Project design document form
(Version 11.0)

BASIC INFORMATION	
Title of the project activity	250 MW Solar Power Plant in Pavagada Solar Park in Karnataka
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	02
Completion date of the PDD	17/04/2020
Project participants	Fortum Solar India Pvt Ltd
Host Party	India
Applied methodologies and standardized baselines	Applied Methodology: ACM0002- Grid-connected electricity generation from renewable sources --- Version 20.0 Standardized baselines: NA
Sectoral scopes	Sectoral Scope 1: Energy Industries (renewable/non-renewable sources)
Estimated amount of annual average GHG emission reductions	467,318 tCO_2e/annum

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The main purpose of this project activity is to generate clean form of electricity through renewable solar energy source. Fortum Solar India Pvt Ltd is the promoter of the proposed project activity. The project activity involves installation of 250 MWp solar power project at village Thirumani, Rayacherlu, Vallur, Balasamundra and Kyataganacherlu of Nafalmadike Hobli, Pavagada Taluk, Tumkur District of Karnataka.The project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 467,318 tCO_2e per year, thereon displacing average of 496,144 MWh/year amount of electricity from the generation-mix of power plants connected to the Indian grid, which is mainly dominated by thermal/fossil fuel based power plant.

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

Project Promoters' Name	Capacity in MW	Connection with Grid	State
Fortum Solar India Pvt Ltd	250 MWp	Indian Grid	Karnataka

Sectoral Scope: 01 : Grid-connected electricity generation from renewable sources ACM0002-Version 20.0[1]
Project Type: (i) : Renewable energy projects

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 22 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 "TOOL07: Tool to calculate the emission factor for an electricity system".*

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

Sustainable development indicators
The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment, Forests and Climate Change (MoEFCC), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India[2].Thus the project's

[1] https://cdm.unfccc.int/UserManagement/FileStorage/AG07ZJQ3EXD42LT5YV9HR16M8KINPO

[2] http://www.cdmindia.gov.in/approval_process.php

contribution towards sustainable development has been addressed based on the following sustainable development aspects:

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

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

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

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

The Host County Approval issued by Indian DNA declaring acceptability of the Sustainable Indicators by the project activity shall be submitted to DOE.

A.2. Location of project activity

Village : Thirumani, Rayacherlu, Vallur, Balasamundra and Kyataganacherlu
Tehsil : Pavagada
District : Tumkur
State : Karnataka

Project Promoters' Name	Site Zone	Capacity (MW)	Latitude (N)	Longitude (E)	Date of Commissioning
Fortum Solar India Pvt Ltd.	B5	50	14° 16' 28.0"	77° 24' 50.0"	03-08-2019
	B9	50			18-07-2019
	B14	50			15-07-2019
	B20	50			15-07-2019
	B40	50			05-08-2019

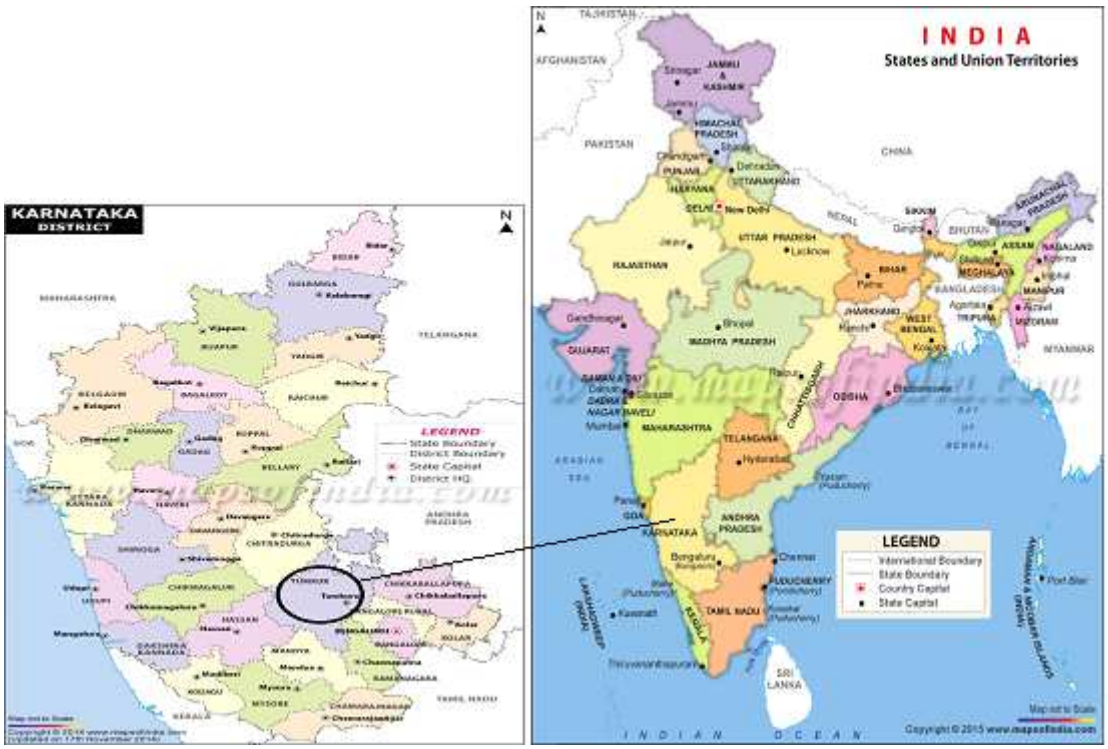


Figure 1. Satellite view of the project

A.3. Technologies/measures

Sectoral Scope : 01 - Energy industries (renewable / non-renewable sources)
Project Type : I - Renewable Energy Projects
Project Category Version 20.0 : ACM0002: Grid-connected electricity generation from renewable sources-

The project activity aims to harness solar energy through installation of PV with total installed capacity of 250 MWp. For Plant Load Factor, please refer Section B.6.3.

Technical detail of the equipment	Remark
Technology	Thin Film-CdTe modules on Fixed Tilt at 20 degrees
Solar photovoltaic module	95 Wp Modules
No. of modules	1,536,850
Total Number of Invertors	100 Units
Transformer	100
Central inverters of nominal AC power output	680 kVA-CONEXT CORE XC 680, Schneider Make), three phase , 50 Hz.
Technical & Operational Lifetime	25 years

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

Baseline Scenario:
As the project activity is the installation of a Greenfield power plant, the baseline scenario is the following as per applied methodology: *"If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

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

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host Party)	Fortum Solar India Pvt Ltd	No

A.5. Public funding of project activity

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

A.6. History of project activity

This is to confirm that:

- The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA);
- The proposed CDM project activity is not a project activity that has been deregistered.
- The proposed CDM project activity was not a CPA that has been excluded from a registered CDM PoA;

The proposed project activity was not registered with any CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not Applicable

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

The methodology for the project activity is approved methodology for large-scale CDM project activities. The details of the methodology are as follows:

Methodology : ACM0002
Project Type : Type-I: Renewable Energy Projects
Title : Grid-connected electricity generation from renewable sources
Version No. : Version 20.0;
Reference : CDM Methodology[3] (The project activity meets the eligibility criteria of large scale project as it is more than 15MW)

The methodology refers to following CDM Tools:

- Tool for the demonstration and assessment of additionality[4] (Version 07.0.0, EB 70, Annex 8)
- Tool to calculate the emission factor for an electricity system[5] - (Version 07.0 EB 100, Annex 04)

B.2. Applicability of methodologies and standardized baselines

The project activity under the project activity will meets the applicability conditions of the approved consolidated baseline and monitoring methodology ACM0002, Version 20.0, Sectoral Scope 1, as described below:

Applicability Criterion	Project Case
This methodology is applicable to grid-connected renewable power generation project activities that: • install a Greenfield power plant; • involve a capacity addition to (an) existing plant(s); • involve a retrofit of (an) existing operating plants/units; • involve a rehabilitation of (an) existing plant(s)/unit(s) or • 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.
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;	The proposed project activity are installation of a new grid connected solar renewable energy power plant and hence this condition is met.
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	The proposed project activity does not involve any capacity additions, retrofits or replacements and therefore this condition is not applicable.

[3] https://cdm.unfccc.int/UserManagement/FileStorage/AG07ZJQ3EXD42LT5YV9HR16M8KINPO

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

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

implementation of the project activity;	
In case of hydro power plants, one of the following conditions shall apply: • The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or • The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (7), is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m^2.	The proposed project activity under project activity is a grid connected solar renewable energy power project. This condition is applicable only for hydro power plants and not applicable for solar projects. Hence this criteria is not applicable.
The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: • The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m^2; • Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; • Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be; ✓ Lower than or equal to 15 MW; and ✓ Less than 10 per cent of the total installed capacity of integrated hydro power project.	The proposed project activity under project activity is a grid connected solar renewable energy power project. This condition is applicable only for hydro power plants and not applicable for solar projects.
In the case of integrated hydro power projects, project participant shall: • 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 • Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The proposed project activity is a grid connected solar renewable energy power project. This condition is applicable only for hydro power plants and not applicable for solar projects.
Methodology is not applicable to the following • 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; • Biomass fired power plants/units	The proposed project activity is the installation of a new grid connected solar renewable energy power project and does not involve switching from fossil fuel to renewable energy and hence this criterion is not relevant to the project activity. This project activity does not involve any biomass based power plants and hence this criterion is not applicable to the project activity.

In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The proposed project activity is a new grid connected solar renewable energy power plant and not a retrofits, replacement or capacity additions and therefore this criterion is not applicable to the project activity.

Tool to calculate the emission factor for an electricity system[6] - Version 07.0 (EB 100, Annex 04)

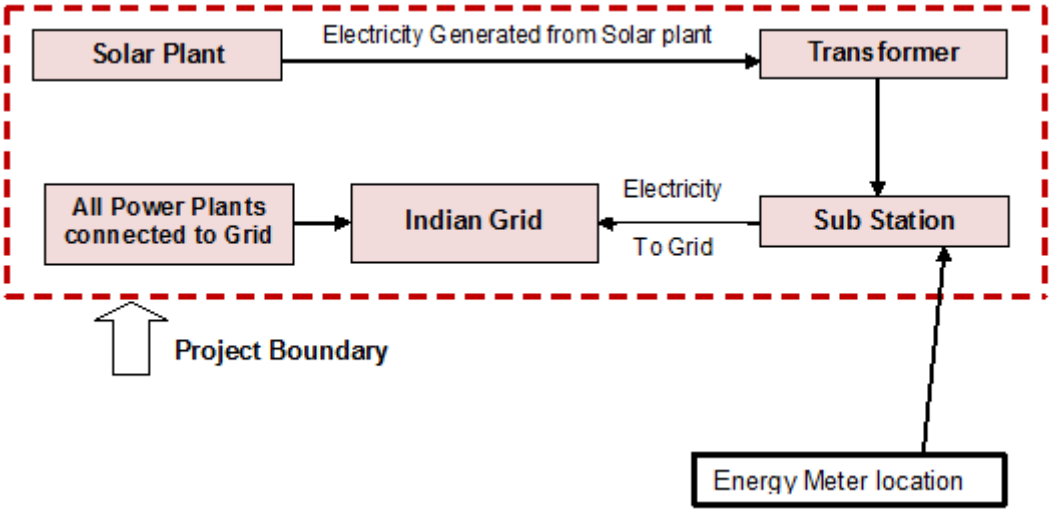
Applicability Criterion	**Project Case**
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings 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) 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 is 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 CO_2 emission factor of biofuels is zero.	The project is a solar project and there is no involvement of biofuels.

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

As per ACM0002 version 20.0 - "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to".

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

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



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

Source		GHGs	Included?	Justification/Explanation
Baseline	Grid connected electricity generation.	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	Greenfield Solar 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

B.4. Establishment and description of 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”.

Annexure 3 of the EB 22 states that national and/or sectoral policies and circumstances have to be accounted for when considering the baseline scenario. Para 7(a) of the same states that, only those national and/or sectoral policies or regulations under paragraph 6(a) i.e. type E+ policy that increase GHG emissions, that have been implemented before adoption of the Kyoto Protocol by the COP (decision 1/CP.3, 11 December 1997), shall be taken into account when developing a baseline scenario. The Electricity Act of 2003 promoted cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity (Refer Section 86(1) of Electricity Act 2003). Therefore, it could be seen that the provincial and sectoral policies are E- i.e., policies that decrease GHG emissions and are after November 2001. Hence the baseline scenario is the electricity generation by grid connected fossil fuel dominated power plants confirming to Annex 3 of EB 22.

Further, the baseline alternative mentioned above is in compliance with all the applicable regulatory policies and laws. Additionally, the project participant is under no compulsion to opt for any particular technology or even a renewable mode of power generation. There is no

governmental body or EB policy which requires a particular kind of fuel to be chosen and there is no legal requirement to which the above alternative does not conform.

As per ACM0002 version 20.0; "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, the baseline for the project activity is the equivalent amount of power from the INDIAN grid.

The combined margin ($EF_{grid,y}$) 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 of CEA database (where available) and made publically available.

The combined margin of the INDIAN National Grid used for the project activity is as follows:

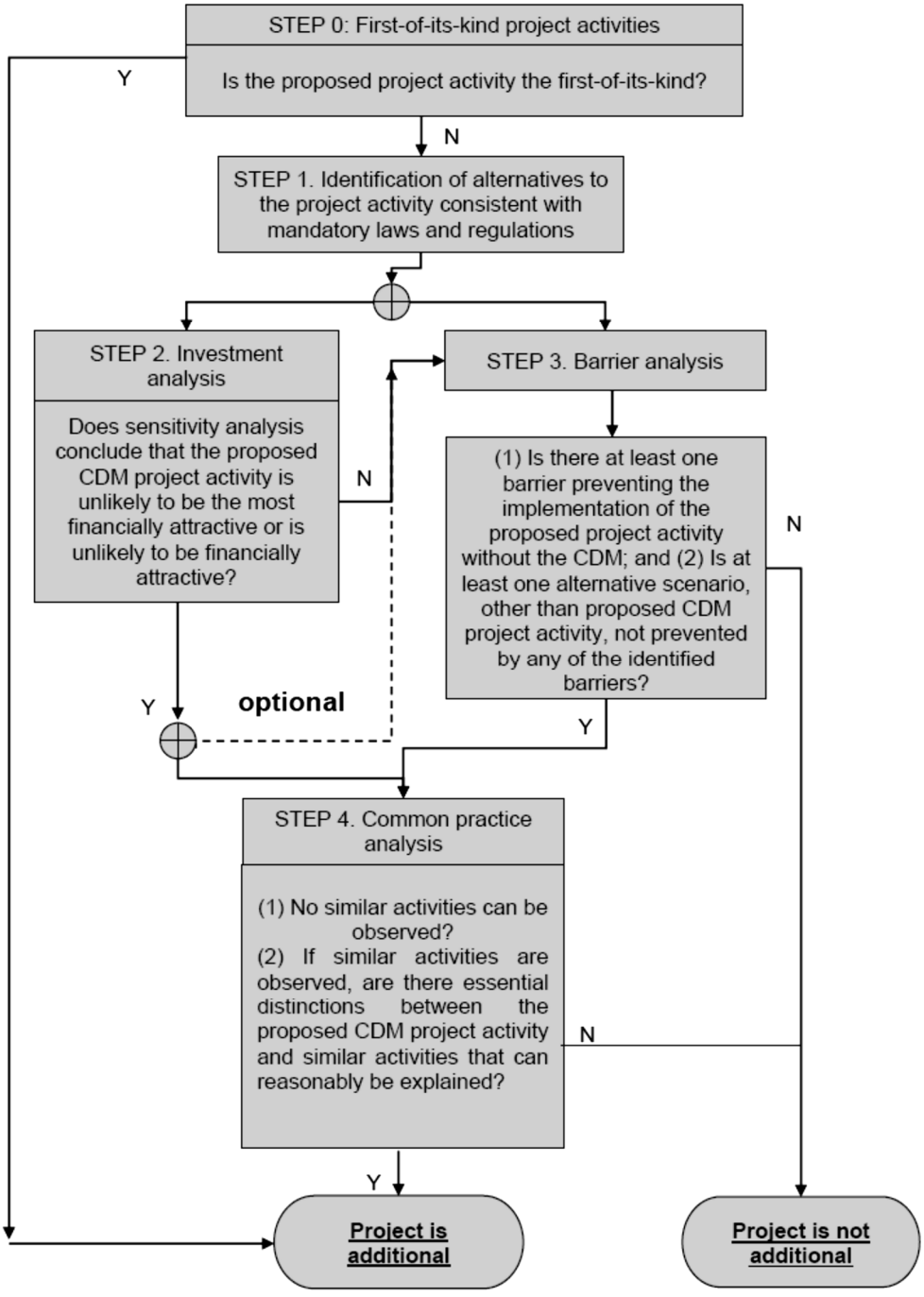
Parameter	Value	Nomenclature	Source
$EF_{grid,CMy}$	0.9419 tCO_2/MWh	Combined margin CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline CO_2 Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9622 tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2016-17, 2017-18 and 2018-19) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 15.0, Dec 2019 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8811 tCO2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Baseline CO_2 Emission Database, Version 15.0, May 2019 published by Central Electricity Authority (CEA), Government of India

B.5. Demonstration of additionality

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

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

The proposed CDM project generates power using Solar PV energy which is a renewable, zero emission source of energy. Baseline considerations for the project are based on approved consolidated baseline methodology ACM0002 (Version 20.0). The methodology requires the project participant to determine the additionality based on "Tool for the demonstration and assessment of additionality", Version 7.0.0. The step-wise approach to establish additionality of the project activity has been followed, details of which are provided in the following paragraphs:



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

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

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

As per the applied methodology ACM0002 version 20.0; 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 participant have considered Post-Tax Equity IRR for investment analysis at the time of decision-making. As Project participant 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 guidance 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.

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 16 of Appendix of EB 105, Annex 6, 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[7].

Appendix A in EB 101, Annex 11 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **10.24%**

The benchmark has been computed in the following manner:
Nominal Benchmark[8] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where,
Real Benchmark = 10.24% (as per Appendix of EB 105, Annex 6)
Inflation rate = Projected Inflation Rate for India in next 10 years (RBI Forecast)

[7] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=19416

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

Based on decision made for the large scale project activity, the inflation rate are taken from RBI forecast. The investment decision date is 28-06-2018.

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

Project Investor	Inflation Forecast (10 Years)	Benchmark
Fortum Solar India Pvt Ltd	3.10% dated 06/02/2020[9]	13.66%
	3.70% dated 07/02/2018[10]	14.83%

The investment date is 28-06-2018, the Investment analysis methodological tools version 8.0 was applicable but it's not valid at the time of registration, therefore the latest Investment analysis version 10.0 and the latest Inflation forecast values are considered for the IRR comparison with the version available at the time of investment. The lower benchmark values are considered.
Thus benchmark of 13.66% 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.

The IRR and Benchmark analysis are calculated in excel spreadsheet and same will be submitted to DOE during validation of project activity. Based on result of IRR excel spreadsheets, equity IRR is less than Benchmark. This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark). Thus it can be easily concluded that project activity is additional & is not business as usual scenario. Input values used in all investment analysis shall be valid and applicable at the time of the investment decision taken by the project participant which can be clearly validated by the DOE, thus it complies with guidance 10 of EB 105, Annex 11, Annex 6.

The financial spread sheets for the key assumption (web links & source of parameters) supporting the financial projections are tabulated below:

Details of the project		Source
State where the project is situated	Karnataka	As per DPR
Total Capacity (MW)	250.00	As per DPR
Expected Date of Commissioning	30-09-19	As per DPR
Life of the plant (Yrs.)	25	KERC order, Section 1.1, pg 6[11]
Generation of electricity		
PLF (%)	23.00%	As per DPR
Annual generation (kWh)	503,700,000	Calculated Value
Annual Degradation per year	0.50%	KERC order, Section 1.5, pg 7[11]
Tariff rate at the decision making (INR/kWh)	2.85	As per PPA

[9] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=19416

[10] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=18265

[11] https://www.karnataka.gov.in/kerc/Documents/Determination%20of%20tariff%20in%20respect%20of%20SOlar%20Power%20Projects%20(including%20Solar%20Rooftop%20Photovoltaic%20Projects%20for%20FY20.pdf

Escalation in tariff rate	0.0%	
Transmission & Wheeling Losses (%)	0.00%	
Operation and maintenance cost and Insurance		
O & M Expenses (INR Mn.)	112.50	KERC Order, Section 1.7 pg 14[11]
O & M free for (Yr.)	-	
Escalation in the operational expenses (%)	5.72%	KERC Order, Section 1.7 pg 14[11]
Insurance (INR Mn.)	63.75	CERC order[12]
Financial parameters		
TOTAL COST (INR Mn.)	12,750.00	As Per DPR
Loan Amount (INR Mn.)	8,925.00	As Per DPR
Equity Investment (INR Mn.)	3,825.00	As Per DPR
Term loan		
Loan Amount (INR Mn.)	8,925.00	KERC order, Section 1.5, pg 9[11]
Interest rate (%)	10.50%	KERC section 1.8: pg 16[11]
Loan Tenure (Qtr.)	52	KERC section 1.8: pg 16[11]
Moratorium Period (Qtr.)	-	Assumption
Repayment Period (Qtr.)	52	Calculated Value
Repayment instalments value (INR Mn.)	171.635	Calculated Value
1st instalment from (Qtr. end)	31-Dec-19	Considered from the next Quarter End
Book Depreciation (SLM Method)		
Land	3,125.00	Section 4 pg 11CERC Order: Estimate Acre land required @ 5 acre/mw and 2.5 mn/acre[12]
Gross Depreciable Value (INR Mn.)	9,625.00	Calculated Value
Salvage Value (%)	10.00%	
Salvage value (INR Mn.)	962.50	Calculated Value
Net Depreciable Value (INR Mn.)	8,662.50	Calculated Value
Residual Value (INR Mn.)	4,087.50	Calculated Value
IT Depreciation		
IT Depreciation (%)	40.00%	IT act[13]
Income Tax		
Financial Year	**FY 2018-19**	
Income tax rate (%)	30.00%	As Per Income Tax Rule[14]
Corporate Tax / MAT (%)	33.00%	As Per IT rule [15]
GST (%)	18.00%	As Per Income Tax Rule[16]
Surcharge (%)	12.00%	As Per Income Tax Rule[16]
Health & Education cess (%)	4.00%	As Per Income Tax Rule[16]
Final Tax rates		
Income tax rate (%)	34.9440%	Calculated Value
MAT (%)	38.44%	Calculated Value
GST (%)	18.7200%	Calculated Value

[12] http://www.cercind.gov.in/2016/orders/SO17.pdf

[13] http://www.taxafin.com/Income_Tax/Tax_Rates/Depreciation_Rates.html

[14] https://www.indiabudget.gov.in/budget2017-2018/ub2017-18/fb/bill.pdf

[15] https://www.bankbazaar.com/tax/corporate-tax.html

[16] https://www.paisabazaar.com/tax/gst-rates/

Considering the input values, Equity IRRs is given below:

SPV Name - Fortum India Pvt. Ltd.	Equity IRR without CDM	Benchmark (Equity IRR)
	5.98%	13.66%

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

Sub-step 2d: Sensitivity Analysis

Addressing section 7 of EB 105, Annex 6, following factors has been subjected to sensitivity analysis:
1. PLF
2. O&M Cost
3. Project Cost
4. Tariff

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

Variation %	**-10%**	**Normal**	**10%**	**Breaching Value**
PLF	4.19%	5.98%	7.78%	42.23%
O&M	6.27%	5.98%	5.71%	-324.74%
Project Cost	7.53%	5.98%	4.63%	-37.41%
Tariff Rate	4.19%	5.98%	7.78%	42.23%

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 for is as per Third Party PLF report in line with **"Guidelines for the reporting and validation of Plant load factors" stated in EB48 Annex11 option 3(b)**. Hence, variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third Party Report based on long term data.
Sensitivity Parameter 2 : O&M
The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.
Sensitivity Parameter 3 : Project Cost
Project Cost for financial analysis is considered from DPR of the project activity, being available at the time of investment making decision to go ahead with the project activity. The actual project cost is higher than the DPR cost. Since the Purchase Order cost is firm, there is no possibility of project cost going below this level. However, Sensitivity is carried out for threshold level below which benchmark is not breached.
Sensitivity Parameter 4 : Tariff Rate

The tariff is determined by PPA which is fixed for entire lifetime of the project activity. Hence, there is no probability to get variation for the same. However, Sensitivity is carried out for +/-10% even then the benchmark is not breached.

Outcome of Step 2:

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

Step 3: Barrier analysis

Barrier analysis has not been used.

Step 4: Common practice analysis

For the concerned project instances, the Common Practice Analysis has been carried out.

The project activity involves generation of electricity from Solar energy. The project activity is located in the state of Karnataka India and the policy applicable for the Solar power projects is regulated by State Electricity regulation Commission (SERC) of the respective state. The policies/tariff for each state is regulated by State Electricity Regulatory Commissions of respective states and they differ for respective states.
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. Since grouped project activity instance 1 is of large scale, capacity of group instance 1 has been considered for the CPA analysis.

Range	Capacity	Unit
+50%	375	MW
Capacity of the proposed project activity	250	MW
-50%	125	MW

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

(a) The projects are located in the applicable geographical area;

(b) The projects apply the same measure as the proposed project activity;

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

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

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

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

(a) As the projects are located Karnataka state of India, therefore, projects in the geographical area of Karnataka have been chosen for analysis. The project activity involves generation of electricity from solar energy. The project activity is located in the different states in India and the policy applicable for the solar projects is regulated by respective state policy. The policies/tariff for each state is regulated by State Electricity Regulatory Commissions of respective states and they differ for respective states.

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

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

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

(e) The capacity range of the projects is within the applicable capacity range from 125 MW to 375 MW.

(f) The start date of the large scale project activity is 07/09/2018. Therefore the projects have start date before 07/09/2018 have been considered for analysis.

Based on the solar power projects commissioned list published by Karnataka Renewable Energy Development Ltd[17] and State wise commissioning status of grid connected Solar Power Projects (As on 30.03.2017)- MNRE, India[18], the Numbers of Similar projects identified, which fulfil above-mentioned conditioned are Numbers of Similar projects identified, which fulfil above-mentioned condition are

N_{Solar} = 1

S.no.	Name of the Investor/Project	State/Province	Capacity, MW	Date
1	Amplus KN Solar Pvt Ltd	Karnataka	135	**10-07-2017**

Above conclusion are based on publically available data by Ministry of New & Renewable Energy, Government of India for State wise commissioning status of grid connected Solar PV Power Projects.

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

CDM project activities, which have got registered or are under validation have been excluded in this step. The list of the Solar PV projects identified is provided to the DOE.

N_{all} = 0

[17] http://kredlinfo.in/scrollfiles/Commissioned%20list%20Solar.pdf

[18] http://mnre.gov.in/file-manager/UserFiles/state-wise-commissioned-grid-connected-solar-power-projects.htm

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

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

1. Size of Installation – Since project activity is large scale project, small and micro scale projects are considered as different technology project. Based on this criteria, there are no any different technology project out of similar identified projects.

2. Investment climate on the date of the investment decision – For proposed project activity, there are no any different technology project considered out of similar identified projects.

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

$N_{diff} = 0$

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

Calculate $F=1-N_{diff}/N_{all}$

$F = 1-(0/0) = 1$

As per methodological tool "common practise" version 03.1, the proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.

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

Outcome of Common Practise analysis:

As,

i. $F = 1$; is greater than 0.2
ii. $N_{all}-N_{diff} = 0$; is not greater than 3

The project activity does not satisfy condition (b). Hence, project activity is not a common practice.

Thus, the proposed project activity is not a "common practice" within a sector in the applicable geographical area.

The above discussions show that Solar PV power development of such magnitude is not a common practice and the project activity is not financially attractive; hence the project activity is additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

As per the approved consolidated Methodology ACM0002 version 20.0 that 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 (tCO_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" (tCO_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 15, Dec 2019[19] published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

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

(a) **Step 1:** Identify the relevant electricity systems;

(b) **Step 2:** Choose whether to include off-grid power plants in the project electricity system (optional);

(c) **Step 3:** Select a method to determine the operating margin (OM);

(d) **Step 4:** Calculate the operating margin emission factor according to the selected method;

(e) **Step 5:** Calculate the build margin (BM) emission factor;

(f) **Step 6:** Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

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

However since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this 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

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

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	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	**Karnataka**
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar & Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Puducherry
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	Telangana
Uttar Pradesh				
Uttarakhand				

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

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

Step 3: Select a method to determine the operating margin (OM)

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

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

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

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

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
India	18.6%	16.8%	15.1%	14.6%	14.3%	14.5%

Data Source: Central Electricity Authority (CEA) database Version 14, Dec'2018[20]

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

(a) **Ex-ante option:** if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

OR

(b) **Ex-post option:** if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

PP has chosen ex-ante option for calculation of Simple OM emission factor using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the 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 crediting period.

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

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

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

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2016-17	2017-18	2018-19
INDIAN Grid	0.9636	0.9543	0.9685

Weighted Generation Operating Margin	
INDIAN Grid	**0.9622**

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.

[20] https://cdm.unfccc.int/UserManagement/FileStorage/58IAGB7SZUDEO2VN6LYM30K41HFPRQ

Build Margin (tCO_2/MWh) (not adjusted for imports)	
	2018-19
INDIAN Grid	**0.8811**

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

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

Where,

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

Baseline Emission factor (INDIAN Grid) = 0.75*0.9622 + 0.25*0.8811
= 0.9419 tCO_2/MWh

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

Project Emissions

As per the approved consolidated Methodology ACM0002 (Version 20.0) para 31: "For most renewable energy power generation project activities, PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

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

Where:

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

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

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

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

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

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

B.6.2. Data and parameters fixed ex ante

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 15, December 2019[21]
Value(s) applied	0.9622
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as 3-year generation weighted average using data for the years 2016-17, 2017-18 & 2018-19. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 15, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

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

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 15,Dec 2019[22]
Value(s) applied	0.8811
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as 3-year generation weighted average using data for the years 2016-17, 2017-18 & 2018-19. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 15, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

Data/Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 15, Dec 2019[23]
Value(s) applied	0.9419
Choice of data or measurement methods and procedures	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period.

B.6.3. Ex ante calculation of emission reductions

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

$ER_Y = BE_Y - PE_Y - LE_Y$

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

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

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

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

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

Where,
$EG_{PJ,y}$ = Total quantity of net electricity delivered to the INDIAN grid
$EF_{grid,CM,y}$ = Baseline emission factor
= 0.9419 tCO_2/MWh

BE_y = 496,144 * 0.9419
= 467,318 tCO_2/year

Since $ER_y = BE_y$

Therefore, ER_y = 467,318 tCO_2/year

Project Investor's Name	Capacity	PLF (%)	Solar Panel Degradation factor per year	Generated Power (MWh) p.a	Baseline Emission Factor (tCO_2/MWh)	Baseline Emissions (tCO_2/year)
Fortum Solar India Pvt Ltd	250	23.00%	0.5%	496,144	0.9419	467,318

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Year 1	474,435	0	0	474,435
Year 2	472,062	0	0	472,062
Year 3	469,690	0	0	469,690
Year 4	467,318	0	0	467,318
Year 5	464,946	0	0	464,946
Year 6	462,574	0	0	462,574
Year 7	460,201	0	0	460,201
Total	3,271,226	0	0	3,271,226
Total number of crediting years	07			
Annual average over the crediting period	467,318	0	0	467,318

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project (Solar) plant/unit to the grid in year y
Source of data	Credit note/ JMR/Form B reports/ monthly generation report from state electricity board/DISCOM
Value(s) applied	496,144
Measurement methods and procedures	The value of net electricity generation supplied to the grid as per Monthly electricity form B /Credit Note or Joint Meter Reading Report forms the basis for calculation of the emission reductions; which can be cross checked from the invoice raised to DISCOM. The Net electricity is calculated based on Export-115%import-Transmission loss. Monthly meter readings are taken from the main and check meter installed at metering point and certified by the representatives of SEB Officials and the representatives of the project participant. The export and import values of the form-B/Credit note or Joint Meter Reports is cross checked with the export and import values mentioned at the electricity sales invoice. Monitoring: Bidirectional Tri vector meter will be used Data type: Measured Type of meter: Static type meter (Main & Check). Both are Bidirectional meters. Class of meter: 0.2s. Calibration frequency: One in five years[24]
Monitoring frequency	Continuous monitoring, hourly measurement and at least monthly recording
QA/QC procedures	The calibration of all the meters will be undertaken at required intervals (once is five years as per CEA notification) and faulty meters will be duly replaced immediately. The meters will be of accuracy class 0.2s. The meter accuracy class and calibration interval is under purview of state electricity board and PP do not have any control on it. It is also noted that apportioning procedure is under control of state electricity board and PP do not have any control on it. The available parameter to PP is the net electricity supplied to grid and same parameter is mentioned as monitoring parameter. The Net electricity is calculated based on Export-115%import-Transmission loss. The Net electricity exported to the grid will be cross checked against the invoice raised by the PP towards the DISCOM.
Purpose of data	Calculation of Baseline emissions
Additional comment	The data would be archived electronically and maintained for the entire crediting period plus two years.

B.7.2. Sampling plan

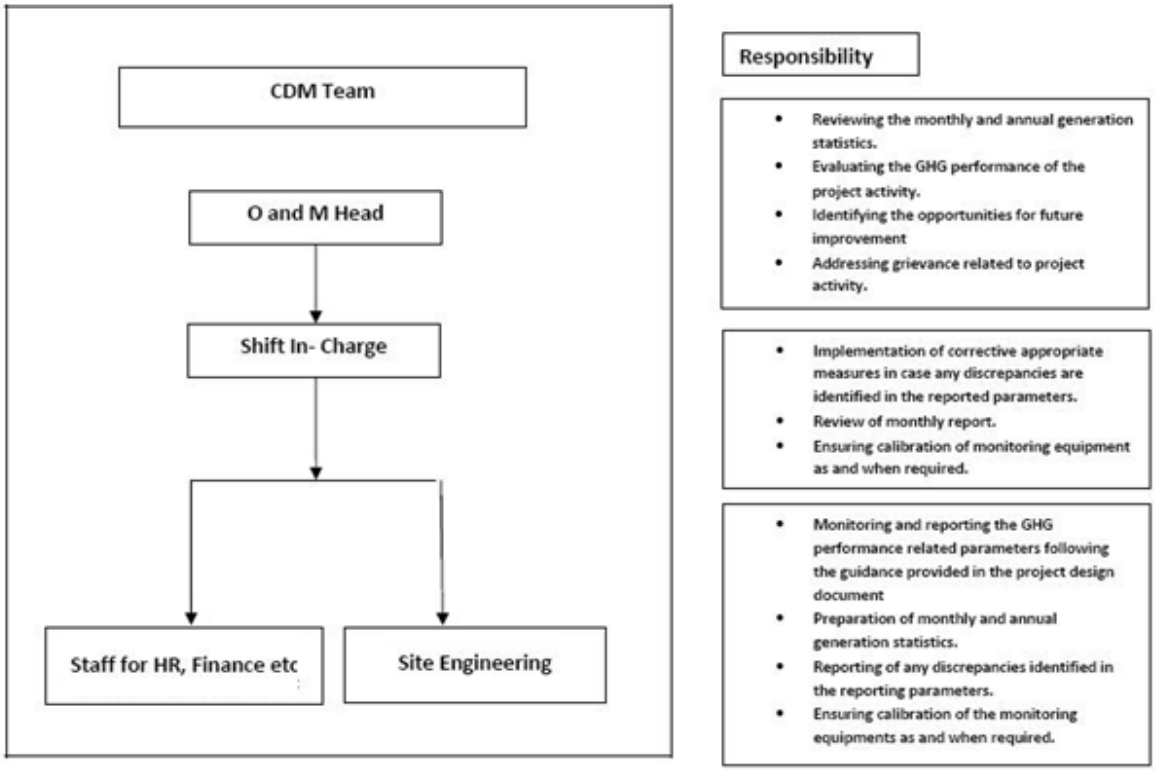
[24] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

No sampling is required

B.7.3. Other elements of monitoring plan

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

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project participant. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members:



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

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

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

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

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

Start date of the project activity is the date of EPC contract as on 07/09/2018.

C.2. Expected operational lifetime of project activity

25 Years 00 Months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

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

C.3.2. Start date of crediting period

31/08/2019 or Date of submission of complete request for registration by the DOE whichever is later.

C.3.3. Duration of crediting period

07 Years 00 Months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The project activity has no significant impact on the environment. Solar PV projects are not included in the Schedule I of the EIA notification S.O.1533 (E) dated 14th September 2006 and subsequent amendments, thus an EIA is not required.

D.2. Environmental impact assessment

Ministry of Environment & forests vide their OM J-11013/41/2006 - IA II (I) dated 13th May 2011 has re-affirmed this and exempted Solar PV power plants from EIA and EC requirement.

SECTION E. Local stakeholder consultation

E.1. Modalities for 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 invitation letters (delivered in hand) and public notice to attend the stakeholders meeting.

The details of the Stakeholder Meetings are as follows:

Date of invitation – 05/07/2018
Date of Meeting – 12/07/2018
Location of Meeting - Project site, Karnataka

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

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

E.2. Summary of comments received

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

The villagers raised various queries as summarised below:

Q: Villagers asked about company's future plans regarding the growth of local infrastructure/ facilities/ educations?
A: The project will provide economic development of the area and will surely contribute to the improvement of necessary facilities in the nearby areas.

Q: How the project activity benefit the villages around the project site and their residents?
A: The project activity will benefit the nearby villagers by providing employment opportunities to local or nearby people and also provides immense opportunity for economic development of the area like increase in business opportunities, improvement in transportation social activities helps to uplift the standard of living.

Q: Villagers having the rumours that Solar PV plant alerts the solar insolation in the nearby areas?
A: Electricity generation due from Solar PV was explained in very conventional manner and clarified that the PV plant in any case doesn't alter insolation or radiate heat to the surrounding.

Q: Villagers were intense to know about the safety measures in case of any emergency?
A: Villagers were explained the safety practices that plant follows and the in-depth level safety assessment before the establishment.

Q: Attendees were eager to know about the scope of employment generation during the operation of the PV Plant?

A: It was responded that the preference would be given to the local villagers for the skilled and unskilled requirements.

Q: Will the project help in improving the electricity supply to the villagers or neighbourhood areas?
A: Yes, the project will help in improving the electricity condition in the adjoining areas.

Q: In any case, the project operation will affects the fertility of nearby fertile land?
A: It was explained that plant has nothing to do with the fertility of the soil.

E.3. Consideration of comments received

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

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

SECTION F. Approval and authorization

The host country approval letter has been received from Ministry of Environment, Forest and Climate Change having letter number 13008/81/2017-CC.

Appendix 1. Contact information of project participants

Organization name	Fortum Solar India Pvt Ltd
Country	India
Address	07th Floor, Tower A, Building 5, DLF Cyber City, Gurgaon, Haryana 122002
Telephone	+91-85276-94527
Fax	NA
E-mail	awadhesh.jha@fortum.com
Website	www.fortum.com
Contact person	Mr. Awadhesh Jha

Appendix 2. Affirmation regarding public funding

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

Appendix 3. Applicability of methodologies and standardized baselines

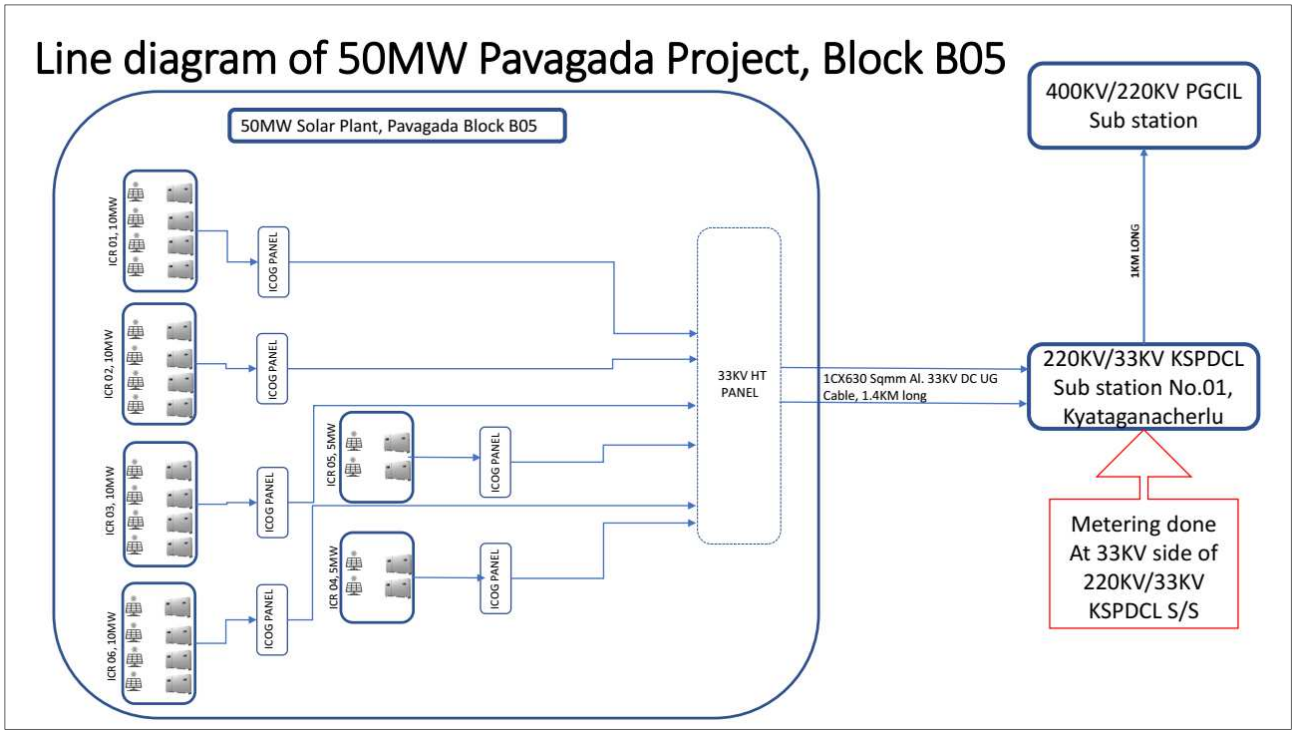
Please refer section B of the PDD for the same.

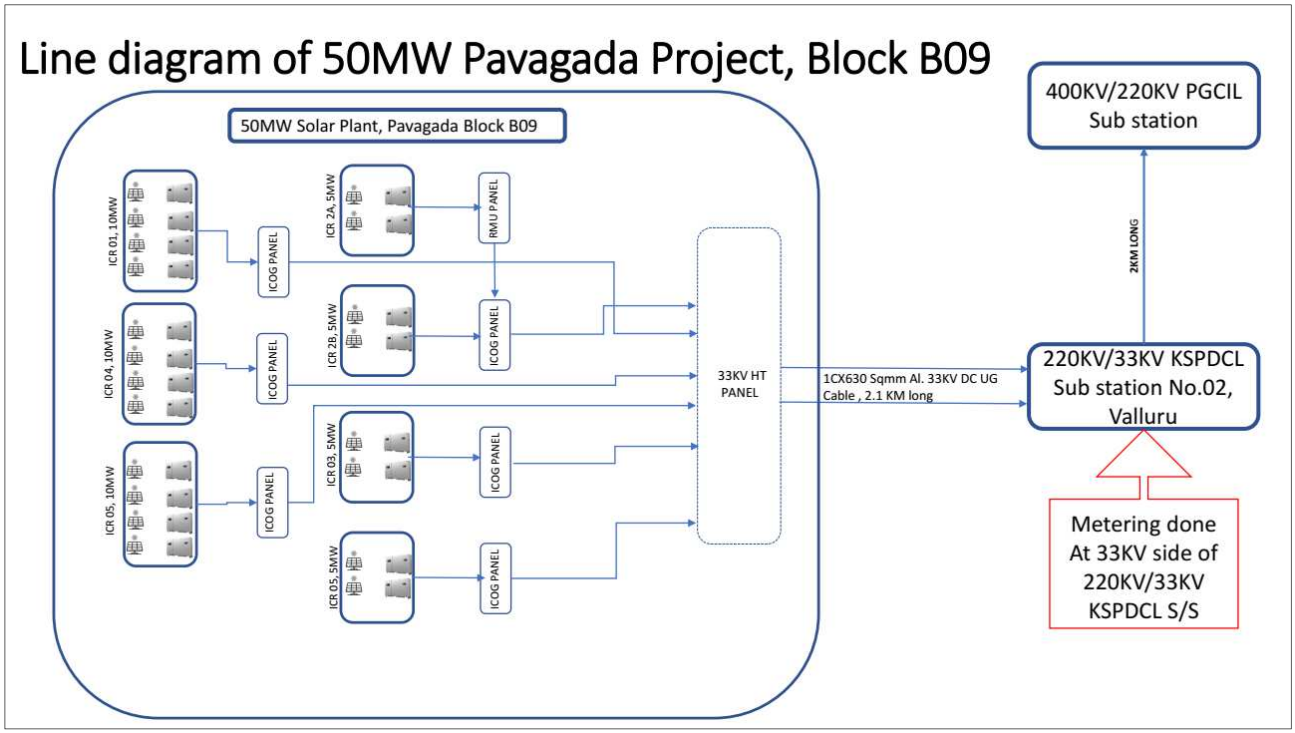
Appendix 4. Further background information on ex ante calculation of emission reductions

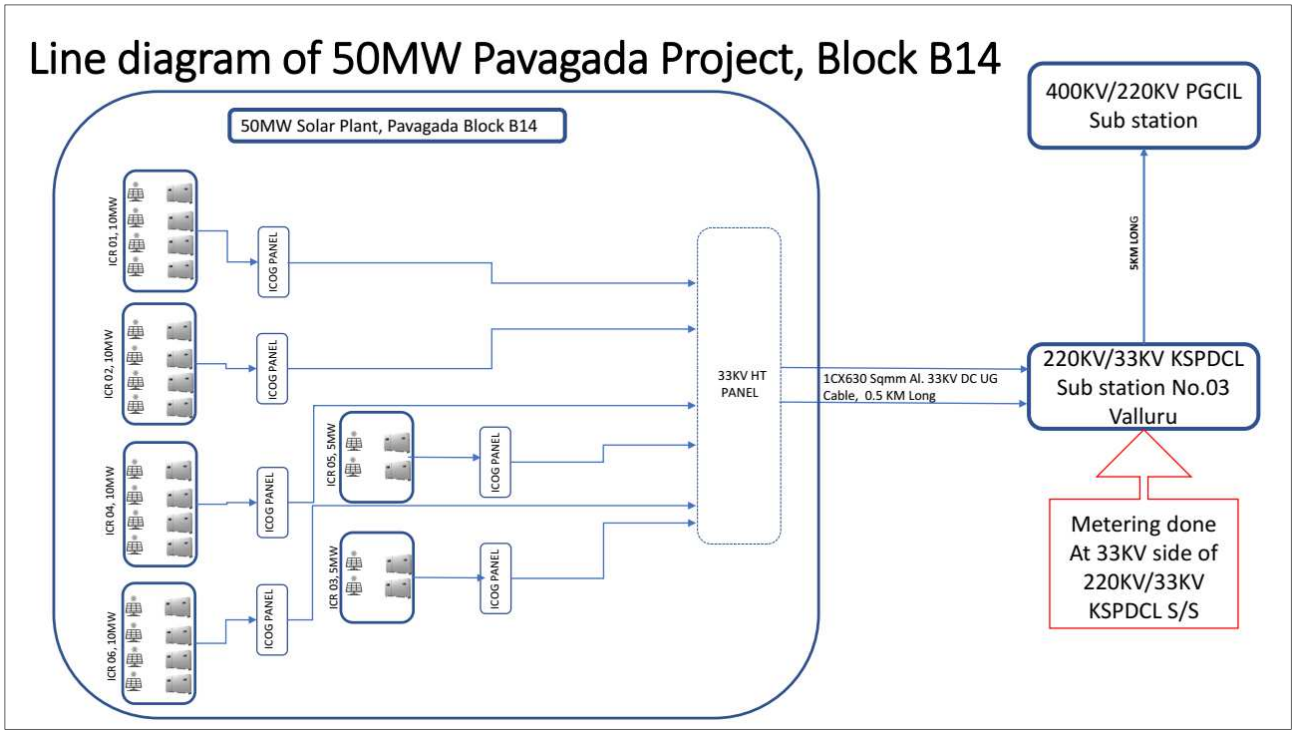
Please refer section B.6.3 and B.6.4 for information on emission reduction calculation.

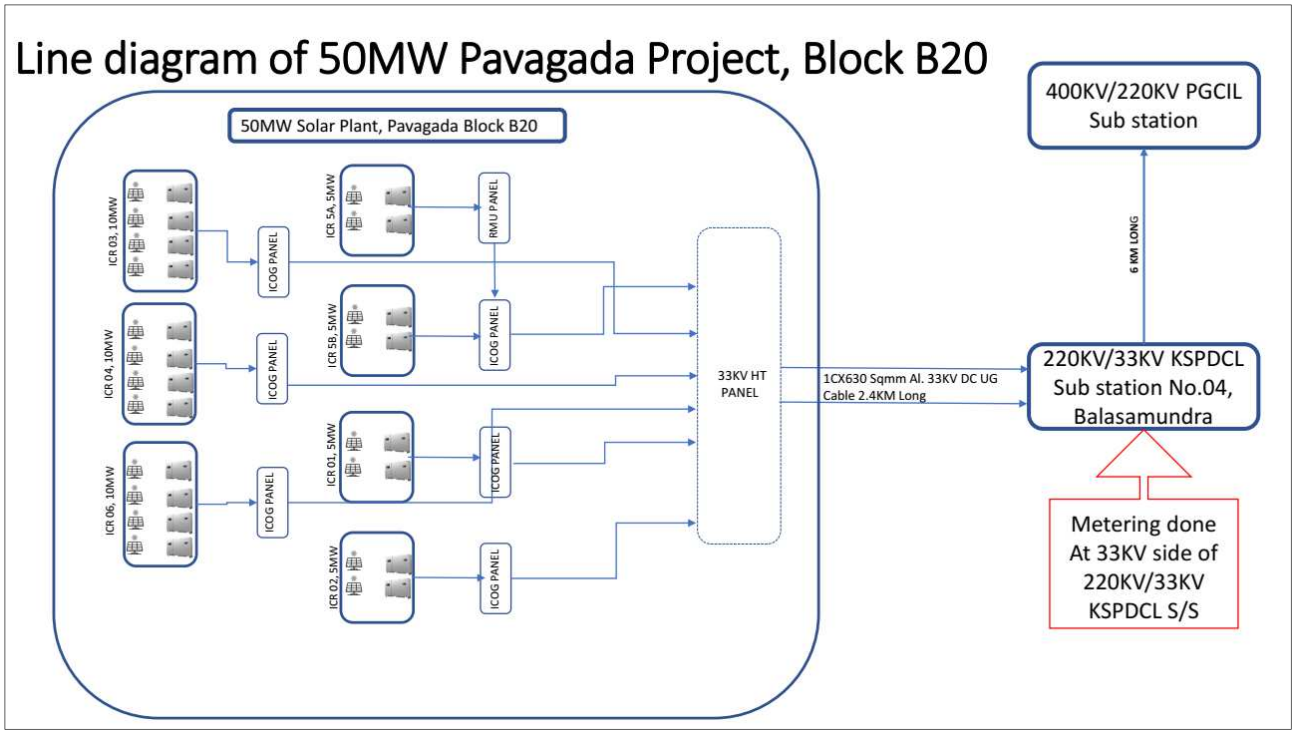
Appendix 5. Further background information on monitoring plan

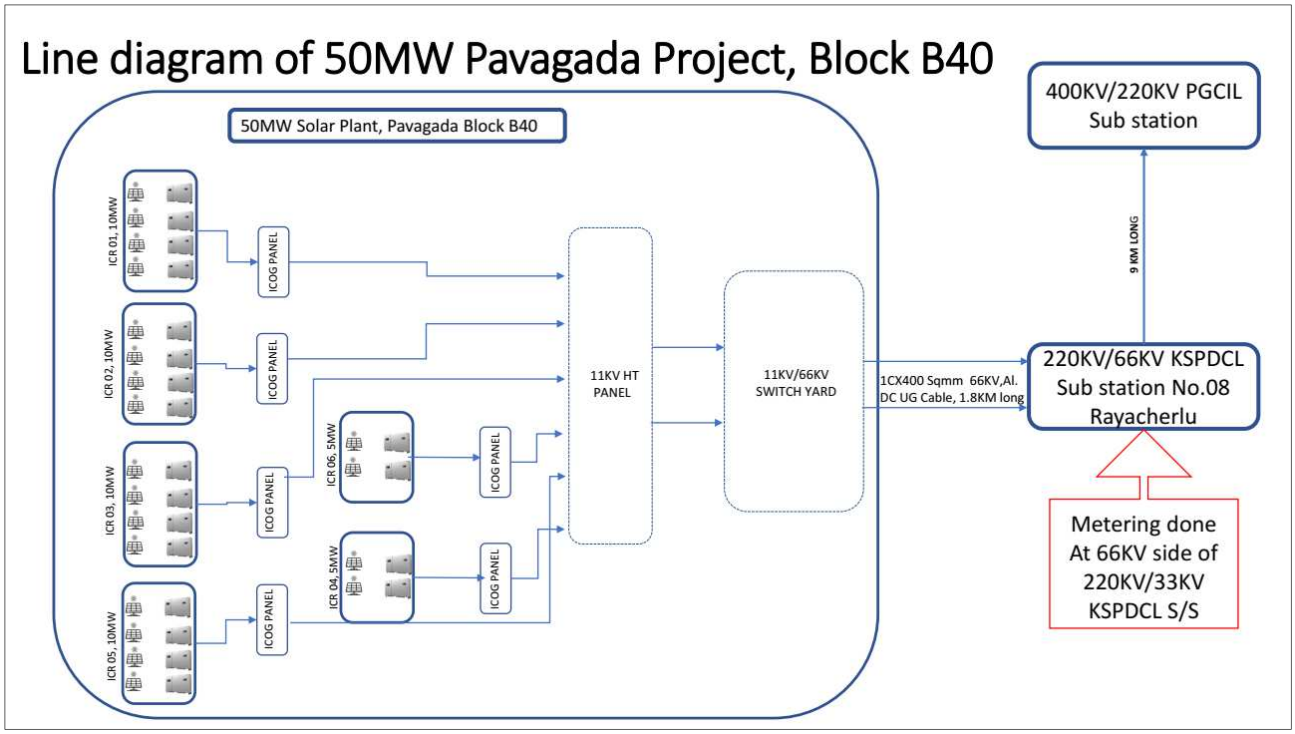
Please refer section B.7 for information on monitoring plan. The respective block wise line diagram is illustrated below:


Line diagram of 50MW Pavagada Project, Block B05
50MW Solar Plant, Pavagada Block B05
ICR 01, 10MW
ICR 02, 10MW
ICR 03, 10MW
ICR 06, 10MW
ICR 05, 5MW
ICR 04, 5MW
ICOG PANEL
33KV HT PANEL
1CX630 Sqmm Al. 33KV DC UG Cable, 1.4KM long
400KV/220KV PGCIL Sub station
1KM LONG
220KV/33KV KSPDCL Sub station No.01, Kyataganacherlu
Metering done At 33KV side of 220KV/33KV KSPDCL S/S


Line diagram of 50MW Pavagada Project, Block B09
50MW Solar Plant, Pavagada Block B09
ICR 01, 10MW
ICR 04, 10MW
ICR 05, 10MW
ICR 2A, 5MW
ICR 2B, 5MW
ICR 03, 5MW
ICR 05, 5MW
ICOG PANEL
RMU PANEL
33KV HT PANEL
1CX630 Sqmm Al. 33KV DC UG Cable , 2.1 KM long
400KV/220KV PGCIL Sub station
2KM LONG
220KV/33KV KSPDCL Sub station No.02, Valluru
Metering done At 33KV side of 220KV/33KV KSPDCL S/S


Line diagram of 50MW Pavagada Project, Block B14
50MW Solar Plant, Pavagada Block B14
ICR 01, 10MW
ICR 02, 10MW
ICR 04, 10MW
ICR 06, 10MW
ICR 05, 5MW
ICR 03, 5MW
ICOG PANEL
33KV HT PANEL
1CX630 Sqmm Al. 33KV DC UG Cable, 0.5 KM Long
400KV/220KV PGCIL Sub station
5KM LONG
220KV/33KV KSPDCL Sub station No.03 Valluru
Metering done At 33KV side of 220KV/33KV KSPDCL S/S


Line diagram of 50MW Pavagada Project, Block B20
50MW Solar Plant, Pavagada Block B20
ICR 03, 10MW
ICR 04, 10MW
ICR 06, 10MW
ICR 5A, 5MW
ICR 5B, 5MW
ICR 01, 5MW
ICR 02, 5MW
ICOG PANEL
RMU PANEL
33KV HT PANEL
1CX630 Sqmm Al. 33KV DC UG Cable 2.4KM Long
400KV/220KV PGCIL Sub station
6 KM LONG
220KV/33KV KSPDCL Sub station No.04, Balasamundra
Metering done At 33KV side of 220KV/33KV KSPDCL S/S



Appendix 6. Summary report of comments received from local stakeholders

Please refer section E.2 for the summary of comments received.

Appendix 7. Summary of post-registration changes

Not Applicable

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.

Version	*Date*	*Description*
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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