# Project design document form
## (Version 11.0)

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

| BASIC INFORMATION | |
|---|---|
| **Title of the project activity** | 70 MW Bhadla Solar power plant by Fortum Finnsurya Energy Pvt Ltd (EKIESL-CDM-APRIL-16-01) |
| **Scale of the project activity** | ☒ Large-scale<br>☐ Small-scale |
| **Version number of the PDD** | 03 |
| **Completion date of the PDD** | 23/08/2019 |
| **Project participants** | Fortum FinnSurya Energy Pvt Ltd |
| **Host Party** | India |
| **Applied methodologies and standardized baselines** | ACM0002- Grid-connected electricity generation from renewable sources --- Version 17.0 |
| **Sectoral scopes** | Sectoral Scope 1: Energy Industries (renewable - /non-renewable sources) |
| **Estimated amount of annual average GHG emission reductions** | 119,384 tCO2e / 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 FinnSurya Energy Private Limited is the promoter of the proposed project activity. The project activity involves installation of 70 MW (AC) (88.2 MWp) solar power project at Bhadla, Jodhpur, Rajasthan. The annual average of estimated electricity generation and estimated emission reduction over 7 years of crediting period will be 122,108 MWh/year and 119,384 tCO2e per year. The project will replace anthropogenic emissions of greenhouse gases (GHG's) by displacing equivalent 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 Participants Name | Capacity in MW (AC) | Capacity in MW (AC) | State |
|---|---|---|---|
| Fortum FinnSurya Energy Pvt. Ltd. | 70 MW | Indian Grid | Rajasthan |

Sectoral Scope: 01 : Grid-connected electricity generation from renewable sources ACM0002-Version 17.0
Project Type: (i) : Renewable energy projects

**Tools referred with above methodology are:**

Tool to calculate the emission factor for an electricity system[1] - Version 05.0 (EB 87, Annex 09)

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

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

**Baseline Scenario:**

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

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

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

**Sustainable development indicators**

[1] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment and Forests (MoEF), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India[2].Thus the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

**Social well-being**

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

**Environmental well-being**

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

**Economic well-being**

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

**Technological well-being**

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

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

**Host party**:India

**Region/State/Province**:Rajasthan

**Village** : Bhadla

**Tehsil** : Bap

**District** : Jodhpur

| Project Participants Name | Latitude | Longitude | Date of Commissioning |
|---|---|---|---|
| Fortum FinnSurya Energy Pvt. Ltd. | N 27° 28' 7.00" | E 71° 58' 17.00" | 31/03/2017 |

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

| Item | Description |
|---|---|
| District Headquarter | Jodhpur |
| Nearest Airport | Jodhpur, (227 km, 4 hrs drive) |
| Nearest railway station | Phalodi (83 km) |
| Road | National Highway |
| Nearest Port | Kandla (~800 km) |
| Water resource | Indira Gandhi Nahar Canal (2 km) |


The location of the project activity as visible in the Google maps is shown below:


## A.3. Technologies/measures

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

The project activity aims to harness solar energy through installation of PV with total installed capacity of 70MW (AC).

For Plant Load Factor, please refer Section B.6.3.

| Technical detail of the equipment[3] | Remark |
|---|---|
| Technology | Solar PV Module |
| Solar photovoltaic module | First solar series 4$^{TM}$ PV Module |
| No of Modules | 112.5Wp:- 88800,<br>115Wp:-587000,<br>117.5Wp:- 85200 |
| Make | First Solar |
| Capacity | 112.5Wp, 115Wp,117.5Wp |
| No of inverters | 70 |
| Capacity | 1000KVA |
| No. of transformers | 18 (ITD) + 2 (PT) |
| 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 | Fortum FinnSurya Energy 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

It is confirmed 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);It is also confirmed that the proposed CDM project activity is not a project activity that has been deregistered.

The proposed CDM project activity was is not a CPA that has been excluded from a registered CDM PoA;

[3] It is to be noted that in future there is possibility of change in module configuration, however project capacity will remain same as 70 MW (AC).

### A.7. Debundling

Not applicable

## SECTION B. Application of methodologies and standardized baselines

### B.1. References to methodologies and standardized baselines

**Title:** Grid-connected electricity generation from renewable sources[4]
**Reference:** The project activity meets the eligibility criteria of large scale project as it is more than 15MW
**Methodology:** ACM0002: Grid-connected electricity generation from renewable sources --- Version 17.0[5]
**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[6] - Version 05.0 (EB 87, Annex 09)
- Tool for the demonstration and assessment of additionality[7]- Version 07.0.0 (EB 70, Annex 08)

### B.2. Applicability of methodologies and standardized baselines

The project activity involves generation of grid connected electricity from renewable solar energy. The project activity has an installed capacity of 70 MW (AC) which will qualify for a large CDM project activity under Type-I of the large scale methodologies. The project status is corresponding to the methodology ACM0002 version 17.0 and applicability of methodology are discussed below.

| Applicability Criterion | Project Case |
|---|---|
| 1. This methodology is applicable to grid-connected renewable energy power generation project activities that:<br>a) Install a Greenfield power plant;<br>b) Involve a capacity addition to (an) existing plant(s);<br>c) Involve a retrofit of (an) existing operating plants/units;<br>d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or<br>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:<br>a) The project activity may include | The option (a) of applicability criteria 2 is applicable as project is renewable energy solar power plant/unit. |

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/approved

[5] http://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf

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

| | |
|---|---|
| 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;<br>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. | |
| 3. In case of hydro power plants, one of the following conditions shall apply:[8]<br>a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or<br>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<br>c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 $W/m^2$; or<br>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:<br>i. The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 $W/m^2$;<br>ii. Water flow between reservoirs is | The project is installation of new solar based electricity generation plants (not a hydro power plant). Hence this criteria is not applicable. |

[8] 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.

| | |
|---|---|
| not used by any other hydropower unit which is not a part of the project activity;<br>iii. Installed capacity of the power plant(s) with power density lower than or equal to 4 W/$m^2$ shall be:<br>a. Lower than or equal to 15 MW; and<br>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:<br>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;<br>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<br>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 | Not applicable, the solar project is a Green field project activity and this project is not the enhancement or up gradation project. |

| | |
|---|---|
| project activity and undertaking business as usual maintenance". | |
| 9. In addition, the applicability conditions included in the tools referred to below apply.[9] | Please refer tables below. |

Tool to calculate the emission factor for an electricity system[10] - Version 05.0 (EB 87, Annex 09)

| **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 CO2 emission factor of biofuels is zero. | The project is a Solar project and there is no involvement of biofuels. |

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

Applicability Criteria has been demonstrated in section on additionality below.

[9] 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.

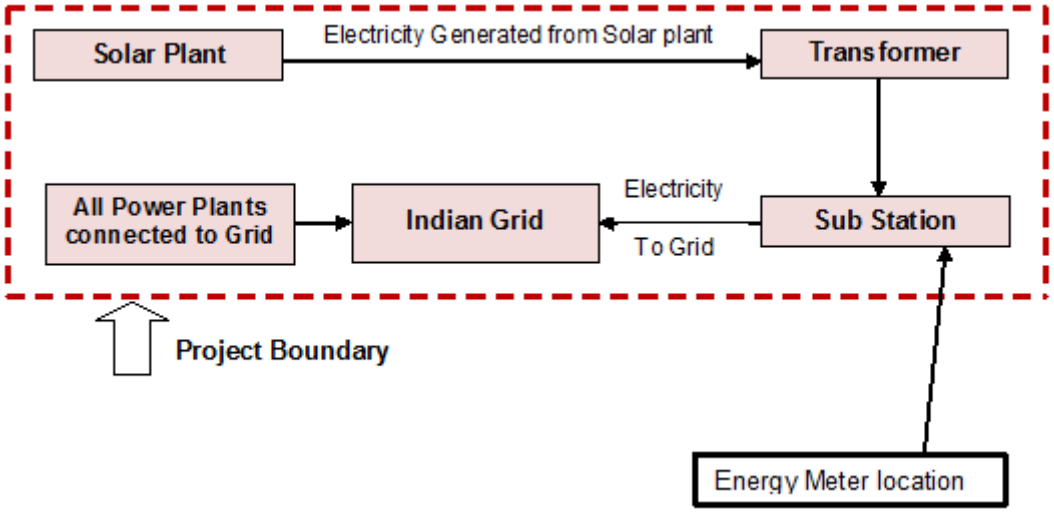
[10] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf

The project activity qualifies as Type I during every year of the crediting period in accordance with applicable provisions for project activity eligibility as discussed above. Also the total installed capacity of project activity is 70 MW which is applicable as per large scale project activities methodology ACM0002: Grid-connected electricity generation from renewable sources Version 17.0. 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.

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

As per ACM002 version 17 - "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to".

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




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

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

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

As per the approved consolidated Methodology ACM0002 (Version 17.0, EB 89, Annex 1) para 24: "If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as

reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

The project activity involves setting up of solar projects to harness the power of sun to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the Indian grid, which is fed mainly by fossil fuel fired plants.

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

The combined margin ($EF_{grid, CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 11 was the latest available data at the time of PDD submission to DOE for validation, hence same is considered for emission factor calculations.

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

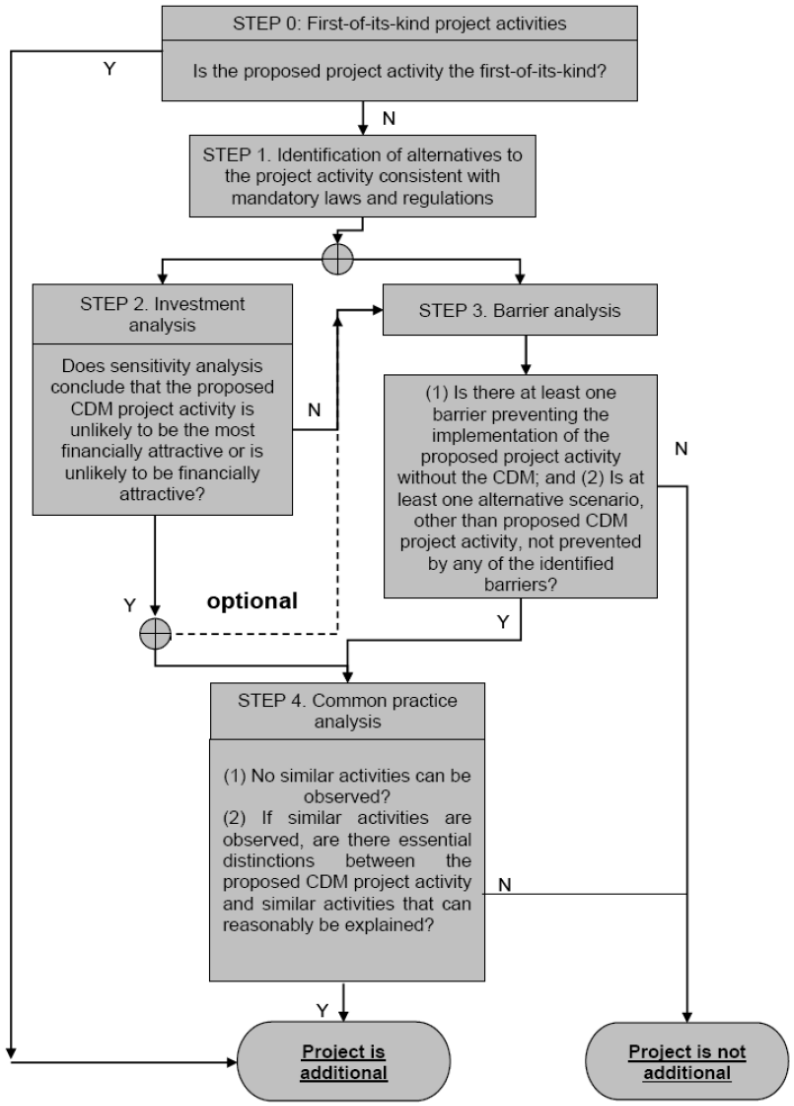
| Parameter | Value | Nomenclature | Source |
|---|---|---|---|
| $EF_{grid,y}$ | 0.9777 $tCO_2/MWh$ | Combined margin $CO_2$ emission factor for the project electricity system in year y | Calculated as the weighted average of the operating margin (0.75) & build margin (0.25) values, sourced from Baseline $CO_2$ Emission Database, Version 11.0, April 2016 published by Central Electricity Authority (CEA), Government of India |
| $EF_{grid,OM,y}$ | 0.9941 $tCO_2/MWh$ | Operating margin $CO_2$ emission factor for the project electricity system in year y | Calculated as the last 3 year (2012-13, 2013-14, 2014-15) generation-weighted average, sourced from Baseline $CO_2$ Emission Database, Version 11.0, April 2016 published by Central Electricity Authority (CEA), Government of India |
| $EF_{grid,BM,y}$ | 0.9285 $tCO_2/MWh$ | Build margin $CO_2$ emission factor for the project electricity system in year y | Baseline $CO_2$ Emission Database, Version 11.0, April 2016 published by Central Electricity Authority (CEA), Government of India |

## B.5. Demonstration of additionality

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

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

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




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

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

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

As per the applied methodology ACM0002 version 17.0; Para 24, if the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid connected power plant and by the addition of new generation sources.

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

**Step 2: Investment Analysis**

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

As per “Tool for the demonstration and assessment of additionality” (version 07.0.0), for financial analysis of the project, the following three options are available:
Option I: Simple Cost Analysis
Option II: Investment Comparison Analysis
Option III: Benchmark Analysis

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

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

Project 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.

Since EB85 Annex 12 (Methodological Tool: Investment Analysis Version 6) was applicable at the time of investment decision made (i.e on 13/01/2016) for the project activity, however PP has considered the latest methodological tool "Investment Analysis" Version 07 dated 4/11/2016 (EB 92 Annex 5) for default value of 11.06%. This is conservative approach the same is referred for default value for cost of equity. As per Para 16 of EB92, Annex 5 states that Required/expected returns on equity are appropriate benchmarks for an equity IRR. Therefore, the Expected return on equity is considered appropriate benchmark.

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

**Default Value Benchmark:**

As per para 20 of EB92, Annex 5 the cost of equity is determined by selecting the values provided in the Appendix, i.e. Default values for cost of equity (expected return on equity) is presented below:

Appendix in EB92, Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 11.06%

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

Nominal Benchmark[11] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where:

- Default value for Real Benchmark = 11.06% (as per Appendix of EB92, Annex 5)
- Inflation Rate forecast for by Reserve Bank of India (RBI) (i.e. Central Bank of India) for India & in case where RBI Inflation forecast was not available Average Inflation rate forecast for India has been sourced from IMF web site.

**Benchmark estimation:**

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

Appendix in EB92, Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 11.06%

Inflation Forecast for India as per RBI website[12]:

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 Project Investor** | **Inflation Forecast (10 Years)** | **Benchmark** |
|---|---|---|
| Fortum FinnSurya Energy Pvt. Ltd. | 3.80% | 15.28% |

Thus benchmark of **15.28%** has been selected for this project activity.

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

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

Cost of the Project Activity

| | |
|---|---|
| SPV Name<br>Project Location | **Fortum Finnsurya Energy Pvt. Ltd** |
| State | Rajasthan |
| Project Capacity (MW) | 70 |
| Expected Date of Commissioning | 31-Mar-2017 |
| Life of Plant in years | 25 |

| DPR |
|---|
| 10-Nov-15 |

in INR MN

| Items | Cost | Tax | Cost + Tax |
|---|---|---|---|
| Project Cost | 4,179.70 | | 4,179.70 |
| **Total** | 4,179.70 | - | 4,179.70 |

| | | | |
|---|---|---|---|
| O&M Expenses | 91.00 | | 91.00 |
| | 5.85% Escalation, starting from 2nd Yr. | | |

| **Details of the project** | | **Source** |
|---|---|---|
| State where the project is situated | Rajasthan | As per DPR |
| Total Capacity (MW) | 70.00 | As per DPR |
| Expected Date of Commissioning | 31-Mar-17 | Assumption |
| Life of the plant (Yrs.) | 25 | As per DPR and also as per Rajasthan tariff order[13] |
| Generation of electricity | | |
| PLF (%) | 20.00% | As per DPR |
| Annual generation (kWh) | 12,26,40,000 | Calculated Value |
| Annual Degradation per year | 0.50% | As per DPR |
| Tariff rate at the decision making (INR/kWh) | 4.34 | As per DPR |
| Escalation in tariff rate | 0.0% | |

[12] https://rbi.org.in/Scripts/PublicationsView.aspx?id=16710

[13] http://rerc.rajasthan.gov.in/TariffOrders/Order216.pdf

| | | |
|---|---|---|
| Transmission & Wheeling Losses (%) | 0.00% | |
| GBI Benefit (INR/kWh) if applicable | - | As per MNRE scheme dt. 04.09.2013[14], |
| **Operation and maintenance cost and Insurance** | | |
| O & M Expenses (INR Mn.) | 91.00 | As per DPR |
| O & M free for (Yr.) | - | |
| Escalation in the operational expenses (%) | 5.85% | As per DPR |
| Administrative expenses (INR MN) | 0.00 | Conservatively Administration and Miscellaneous expenses are excluded |
| Escalation in Administrative expenses | 0.00% | Escalation for Admin Expenses |
| Insurance (INR Mn.) | 20.90 | CERC order[15] |
| **Financial parameters** | | |
| TOTAL COST (INR Mn.) | 4,179.70 | As Per DPR |
| Loan Amount (INR Mn.) | 2,925.79 | Assumption |
| Equity Investment (INR Mn.) | 1,253.91 | Calculated Value |
| **Term loan** | | |
| Loan Amount (INR Mn.) | 2,925.79 | Assumption 70% loan and 30% equity As per Rajasthan tariff order |
| Interest rate (%) | 13.00% | As per Rajasthan tariff order |
| Loan Tenure (Qtr.) | 48 | Assumption |
| Moratorium Period (Qtr.) | - | Assumption |
| Repayment Period (Qtr.) | 48 | Calculated Value |
| Repayment instalments value (INR Mn.) | 60.954 | Calculated Value |
| 1st instalment from (Qtr. end) | 30-Jun-17 | Considered from the next Quarter End |
| **Book Depreciation (SLM Method)** | | |
| Land | - | |
| Gross Depreciable Value (INR Mn.) | 4,179.70 | Calculated Value |
| Salvage Value (%) | 10.00% | |
| Salvage value (INR Mn.) | 417.97 | Calculated Value |
| Net Depreciable Value (INR Mn.) | 3,761.73 | Calculated Value |
| Residual Value (INR Mn.) | 417.97 | Calculated Value |
| **IT Depreciation** | | |
| IT Depreciation(%) | 80.00% | IT act[16] |
| **Income Tax** | | |
| **Financial Year** | **FY 2016-17** | |
| Income tax rate (%) | 30.00% | As Per Income Tax Rule, Pg 30 Para E(I)[17] |
| MAT (%) | 18.50% | As Per IT rule Pg 4[18] |
| Service Tax (%) | 15.00% | As Per Income Tax Rule[19] |
| Surcharge (%) | 12.00% | As Per Income Tax Rule, Pg 30[20] |

[14] http://www.ireda.gov.in/forms/contentpage.aspx?lid=743

[15] http://www.cercind.gov.in/2015/orders/SO5.pdf

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

[17] http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html

[18] http://taxguru.in/income-tax/income-tax-slab-financial-year-201516.html

[19] http://taxguru.in/service-tax/service-tax-rate-chart-effect-01062016.html

| | | |
|---|---|---|
| Education cess (%) | 3.00% | As Per Income Tax Rule, Pg 5, 11 and 12[21] |
| **Final Tax rates** | | |
| Income tax rate (%) | 34.61% | Calculated Value |
| MAT (%) | 21.34% | Calculated Value |
| Service Tax (%) | 15.45% | Calculated Value |

Considering the input values, Equity IRRs is given below:

| S. No | Project Investor | Equity IRR without CDM | Benchmark (Equity IRR) |
|---|---|---|---|
| 1 | Fortum FinnSurya Energy Pvt. Ltd. | 5.00% | 15.28% |

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

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

Addressing Guidance 28 & 29 of EB92, Annex 5, following factors has been subjected to sensitivity analysis:

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

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

The results of sensitivity analysis are as follows:

| Variation % | -10% | Normal | 10% | Breaching Value |
|---|---|---|---|---|
| PLF | 1.59% | 5.00% | 8.72% | 23.94% |
| O&M | 6.11% | 5.00% | 3.85% | -93.10% |
| Project Cost | 7.87% | 5.00% | 2.93% | -24.40% |
| Tariff Rate | 1.59% | 5.00% | 8.72% | 23.94% |

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 DPR in line with "**Guidelines for the reporting and validation of Plant load factors**" stated in EB48 Annex11.<br><br>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.<br><br>The threshold limit for PLF is 23.94% increase in PLF (i.e PLF above 24.79%) which is unlikely scenario**.** |

[20] http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html

[21] http://taxguru.in/income-tax/income-tax-rate-chart-slabs-for-ay-2017-18-fy-2016-17.html

| **Sensitivity Parameter 2 : O&M** |
|---|
| The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely. |
| **Sensitivity Parameter 3 : Project Cost** |
| Project Cost for financial analysis is considered from DPR. The 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.<br>The actual project cost is 4,488.99 million INRs which is higher than DPR cost , thus with actual project cost and actual fixed Tariff rate of 4.34 INR/KWh, the IRR crosses the benchmark for PLF more than 31.20% ( i.e PLF of 26.24%) which is highly unlikely scenario**.** |
| **Sensitivity Parameter 4 : Tariff Rate** |
| The tariff is determined by Tendering process 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**

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

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

| **Range** | **Capacity** | **Unit** |
|---|---|---|
| +50% | 105 | MW |
| Capacity of the proposed project activity | 70 | MW |
| -50% | 35 | 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 in Rajasthan state of India, therefore, projects in the geographical area of Rajasthan have been chosen for analysis. Each state have different policies regarding renewable energy, hence Rajasthan state is considered as geographical region for common practise analysis.

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

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

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

e) The capacity range of the projects is within the applicable capacity range from 35 MW to 105 MW.

e) The start date of the project activity is 29-Jul-2016. Therefore projects, which have started commercial operation before 29-Jul-2016, have been considered for analysis.

Numbers of Similar projects identified, which fulfil above-mentioned conditioned are
**$N_{solar}$= 4**

The below sources are considered to determine the similar projects.

State wise commissioning status of grid connected Solar Power Projects (As on 30.11.2015)- MNRE, India and Publically available data for solar projects in Rajasthan till July 2016.
http://mnre.gov.in/file-manager/UserFiles/state-wise-commissioned-grid-connected-solar-power-projects.htm

List of Solar Projects in Rajasthan (RRECL- Website) as on 31.10.2015. No projects of having capacity of 35 MW to 105 MW was found on publically available data till July 2016
http://energy.rajasthan.gov.in/content/dam/raj/energy/rrecl/pdf/Activities/Solar/4.37%20Details%20of%20commissioned%20Solar%20Projects.pdf

**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 power plants identified is provided to the DOE. After excluding the registered and under validation projects the total number of projects. One project of 40 MW by Dahanu Solar Power Pvt. Ltd was found as CDM Registered.

**$N_{all}$ = 3**

**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 can be 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 – The solar projects developed under different phases and different batches of National Solar Mission (NSM) can considered as different technology projects. For proposed project activity, there are no any different technology project considered out of similar identified projects.

Hence, there are no any single project which can be considered as different technology projects from identified similar 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 $F=1-N_{dif}f/N_{all}$
F = 1-(0/3) = 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 $N_{al}l-N_{diff}$ 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. $N_{all}-N_{diff}$= 3; is not greater than 3

The project activity does not satisfy second condition. Hence, project activity is not a common practice.
The proposed project activity is not a "common practice" within a sector in the applicable geographical area.

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

**Demonstration of Parallel and continuing actions**

CDM Project Standard Version 09.0, Section 6.5 states that "For a proposed CDM project activity with a start date on or after 2 August 2008, project participants shall inform the host Party's designated national authority (DNA) and the secretariat of their intention to seek CDM status in accordance with the Project cycle procedure".

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

| Project Investor | Start Date | F-CDM Date |
|---|---|---|
| Fortum FinnSurya Energy Pvt. Ltd. | 29/07/2016 | 05/04/2016 |

## B.6. Estimation of emission reductions

### B.6.1. Explanation of methodological choices

**Project Emissions:**

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

"For most renewable energy power generation project activities, PEy = 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:

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

Where:
$PE_y$ = Project emissions in year y (t $CO_2$e/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 $CO_2$e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (t $CO_2$e/yr)"

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

**Baseline Emissions:**

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

Baseline emissions include only $CO_2$ 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 05 is calculated as below.

$CO_2$ Baseline Database for the Indian Power Sector, Version 11, April 2016 published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per Methodological tool: Tool to calculate the emission factor for an electricity system (Version 05.0, EB 87, Annex 9), following six steps have been followed:

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

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

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

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

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

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

**Step 1: Identify the relevant electricity systems**

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

However since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this $CO_2$ 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 | Andhra Pradesh |
| Delhi | Jharkhand | Gujarat | Assam | Karnataka |
| Haryana | Orissa | Daman & Diu | Manipur | Kerala |
| Himachal Pradesh | West Bengal | Dadar& Nagar Haveli | Meghalaya | Tamilnadu |
| Punjab | Andaman & Nicobar | Maharashtra | Nagaland | Lakshadweep |
| **Rajasthan** | | Goa | Tripura | |
| 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)**

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

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

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

The simple OM emission factor is calculated as the generation-weighted average $CO_2$ emissions per unit net electricity generation (t $CO_2$/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 CDM-PDD to the DOE for validation.
OM determined at validation stage will be the same throughout the crediting period. There will be no requirement to monitor & recalculate the emission factor during the crediting period.

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

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

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

| | Simple Operating Margin (tCO2/MWh) (incl. Imports) | | |
|---|---|---|---|
| | 2012-13 | 2013-14 | 2014-15 |
| INDIAN Grid | 0.99 | 1.00 | 1.00 |

| Weighted Generation Operating Margin | | | |
|---|---|---|---|
| INDIAN Grid | | | 0.9941 |

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

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 05.0, EB 87, Annex 9) para 70:

In terms of vintage of data, project participants can choose between one of the following two options:

(a) Option 1 - for the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

(b) Option 2 - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

| Build Margin ($tCO_2$/MWh) (not adjusted for imports) | |
|---|---|
| | 2014-15 |
| INDIAN Grid | 0.9285 |

**Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)**

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

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.
The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin $CO_2$ emission factor in year y (t $CO_2$/MWh)

$EF_{grid,OM,y}$ = Operating margin $CO_2$ emission factor in year y (t $CO_2$/MWh)

$W_{OM}$ = Weighting of operating margin emissions factor (per cent)

$W_{BM}$ = Weighting of build margin emissions factor (per cent)

The following default values should be used for $W_{OM}$ and $W_{BM}$:
Wind and solar power generation project activities: $W_{OM}$= 0.75 and $W_{BM}$= 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods. Since project activity is of solar power generation, the above weightage has been considered for OM and BM.

Therefore, $EF_{grid,CM,y}$ = 0.9941*0.75 + 0.9285*0.25
= 0.9777 t $CO_2$/MWh

**Baseline emission factor ($EF_y$):**

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

Therefore, $EF_y = EF_{grid,CM,y}$= 0.9777 t $CO_2$/MWh.

**Leakage Emissions:**

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

**Emission reductions:**

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$

Where:

$ER_y$ = Emission reductions in year y (t $CO_2$e/yr)
$BE_y$ = Baseline emissions in year y (t $CO_2$e/yr)
$PE_y$ = Project emissions in year y (t $CO_2$e/yr)

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

| **Data/Parameter** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit | $tCO_2/MWh$ |
| Description | Operating Margin CO2 emission factor in year y |
| Source of data | Calculated from CEA database, Version 11, April 2016[22] |
| Value(s) applied | 0.9941 |
| Choice of data or measurement methods and procedures | Calculated as per "Tool to calculate the emission factor for an electricity system, version 05" as 3-year generation weighted average using data for the years 2012-13, 2013-14, & 2014-15. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 11, 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** | $EF_{grid,BM,y}$ |
|---|---|
| Data unit | $tCO_2/MWh$ |
| Description | Build Margin $CO_2$ emission factor in year y |
| Source of data | Calculated from CEA database, Version 11, April 2016[23] |
| Value(s) applied | 0.9285 |
| Choice of data or measurement methods and procedures | Calculated as per "Tool to calculate the emission factor for an electricity system, version 05" as 3-year generation weighted average using data for the years 2012-13, 2013-14, & 2014-15. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 11, 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 11, April 2016[24] |
| Value(s) applied | 0.9777 |
| Choice of data or measurement methods and procedures | The combined margin emissions factor is calculated as follows:<br><br>$EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$<br>Where:<br>$EF_{grid,BM,y}$= Build margin CO2 emission factor in year y (tCO2/MWh)<br>$EF_{grid,OM,y}$= Operating margin CO2 emission factor in year y (tCO2/MWh)<br>$W_{OM}$ = Weighting of operating margin emissions factor (%) = 75%<br>$W_{BM}$= 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. |

[22] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf

[23] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf

[24] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf

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

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

$ER_Y = BE_Y – PE_Y$

Where,
$ER_Y$ = Emission Reduction in tCO2/year
$BE_Y$ = Baseline emission in tCO2/year
$PE_Y$ = Project emissions in tCO2/year

**Baseline Emission ($BE_Y$)**

The baseline emissions are the product of electrical energy baseline EGPJ,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
= 0.9777 $tCO_2$/MWh

$BE_y$ = 122,640 * 0.9777 (first year electricity generation is considered here)
= 119,905 $tCO_2$/year (for first year)

Since $ER_y = BE_y$

Therefore, $ER_y$ = 119,905 $tCO_2$/year (for first year)

For ER estimation, 0.5% degradation factor per year is applied from second year and emission reductions are determined as below.

### 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 | 119,905 | 0 | 0 | 119,384 |
| Year 2 | 119,305 | 0 | 0 | 119,305 |
| Year 3 | 119,302 | 0 | 0 | 119,302 |
| Year 4 | 119,299 | 0 | 0 | 119,299 |
| 0 | 119,296 | 0 | 0 | 119,296 |
| Year 6 | 119,293 | 0 | 0 | 119,293 |
| Year 7 | 119,290 | 0 | 0 | 119,290 |
| **Total** | 835,690 | 0 | 0 | 835,690 |
| **Total number of crediting years** | 7 | | | |
| **Annual average over the crediting period** | 119,384 | 0 | 0 | 119,384 |

For ER estimation, 0.5% degradation factor per year is applied from second year and emission reductions are determined accordingly. Please refer ER estimation spreadsheet for the same.

## B.7. Monitoring plan

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

*(Copy this table for each piece of data or parameter.)*

| **Data/Parameter** | **$EG_{PJ,y}$** |
|---|---|
| Data unit | MWh/y |
| Description | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y in MWh |
| Source of data | Monthly joint meter reading reports (70MW) |
| Value(s) applied | 122,640 |
| Measurement methods and procedures | **Plant end dedicated metering:** The electricity exported / supplied by the plant is first metered by plant end dedicated meter. This can be considered as stand by meter.<br><br>**Common metering at the substation:** All the plants (including the project activity solar plant and other investors solar plant ) are further connected to a common metering point at Pooling substation 132/220 KV GSS II and further electricity is transferred to 220/400 KV RRVPNL substation. The common metering point consists of both main & check meters (ABT Meters) having accuracy class of 0.2s. The export/import losses between these two substations are apportioned based on pooling substation readings.<br><br>The difference of final apportioned value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations. |
| Monitoring frequency | Continuous measurement & monthly recording |
| QA/QC procedures | The meters is approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years.[25] The monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness of metering.<br>The metering arrangement, accuracy class of meters, calibration frequency and apportioning approach is under control of state electricity board and PP do not have any control on it. PP is getting value of net electricity supplied to grid and the same is considered the monitoring parameter. |
| Purpose of data | Calculation of baseline emissions |
| Additional comment | Data will be archived in paper & electronic form for two years after the end of crediting period or of the last issuance of CERs for this project activity, whichever occurs later. |

### B.7.2. Sampling plan

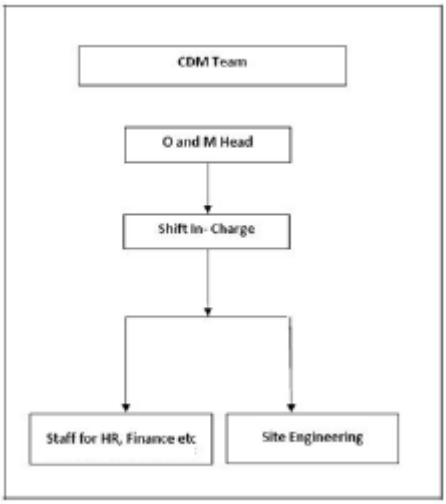
No sampling is required

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

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities and is proposed for grid-connected solar power project being implemented in Rajasthan, 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.

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

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.




| Responsibility |
| --- |
| • Reviewing the monthly and annual generation statistics.<br>• Evaluating the GHG performance of the project activity.<br>• Identifying the opportunities for future improvement<br>• Addressing grievance related to project activity. |
| • Implementation of corrective appropriate measures in case any discrepancies are identified in the reported parameters.<br>• Review of monthly report.<br>• Ensuring calibration of monitoring equipment as and when required. |
| • Monitoring and reporting the GHG performance related parameters following the guidance provided in the project design document<br>• Preparation of monthly and annual generation statistics.<br>• Reporting of any discrepancies identified in the reporting parameters.<br>• Ensuring calibration of the monitoring equipments as and when required. |

**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 FinnSurya Energy Pvt. Ltd, invoices will be raised. These invoices can be used for cross checking the meter readings taken for the respective project activity.

In case of billing cycle and monitoring period cycle does not match, then daily generation data will be used to determine net electricity export for particular period.

**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 purchase order for solar PV modules as on 29/07/2016.

### C.2. Expected operational lifetime of project activity

25 Years 00 Months

### C.3. Crediting period of project activity

#### C.3.1. Type of crediting period

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

#### C.3.2. Start date of crediting period

01/08/2017 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 (first crediting period)

## 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[26] and thus an EIA is not required.

### D.2. Environmental impact assessment

Environmental impact assessment is not required as per Ministry of Environment & forests vide their OM J-11013/41/2006 - IA II (I) dated 13th May 2011[27] 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 public notice to attend the stakeholders meeting.

The details of the Stakeholder Meetings are as follows:

Date of invitation – 14/05/2016

[26] http://envfor.nic.in/legis/eia/so1533.pdf

[27] http://moef.nic.in/downloads/public-information/OM-SolarPV.pdf

Date of Meeting – 25/05/2016
Location of Meeting - Project site, Rajasthan

In the introductory speech, the representative of EKI Energy Services Limited (CDM consultant) and representative of Fortum FinnSurya Energy Pvt Ltd, Mr. Chimay Samantha 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 detailed discussions, the session was open for questions from stakeholders.

The villagers raised various queries which are summarised below:

**Q:** Will the operation of the plant result in increased temperature in the surroundings?

**A:** There will be no impact on ambient temperature due to operation of the plant.

**Q:** Does the project provides employment opportunities or improve economic development of the area?

**A:** Yes, the project will provide economic development of the area and will provide employment opportunities to the local people depending upon their skill and qualification.

**Q:** Will the project help in improving the electricity supply to the villagers or neighbourhood areas?

**A:** The electricity generated from the project shall be sold to NTPC under 25 year PPA who in turn shall sell it to state discom whose responsibility is to distribute electricity in their respective jurisdiction including surrounding villages. It is envisaged that this would improve the electricity availability situation in the neighbourhood area.

**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 in the form of works for module cleaning, hiring of vehicle etc., improvement in transportation; and various social activities shall help to uplift the standard of living.

Also below specific queries were raised by local stakeholders

| | |
|---|---|
| **Name of Stakeholder** | Mehbob |
| **Occupation** | Villager |
| 1. What are the advantages of Solar Plant?<br><br>2. Can we install solar plant at our home? | |

3. Will it increase temperature in neighbourhood?
4. Will it reduce power cut problem?

| **Name of Stakeholder** | Devisingh |
|---|---|
| **Occupation** | Driver |

1. Does this project work at night?
2. How many year this project work?
3. Will it increase temperature in neighbourhood?
4. Will it reduce power cut problem?

| **Name of Stakeholder** | Sadhechadji |
|---|---|
| **Occupation** | Shopkeeper |

1. What benefits will be there due to the project?
2. Can solar project operate in night?
3. What is the disadvantage of solar plant?
4. Will we get employment opportunity?
5. Will it promote business activities like hotels?

| **Name of Stakeholder** | Ghanshyam |
|---|---|
| **Occupation** | Vegetable seller |

1. Will the project help in economic development?
2. Will there be any harm on agriculture?
3. Will the project result in any kind of air or water pollution?

| **Name of Stakeholder** | Mukesh Parik |
|---|---|
| **Occupation** | Farmer |

1. What are the benefits from this project?
2. Does it ensure 24 hour power supply?
3. How much land do you need for the project?
4. Is there any adverse impact within the neighbourhood?

| **Name of Stakeholder** | Kishore |
|---|---|
| **Occupation** | Villager |

1. What benefits will be there due to the project?
2. Does the UV rays are harmful to us?
3. Will the villagers get electricity from the project?

| **Name of Stakeholder** | Rakesh |
|---|---|
| **Occupation** | Shopkeeper |

1. This project will cause harm?

2. What are the other things that can be done from solar?
3. Summer season will produce more electricity?

| **Name of Stakeholder** | Lile Jha |
|---|---|
| **Occupation** | Villager |

1. Will the operations of plant result in increased temperature in the surrounding?
2. Does this project provide employment opportunity?
3. How much time does the project needs to get commission?
4. Does the project release any harmful rays or gases?

| **Name of Stakeholder** | Matharya |
|---|---|
| **Occupation** | Student |

1. Is there any way to generate power at night?
2. What is the lifetime of the battery in the solar project?
3. How will it help reduce pollution?
4. What is the lifetime of the project?
5. Will there be harmful emission from project?

| **Name of Stakeholder** | Ramesh |
|---|---|
| **Occupation** | Teacher |

1. What is technology of this project?
2. How many time taken to develop?
3. How it work?
4. How rain water is effected?

| **Name of Stakeholder** | Dabuwan |
|---|---|
| **Occupation** | Villager |

1. Project activity will provide free electricity to the villagers?
2. Scope for employment for the local villagers?
3. Will the project cause any harmful emission?

| **Name of Stakeholder** | Jayant |
|---|---|
| **Occupation** | Farmer |

1. Does the project provides employment opportunity or improve economic development of the area?
2. How many workers will be employed?
3. Does this project cause emission of harmful sun radiation?

| **Name of Stakeholder** | Khajya |
|---|---|

| **Occupation** | Villager |
|---|---|
| 1. What is the reason for setting up project here?<br>2. Will there be any negative impact on our land or cultivation?<br>3. Will we get 24 hr electricity from this project?<br>4. Will there be employment opportunity for the youth? | |

| **Name of Stakeholder** | Padam Singh |
|---|---|
| **Occupation** | Student |
| 1. Do I get any employment opportunity?<br>2. How will the project help electricity generation of our village? | |

| **Name of Stakeholder** | Lateeb |
|---|---|
| **Occupation** | Farmer |
| 1. Does this project cause any inconvenience?<br>2. What are the benefit of this project?<br>3. Can electricity be generated at night? | |

| **Name of Stakeholder** | Saeed |
|---|---|
| **Occupation** | Shopkeeper |
| 1. Solar plant will increase the temperature in nearby areas?<br>2. Solar energy generation will produce any harmful radiation?<br>3. This project will cause any problem to us?<br>4. What are the development which possess from this project?<br>5. Will you help us in getting loans? | |

### E.3. Consideration of comments received

All the above queries were 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 project obtained Host Country Approval from Indian DNA i.e. Ministry of Environment Forest and Climate Change vide letter no. 4/7/2016-CC dated 24th May, 2017.

# Appendix 1. Contact information of project participants

| | |
|---|---|
| **Organization name** | Fortum FinnSurya Energy Pvt. Ltd. |
| **Country** | India |
| **Address** | Building: Ground Floor, World Trade Centre, Baber Road, City: New Delhi State/Region:New Delhi |
| **Telephone** | +91-85276-94527 |
| **Fax** | NA |
| **E-mail** | awadhesh.jha@fortum.com |
| **Website** | |
| **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 callculation.

# Appendix 5. Further background information on monitoring plan

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

# Appendix 6. Summary report of comments received from local stakeholders

Please refer section E.2 for information on summary of comments received from the local stakeholders.

# Appendix 7. Summary of post-registration changes

The geo-coordinates of the project site mentioned at the PDD version 2 dated 04/08/2017 found incorrect and actual project site is at different location but near to incorrect location provided. The new location found consistent during verification and exact location has been updated in the section A.2. The nature of this is permanent.

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## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 11.0 | 31 May 2019 | Revision to:<br>• Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN);<br>• Make editorial improvements. |
| 10.1 | 28 June 2017 | Revision to make editorial improvement. |
| 10.0 | 7 June 2017 | Revision to:<br>• Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms;<br>• Make editorial improvement. |
| 09.0 | 24 May 2017 | Revision to:<br>• Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0);<br>• Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM);<br>• Make editorial improvement. |
| 08.0 | 22 July 2016 | EB 90, Annex 1<br>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:<br>• Include provisions related to statement on erroneous inclusion of a CPA;<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to local stakeholder consultation;<br>• Provisions related to the Host Party;<br>• Make editorial improvement. |
| 05.0 | 25 June 2014 | Revision to:<br>• 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));<br>• Include provisions related to standardized baselines;<br>• 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;<br>• Change the reference number from F-CDM-PDD to CDM-PDD-FORM;<br>• 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). |

| *Version* | *Date* | *Description* |
|---|---|---|
| 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<br>Initial adoption. |

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