology ACM0002 (version 19), net GHG emission reductions are calculated as follows:

$ER_y = BE_y – PE_y$

ER_y = Emission reductions in year y (tCO_2e/yr)

BE_y = Baseline emissions in year y (tCO_2e/yr)

PE_y = Project emissions in year y (tCO_2e/yr)

Ex-ante calculation (estimate) of net GHG emission reductions:

Ex-ante emission reduction calculations are calculated based on current 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	39,74,092	0	0	39,74,092
Year 2	39,54,221	0	0	39,54,221
Year 3	39,54,122	0	0	39,54,122
Year 4	39,54,022	0	0	39,54,022
Year 5	39,53,922	0	0	39,53,922
Year 6	39,53,821	0	0	39,53,821
Year 7	39,53,720	0	0	39,53,720
Year 8	39,53,618	0	0	39,53,618
Year 9	39,53,515	0	0	39,53,515
Year 10	39,53,412	0	0	39,53,412
Total	**39,558,465**	0	0	**39,558,465**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018
Value applied:	0.9727
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0.0" as 3-year generation weighted average using data for the years 2014-2015, 2015-2016 & 2016-2017. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 13.0, published by the Central Electricity Authority, Ministry of Power, Government of India
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire first crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018
Value applied:	0.8723
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for the most recent year 2016-17. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 13, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire first crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018
Value applied:	0.9476
Justification of choice of	Calculated as per "Tool to calculate the emission factor for an

data or description of measurement methods and procedures applied	electricity system, version 07.0.0". The data is obtained from "CO_2 Baseline Database for Indian Power Sector" Version 13, June 2018, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire first crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity supplied (MWh) to the grid as a result of the implementation of the project activity in year y
Source of data	Credit Report /JMR as per Monthly Generation Report
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: One in five 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 state electricity board as per below equation: $EG_{facility,y} = EG_{Export} - EG_{Import}$ The joint reading at metering point is carried out once in a month in presence of O&M officials and state electricity board personnel. The calculations/measurement of net electricity supplied to grid is under purview of state electricity board and the PP/Project activity owner has no role on it. PP/Project activity owner will get value of net electricity supplied to grid and hence this parameter is mentioned as a part of monitoring plan. Cross Checking: Quantity of net electricity supplied to the grid will be cross checked from the invoices raised by the PP to the State Electricity Board or invoices with third party.
Frequency of monitoring/recording	Continuous monitoring and monthly recording
Value applied:	41,93,850
Monitoring equipment	Monitoring equipment will be energy meter installed at the project activity site. Readings will be cross checked with back up meter. The accuracy class of meters, calibration frequency of meters is totally under purview of state electricity board and PP do not have

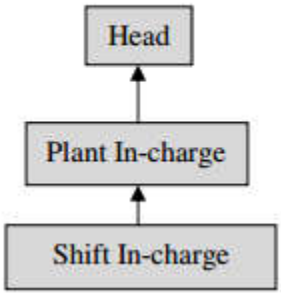
	any control on it.
QA/QC procedures applied	The calibration of all the meters will be undertaken once in five years[16] and faulty meters will be duly replaced immediately. The meters will be of accuracy class 0.5s or higher. The meter accuracy class and calibration interval is under purview of state electricity board and PP/Project Activity owner do not have any control on it. It is also noted that apportioning procedure (if applicable for project activity) is under control of state electricity board and PP do not have any control on it. The available parameter to PP/project activity owner is the net electricity supplied to grid and same parameter is mentioned as monitoring parameter.
Purpose of data	The Data/Parameter is required to calculate the baseline emission.
Calculation method	The parameter is measured and if any calculation is required, the calculation is based on measured parameters.
Comments	Data will be archived electronically for a period of 2 years beyond the end of crediting period

4.3 Monitoring Plan

The monitoring plan, which is implemented by the PP 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 results with the PP. 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:

Organisational Structure for Monitoring



PP has assigned the responsibility of operation and maintenance of project activity with relevant and authorised O&M contractors. The Plant In-charge and Shift In-Charge would be deployed by O&M contractors.

Responsibilities of Head: Overall functioning and maintenance of the data.
Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data (calibration of equipments).
Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day log book for monitored data.

[16] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

In the event when the individual verification period dates and billing cycle dates of the project activity do not coincide, then the electricity export will be apportioned based on number of days. The ratio of number of days under monitoring period and total number of days under billing cycle will multiplied to total electricity export to billing cycle.

For project activity which involves solar projects with common metering, apportioning will be followed to determine net electricity export to grid. The apportioning procedure is not under control of PP, thus value of net electricity supplied to grid is available to PP and same is mentioned as monitoring parameter. The value of net electricity supplied to grid is used for ER calculations.

It is to be noted that the metering arrangement, accuracy class of meters, feeder arrangements, calibration frequency of meters are under control of state electricity board and PP do not have any control on it. Thus any deviation at actual site or during verification is accepted.

QA & QC Procedures to be followed

Necessary check meters as required would be installed, to operate in standby mode or when the main meters are not working. All meters will be calibrated at least once in five year as per CEA notification. Records of calibration certificates will be maintained for verification. Hence, high quality is ensured with the above parameters. The calibration of meters is under purview of state electricity board and CME/ project activity owner do not have any control on it.

Data Recording and Storage

For measuring the net energy supplied to grid by the project activity at the interconnection point, one set of Main meter and Check Meter shall be provided. Representatives of both project activity Owner and State Utility will be present to record the monthly meter readings. The state utility will prepare the credit report for the net energy supplied to the grid and same will be used as a basic document for monitoring and verification of the net energy supplied to the grid. Based on the monthly credit report, the project activity Owner shall raise an invoice to the utility. Utility will pay to the project activity Owner based on this document.

The above document will be kept at safe storage for verification of emission reductions generated from the project activity. The period of data storage will be 2 years beyond crediting period.

Emergency preparedness

The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. However, in case monitoring equipment get failed or found faulty, they shall be replaced with calibrated meters as quickly as possible. In case main meter get failed or found faulty, the reading of check meter will be considered.

Personnel training

In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff will be trained. The Shift In-charge and Plant In-charge will be trained in equipment operation, data recording, operation and maintenance and emergency procedures in compliance with the monitoring plant.

5 SAFEGUARDS

5.1 No Net Harm

The project activity does not cause any harm to the local ecology. It primarily requires the installation of the solar PV power project, interfacing the generators with the State Electricity Board by setting up HT transmission lines and installation of other accessories.

Also as per the Central Pollution Control Board of India notification[17] Solar PV project falls under White Category and are practically non-polluting.

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 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 project activity.

5.3 Local Stakeholder Consultation

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

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

All the stakeholders have been invited through public notice to attend the stakeholders meeting.

5.4 Public Comments

The project will be listed for public comments and the comments received will be taken into consideration.

[17] http://envfor.nic.in/sites/default/files/Latest_118_Final_Directions.pdf

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

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

6.2 Baseline Emissions

The baseline emission calculation for the project activity is attributable to the CO_2 Emission that could have been produced by the fossil fuel based power plants in absence of the proposed project activity. Therefore the amount electricity supplied to the Indian grid will be multiplied by the grid emission factor of Indian grid to calculate the baseline emissions reduced by the proposed project activity.

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

Where,

$\mathbf{BE_y}$	=	Baseline Emissions in year y; tCO_2
$\mathbf{EG_{facility,y}}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$\mathbf{EF_{grid,CM,y}}$	=	CO_2 emission factor of the grid in year y; tCO_2/MWh

6.3 Project Emissions

As per methodology, for renewable energy projects, there is no any project emissions occurred.

Hence, $PE_y = 0$

6.4 Leakage

As per methodology, for renewable energy projects, there is no any leakage emissions occurred.

Hence, $LE_y = 0$

6.5 Net GHG Emission Reductions and Removals

Year	Baseline emissions or	Project emissions or	Leakage emissions	Net GHG emission reductions or

	removals (tCO_2e)	removals (tCO_2e)	(tCO_2e)	removals (tCO_2e)
27/02/2017 to 31/12/2017	507,199	0	0	507,199
01/01/2018 to 31/08/2018	270,720	0	0	270,720
Total	777,919	0	0	777,919