



**Monitoring report form for CDM project activity**  
**(Version 07.0)**

**MONITORING REPORT**

<b>Title of the project activity</b>	Grid connected solar photovoltaic power plant in Bikaner, Rajasthan, India	
<b>UNFCCC reference number of the project activity</b>	9185	
<b>Version number of the PDD applicable to this monitoring report</b>	04	
<b>Version number of this monitoring report</b>	1	
<b>Completion date of this monitoring report</b>	17/10/2020	
<b>Monitoring period number</b>	01	
<b>Duration of this monitoring period</b>	26/02/2013 to 30/06/2020	
<b>Monitoring report number for this monitoring period</b>	01	
<b>Project participants</b>	Sai Maithili Power Company Private Limited	
<b>Host Party</b>	India	
<b>Applied methodologies and standardized baselines</b>	Methodology: AMS.I.D. "Grid connected renewable electricity generation" Version 17, EB 61 Standardized baselines used: N/A	
<b>Sectoral scopes</b>	01 Energy industries (renewable - / non-renewable sources)	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period</b>	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO <sub>2</sub> e	119,858 tCO <sub>2</sub> e
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD</b>	126,157 tCO <sub>2</sub> e	

## SECTION A. Description of project activity

### A.1. General description of project activity

The purpose of this project activity is to generate electricity using solar photovoltaic cell which is a renewable energy technology thus resulting in greenhouse gas emission reduction. It contributes towards reduction in the demand-supply gap during periods of electricity shortage and increases in the share of renewable energy in the grid mix.

Sai Maithili Power Company Private Limited (SMPCPL) has implemented a 10 MW solar photovoltaic technology based power project in Village-Gurha, Tehsil-Kolayat in Bikaner district of Rajasthan State in India entitled "Grid connected solar photovoltaic power plant in Bikaner, Rajasthan, India". The electricity generated from the project activity is exported to the Unified Indian Grid and sold to NTPC Vidyut Vyapar Nigam Ltd. (NVVN) under a power purchase agreement. SMPCPL used thin film technology for its 10 MW project. The whole installation has a minimum of design life of 25 years.

Since the proposed project activity is a Greenfield project, the approved small scale methodology AMS.I.D Version 17 already prescribes the baseline scenario as being "electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources". The electricity exported by the proposed project activity would displace an equivalent amount of electricity generated by the power plants already operational and proposed to be added in the North-East-West-North East (NEWNE) Grid which relies predominantly on fossil fuels. Thus, it contributes towards reduction in the demand-supply gap during periods of electricity shortage and increase in the share of renewable energy in the grid mix.

This project activity results in a total emission reduction of 119,858 tCO<sub>2</sub> for the current monitoring period.

### A.2. Location of project activity

**Host Party(ies) :** India

**Region/State/Province etc.:** Rajasthan

**City/Town/Community etc.:** District: Bikaner

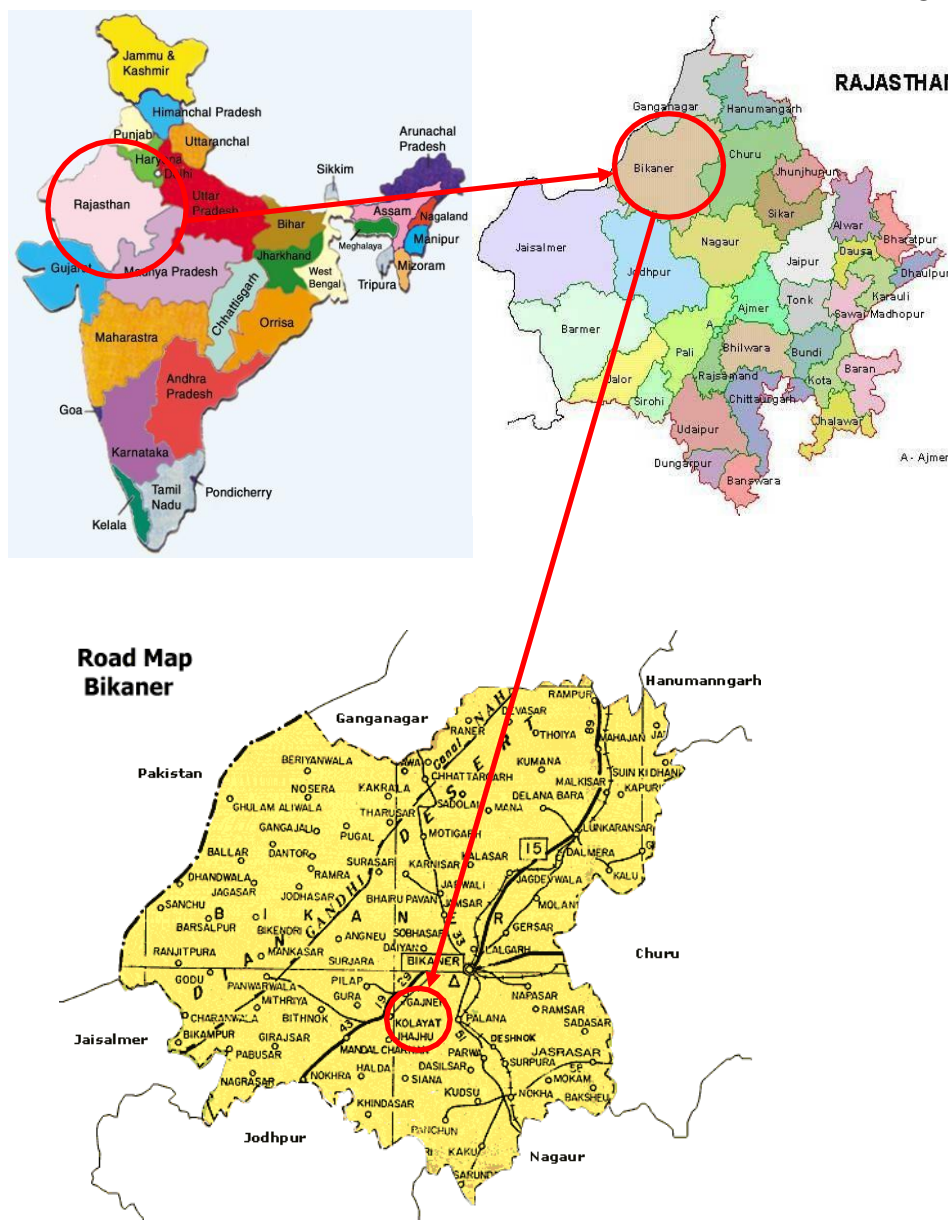
Tehsil: Kolayat

Village: Gurha

**Physical/ Geographical location:** Latitude: 27° 51' 50" North

Longitude: 72° 50' 20" East

The nearest railway station is Kolayat at a distance of 15 Kms and Bikaner railway station is at a distance of 60 Kms from the project site. The nearest airport is Jaipur and the nearest highway is National Highway-15.



### A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	Sai Maithili Power Company Private Limited (Private entity)	No

### A.4. References to applied methodologies and standardized baselines

As per the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, Type I.D Version 17 has been used.

**Title:** "Grid connected renewable electricity generation".

**Reference:** AMS I D, Version 17, EB 61

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC/CDM (<http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>) website.

The approved methodology uses the “Tool to calculate the emission factor for an electricity system” Version 02.2.1<sup>1</sup> for determination of the baseline scenario, “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” Version 02<sup>2</sup> for determining project emissions and also draws upon Appendix B of the simplified modalities and procedures for small-scale CDM project activities “Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories” for demonstration of additionality.

#### A.5. Crediting period type and duration

This project activity has chosen fixed crediting period of 10 years. The duration of crediting period is from 26/02/2013 to 25/02/2023.

### SECTION B. Implementation of project activity

#### B.1. Description of implemented project activity

The project activity was commissioned 10 MW installed capacity of Solar PV Generation on 26<sup>th</sup> February, 2013.

The project activity is 10 MW capacity greenfield thin-film technology (CIGS) based solar photovoltaic power generation plant. Since the project activity is a green field installation there was no electricity generation at the project site prior to its implementation. SMPCPL plans to use CIGS Solar PV modules for converting sunlight into electricity. Expected lifetime of the solar PV power plant is 25 years<sup>3</sup>. The rated capacity of power plant is 10 MW AC. The technical specifications of power plant are given below:

Parameters	Value
Manufacturer	Miasole
Model	MS140GG-02
Cell Type	Copper Indium Gallium Diselenide (CIGS)
Maximum Panel Voltage	29 Voc
Nominal Output	140Wp
Number of Cells	88 Cells
Voltage at maximum power point (Vm)	23 Vmpp
Current at maximum power point (Im)	6.09 Impp

Special grid interactive inverters are installed along with interfacing, protection and control mechanism to operate in parallel with the grid. Each of the inverter is rated 680KVA having 1000V nominal DC input and 380V, 50Hz AC Output. A dedicated 33 kV grid feeder line has been erected from the 10MW PV Power plant to the nearest electricity substation for feeding PV Generated Power into the grid. The interfacing of the 10MW PV system with the grid has been done through seven numbers of 1.5 MVA, 0.380 kV/33kV outdoor type step up Transformers. The data is monitored including the electricity exported to the grid and electricity imported from the grid, which is measured by Main & Check meters installed at the substation. Metering arrangement is facilitated at 33 kV side.

The project activity results in displacing the grid power, thus resulting in reduction of CO<sub>2</sub> emissions that would have occurred at fossil fuel fired power plants connected to the unified Indian grid in the baseline scenario. Solar energy is a pollution-free, infinitely sustainable form of energy. It does not produce greenhouse gases, and it does not produce toxic or radioactive waste. Therefore the technology for the project is environmentally safe and sound. Further, there is no technology transfer associated with the project activity.

<sup>1</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf>

<sup>2</sup> <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>

<sup>3</sup> The operational lifetime of the project activity can be verified from the Mia Sole MS Series 02, CIGS module technical document

**B.2. Post-registration changes****B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents**

Not applicable.

**B.2.2. Corrections**

Not applicable.

**B.2.3. Changes to the start date of the crediting period**

Not applicable.

**B.2.4. Inclusion of monitoring plan**

Not applicable.

**B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents**

Not applicable.

**B.2.6. Changes to project design**

Not applicable.

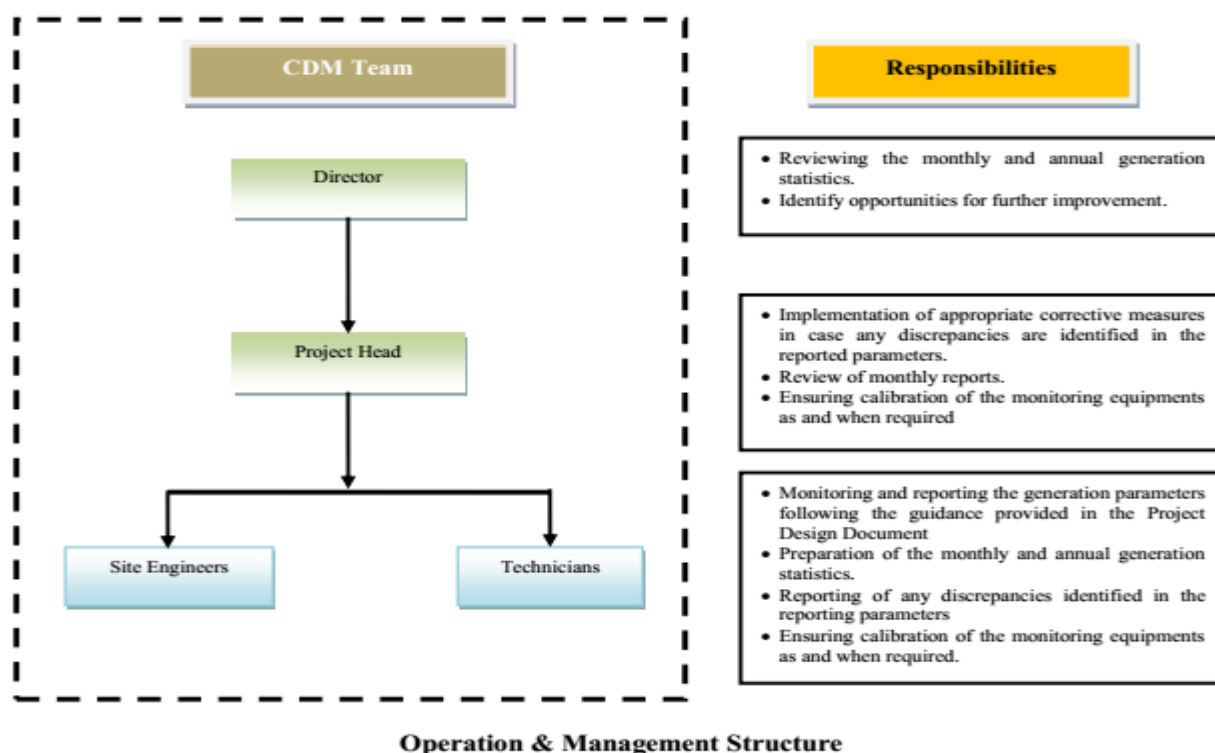
**B.2.7. Changes specific to afforestation or reforestation project activity**

Not applicable.

**SECTION C. Description of monitoring system**

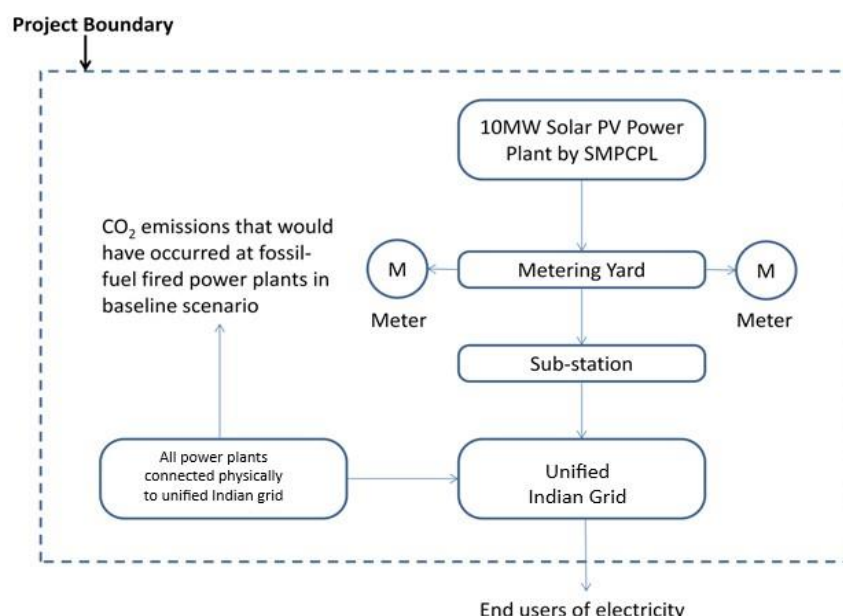
The organizational structure for the power plant envisages the Director as the in-charge for the entire power plant operations and maintenance. He is assisted by the Project head who is further be assisted by Site Engineers and technicians.

The day-to-day operation like planning the routine maintenance, safety and environmental control are placed under the care of the shift in charges. All administrative functions like personnel, industrial relations, labour welfare and financial functions are looked after by Sai Maithili Power Company Private Limited. The organizational structure and responsibilities on project operation, monitoring and data recording has been mentioned below:



### Reading and Correction of Meters:

SMPCPL provided Availability Based Tariff (ABT) compliant meters at the interface points. Interface metering confirms to the Central Electricity Authority (Installation and Operation Meters) Regulation, 2006. In the event that the Main Metering System is not in service as a result of maintenance, repairs or testing, the check meters will be used. The main and check meters were replaced in April 2013. The meter details are provided in Appendix A.



### Calibration of Meters:

The main and check meters are calibrated at regular intervals<sup>4</sup> as per the industry standard and applicable local regulations.

<sup>4</sup> At least once in three years as per the "Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories" Version 12.

**Emergency Preparedness and Uncertainty Procedure:**

In case Main meter or check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the check meter will be used for readings. No such events occurred during current monitoring period.

**Recording:**

SMPCPL keeps complete and accurate records of operating log at the Power Plant. The energy generation data would be available for a period of 2 years beyond the crediting period date.

**Apportioning of electricity:**

In case dates of monitoring period do not match with the dates of Joint Meter Readings the following apportioning formula would be used to estimate the electricity generation for calculating emission reductions:

X = Electricity generation recorded at the plant in the Daily Generation Reports (DGRs) between start/end date of monitoring period and date of billing cycle (MWh)

Y = Electricity generation recorded at the plant in the Daily Generation Reports (DGRs) for the particular month for which Joint Meter Reading has been taken (MWh)

Z = Net electricity exported by project activity to the grid in the particular billing cycle as recorded in the Joint Meter Reading sheet (MWh)

Electricity Generation =  $(X/Y) * Z$  MWh

**Training:**

Operating and maintaining a solar PV power plant requires certain degree of skills and exposure. In order to maintain a close knit operation and safe maintenance, sufficient training is imparted to the O&M team before the implementation of the project.

**SECTION D. Data and parameters****D.1. Data and parameters fixed ex ante**

Data/Parameter	$EF_{grid, OM, y}$		
Unit	tCO <sub>2</sub> /MWh		
Description	Operating Margin emission factor for Unified Indian Grid (then NEWNE Grid)		
Source of data	Referred from CO <sub>2</sub> Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 7.0. ( <a href="http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver7.pdf">http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver7.pdf</a> )		
Value(s) applied	0.9842		
Choice of data or measurement methods and procedures	Calculated it as CEA sourced data 3 years' vintage data (2008-09, 2009-10 and 2010-11) and option of ex ante calculation based on Simple Operating Margin Method. Computed once during PDD finalization.		
	<b>Operating Margin Estimation for Unified Indian Grid (tCO<sub>2</sub> / MWh)</b>		
	<b>Year</b>	<b>Operating Margin (tCO<sub>2</sub>e/MWh)</b>	<b>Net Generation (GWh)</b>
	2008-09	1.0066	421,803
	2009-10	0.9777	458,043
	2010-11	0.9707	476,987
	<b>Generation Weighted Average OM</b>	<b>0.9842 tCO<sub>2</sub>e / MWh</b>	
Purpose of data/parameter	Calculation of baseline emissions		
Additional comments	This value is determined and fixed ex-ante.		



Data/Parameter	$EF_{grid,BM,y}$
Unit	tCO <sub>2</sub> /MWh
Description	Build Margin emission factor for Unified Indian Grid (then NEWNE Grid)
Source of data	Referred from CO <sub>2</sub> Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 7.0. ( <a href="http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver7.pdf">http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver7.pdf</a> )
Value(s) applied	0.8588
Choice of data or measurement methods and procedures	Calculated as per CEA sourced data for the year 2010-11. The build margin is calculated in this database as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation and option of ex ante calculation. Computed once during PDD finalization.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This value is determined and fixed ex-ante.

Data/Parameter	$EF_{grid,CM,y}$								
Unit	tCO <sub>2</sub> /MWh								
Description	Combined Margin CO <sub>2</sub> emission factor for Unified Indian Grid (then NEWNE Grid)								
Source of data	Estimated figure based on 75% of OM and 25% of BM values								
Value(s) applied	0.9528								
Choice of data or measurement methods and procedures	<p>Calculated as per CEA sourced data with 3 years vintage data and option of ex ante calculation based on 75% of OM and 25% of BM values approach. Computed once during PDD finalization.</p> <table border="1"> <thead> <tr> <th colspan="2">Combined Margin Estimation for Unified Indian Grid (tCO<sub>2</sub>e / MWh)</th></tr> </thead> <tbody> <tr> <td>Generation Weighted Average OM ( <math>EF_{grid,OM,y}</math> )</td><td>0.9842</td></tr> <tr> <td>BM ( <math>EF_{grid,BM,y}</math> )</td><td>0.8588</td></tr> <tr> <td>Combined Margin ( <math>EF_{grid,CM,y}</math> )</td><td>0.9528</td></tr> </tbody> </table>	Combined Margin Estimation for Unified Indian Grid (tCO <sub>2</sub> e / MWh)		Generation Weighted Average OM ( $EF_{grid,OM,y}$ )	0.9842	BM ( $EF_{grid,BM,y}$ )	0.8588	Combined Margin ( $EF_{grid,CM,y}$ )	0.9528
Combined Margin Estimation for Unified Indian Grid (tCO <sub>2</sub> e / MWh)									
Generation Weighted Average OM ( $EF_{grid,OM,y}$ )	0.9842								
BM ( $EF_{grid,BM,y}$ )	0.8588								
Combined Margin ( $EF_{grid,CM,y}$ )	0.9528								
Purpose of data/parameter	Calculation of baseline emissions								
Additional comments	This value is determined and fixed ex-ante.								

## D.2. Data and parameters monitored

Data/Parameter	$EG_{BL,y}$
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Measured/calculated/default	Calculated
Source of data	Joint Meter Reading Sheets
Value(s) of monitored parameter	125,795
Monitoring equipment	Energy Meters ( Please refer Appendix 1 for meter details)
Measuring/reading/recording frequency	Monthly



Calculation method (if applicable)	Main meter and Backup ABT (Availability Based Tariff) meters are installed to continuously measure the electricity exported to and imported from the grid separately. The difference of the electricity exported to and imported from the grid is calculated by the Grid Utility and SMPCL to arrive at the net electricity supplied to the grid. Interface meters conforms to the Central Electricity Authority (Installation & Operation Meters) Regulation, 2006. Meter reading is taken jointly by Grid Utility and SMPCL on monthly basis on the first day of every month.
QA/QC procedures	Calibration of all the meters is done once in a period of three years in accordance with the guidelines mentioned in the Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories Version 12 <sup>5</sup> . The meters are bi-directional with accuracy of 0.2s. The main meter reading is cross checked with records for sold electricity (invoices).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The data is kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later

### D.3. Implementation of sampling plan

No sampling approach has been used.

## SECTION E. Calculation of emission reductions or net anthropogenic removals

### E.1. Calculation of baseline emissions or baseline net removals

The baseline emissions are calculated as the product of the net electricity supplied to the grid by the project activity ( $EG_{BL,y}$ ) in MWh and the Baseline Emission Factor ( $EF_{grid,CM,y}$ ) of the Unified Indian grid of India in  $tCO_2/MWh$ . The baseline emission factor was fixed ex-ante as 0.9528  $tCO_2/MWh$ . Therefore baseline emissions are calculated as:

$$BE_y = EG_{BL,y} * EF_{grid,CM,y} = 125,795 * 0.9528 = 119,858 \text{ tCO}_2\text{e (Rounded Down value)}$$

#### Summary of baseline emissions calculations

Parameter	Units	Value	Symbol
Gross electricity export from the project activity ( $E_{EXP,y}$ )	MWh	126,638.73	A
Electricity import by the project activity ( $E_{imp,y}$ )	MWh	843.317	B
Electricity supplied to the grid by the project activity ( $EG_{BL,y}$ )	MWh	125,795.41	C=A-B
CO <sub>2</sub> emission factor of the grid (fixed ex-ante) ( $EF_{grid,CM,y}$ )	$tCO_2/MWh$	0.9528	D
Baseline Emissions ( $BE_y$ )	$tCO_2\text{e}$	119,858	DXC

### E.2. Calculation of project emissions or actual net removals

In accordance with the applied methodology and the registered PDD, there are no project emissions for the project activity.

Therefore,  $PE_y = 0 \text{ tCO}_2\text{e}$

<sup>5</sup> This is conservative as compared to the PPA requirement for all meters to be calibrated in accordance with the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 ([http://www.cea.nic.in/reports/regulation/meter\\_reg.pdf](http://www.cea.nic.in/reports/regulation/meter_reg.pdf)) which states in para 18 (1) (b) that all meters are to be tested once in five years.

**E.3. Calculation of leakage emission**

In accordance with the applied methodology and the registered PDD, there are no leakage emissions for the project activity.

Therefore,  $L_y = 0 \text{ tCO}_2\text{e}$ .

**E.4. Calculation of emission reductions or net anthropogenic removals**

	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
<b>Total</b>	119,858	0	0	0	119,858	119,858

**E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD**

Amount achieved during this monitoring period (t CO <sub>2</sub> e)	Amount estimated ex ante for this monitoring period in the PDD (t CO <sub>2</sub> e)
119,858	126,157

**E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”**

As per the UNFCCC database the amount of reductions for this project activity is 17,169 tCO<sub>2</sub> equivalent per annum. The monitoring period duration is from 26<sup>th</sup> February, 2013 to 30<sup>th</sup> June, 2020 which is total of 2,682 days. So estimated reduction for current monitoring period is calculated with the help of emission value per annum.

Estimated ex-ante for this monitoring period =  $17,169 \times (2,682/365)$   
 = 126,157 tCO<sub>2</sub>e (Rounded down)

**E.6. Remarks on increase in achieved emission reductions**

It is to be noted here that as per the estimated emission reduction to be achieved from the project activity for the current monitoring period is 126,157 tCO<sub>2</sub>e, whereas actual emission reductions achieved are 119,858 tCO<sub>2</sub>e, which is approximately 5% lower than the estimated emission reductions. The generation of electricity depends upon many other climatic conditions, which are not within the control of the project participant. The lower generation during the current verification period is due to certain natural conditions. Hence, it is acceptable.

**E.7. Remarks on scale of small-scale project activity**

The project activity remained within the limit of small scale project activity in each year of the crediting period as the emission reductions are less than the limit of small scale CDM Project activity.

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## Appendix-A: Energy Meter Details

Description	Meter Sl. No.	Calibration Frequency	Accuracy Class	Date of Calibration	Due Date of Calibration
Main Meter	12526396	3 years	0.2s	04/01/2013	04/01/2016
	12090615			07/03/2013	07/03/2016
				18/05/2016	18/05/2019
				22/06/2017	22/06/2020
				10/07/2018	10/07/2021
				09/08/2019	09/08/2022
Check Meter	12527278	3 years	0.2s	04/01/2013	04/01/2016
				07/03/2013	07/03/2016
				18/05/2016	18/05/2019
				22/06/2017	22/06/2020
	12090619			10/07/2018	10/07/2021
				09/08/2019	09/08/2022

## Appendix-A: Breakdown Details

Period	Reason of Tripping/ fault	Duration
28.05.2015 to 04.06.2015	Transmission Line fault - Tower fall incidence	7 days
29.08.2016 to 03.09.2016	Excess moisture ingress in 33kV HT Panels - had to carry out complete drying out of panel to restore generation	6 days
31.05.2019	Transmission Line - Clearance to line beneath reduced, had to carry out stringing rectification	1 day

## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);</li> <li>• Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period;</li> <li>• Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes;</li> <li>• Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods;</li> <li>• Make editorial improvements.</li> </ul>
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);</li> <li>• Make editorial improvements.</li> </ul>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to the Host Party;</li> <li>• Remove reference to programme of activities;</li> <li>• Overall editorial improvement.</li> </ul>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

<i>Version</i>	<i>Date</i>	<i>Description</i>
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		