



Monitoring report form for CDM project activity
(Version 07.0)

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

MONITORING REPORT

Title of the project activity	5 MW Solar PV Power Plant CDM Project by OPG Energy Private Ltd., - Baap, Jodhpur, Rajasthan, India	
UNFCCC reference number of the project activity	UN 10125	
Version number of the PDD applicable to this monitoring report	01.2	
Version number of this monitoring report	01	
Completion date of this monitoring report	25/03/2021	
Monitoring period number	01	
Duration of this monitoring period	01/01/2016 – 31/12/2020	
Monitoring report number for this monitoring period	01	
Project participants	M/s OPG Energy Private Ltd.	
Host Party	India	
Applied methodologies and standardized baselines	Methodologies Used: AMS-I.D. ver. 17 Grid connected renewable electricity generation Standardized baselines used: N/A	
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO ₂	40,813 tCO ₂
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	39,113 tCO ₂	

SECTION A. Description of project activity

A.1. General description of project activity

Purpose of the project activity:

OPG Energy Private Ltd has developed a 5 MWp solar photovoltaic power plant at Baap village (also called as "Bap" village) of Jodhpur district, in the State of Rajasthan. The project participant supplies power to the grid and hence replaces the equal amount of power which would have otherwise been generated by grid connected carbon intensive power plants.

This 5 MWp solar project is a Greenfield project activity. The project activity uses solar photovoltaic modules for producing the power. The process of generating power through solar energy is a clean technology, as there is no fossil fuel fired or no green house gases are emitted during the process. The generated power from this project activity is supplied to the NEWNE grid(now a part of Unified Indian Grid). The project participant has signed Power Purchase Agreement (PPA) for 25 years period, with NTPC Vidyut Vyapar Nigam Limited (NVVN), New Delhi, India. The project has been commissioned on 13th October 2011..

The scenario existing prior to the start of the implementation of the project activity.

In the pre project scenario, the equivalent amount of electricity was being generated by the power plants connected with the NEWNE grid(now a part of Unified Indian Grid). These plants are dominated by the use of fossil fuels to generate electricity.

Baseline scenario

The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity. Hence in the absence of the project activity, the equivalent amount of electricity would have been generated from fossil fuel fired power plants connected with the NEWNE grid(now a part of Unified Indian Grid).

A.2. Location of project activity

Host Party: India

State: Rajasthan

District: Jodhpur

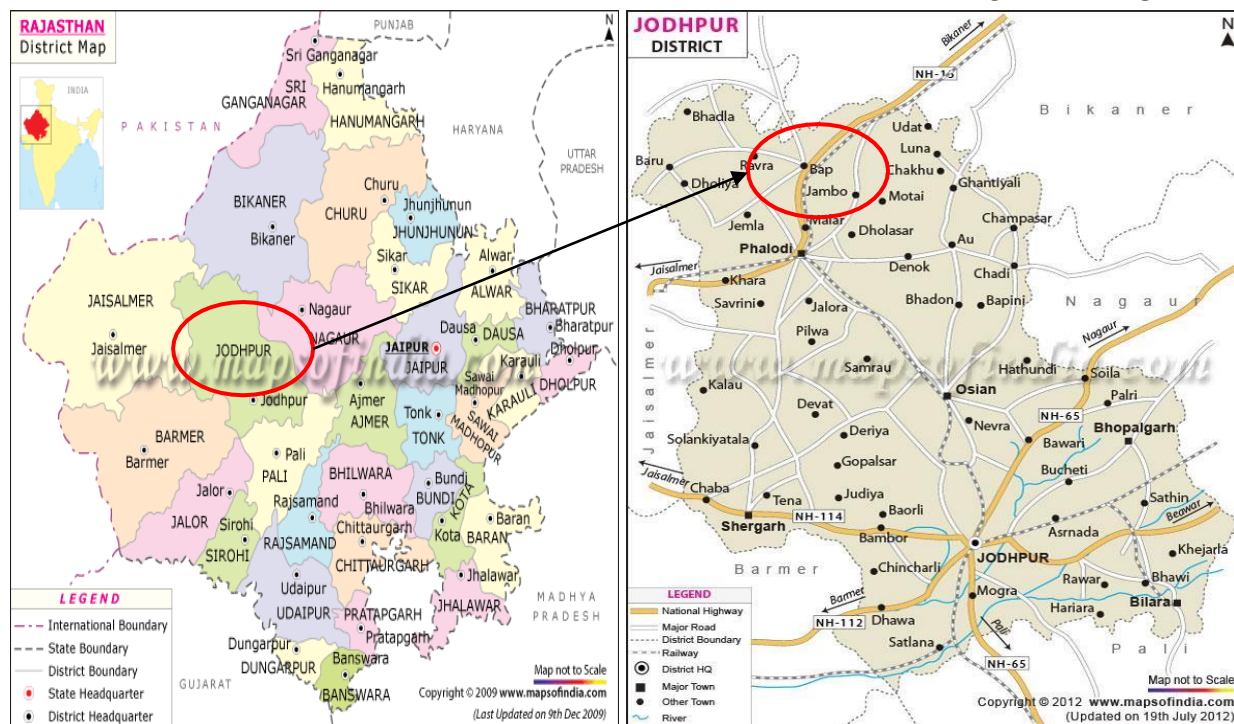
Tehsil: Phalodi

Village: Baap

Latitude: 27° 21'20.61" N

Longitude: 72° 21' 04.71" E

The location map is as given below



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)	OPG Energy Private Ltd (Private entity)	No

A.4. References to applied methodologies and standardized baselines

The project activity is a small scale project activity and conforms to Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Type : I - Renewable Energy Industries
Category : AMS-I.D. Grid Connected Renewable Electricity Generation. Version 17¹, EB 61
Date : 03/06/2011
Tools Used : Tool to calculate the emission factor for an electricity system, Version 04.0² / EB – 75 Annex 15

The project activity does not use standardized baseline.

A.5. Crediting period type and duration

The crediting period for this project is 01/01/2016 – 31/12/2022 and it has 7 years renewable crediting period.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The project activity uses thin film solar photovoltaic technology. The solar photovoltaic cells, also known as the solar cells, are used to convert solar energy into electrical energy. The solar cells are

¹<https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK>

² <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf>

the basic elements of a solar module. Essentially, when light strikes the cell, a certain portion of it is absorbed within the semiconductor material. This energy knocks electrons loose, allowing them to flow freely. PV cells have one or more electric fields that act to force electrons freed by light absorption to flow in a certain direction. This flow of electrons constitutes an electric current, which can be drawn from the cell. This current, together with the cell's voltage defines the power that the solar cell can produce.

Solar modules with varying module wattage of 40 Wp, 62.5 Wp, 72.5 Wp and 240 Wp are connected together to produce the total project capacity of 5 MWp power. The solar modules are further connected to the inverters. Inverters shall convert the DC energy produced by array to AC voltage using its MPPT (Maximum Power Point Control) control to extract maximum energy from solar array and synchronize with the grid through LT/HT panels.

The aforesaid technology is clean as compared to the conventional fossil fuel based system and thus environmentally sustainable. The plant load factor of this project activity is 19%. A module deration factor of 0.5% has been considered (after 2nd year of operation). The expected lifetime of the project equipment is 25 years. There is no technology transfer involved in the project activity. The plant was commissioned on 13/10/2011.

Technical specifications of the solar modules:

Topray Solar (40 W)	
Maximum Power Pmax (W)	40
Open circuit voltage-Voc (V)	61
Short Circuit Current Isc	1
Maximum Power Voltage-Vpm	46
Maximum Power Current-Ipm (A)	0.87
Power Tolerance	+/-3%
Cell Type	Amorphous Silicon Solar Cell
Abound Solar (62.5 W)	
Model number	AB1-62
Nominal Power PMPP (w)	62.5
Voltage at nominal power VMPP (V)	34.3
Current at nominal power IMPP (A)	1.83
Short circuit current Isc (A)	2.24
Open circuit voltage Voc (V)	45.7
Cell Type	Calcium Telluride (CdTe)
Abound Solar (72.5 W)	
Model number	AB1-72
Nominal Power PMPP (w)	72.5
Voltage at nominal power VMPP (V)	34.3
Current at nominal power IMPP (A)	2.10
Short circuit current Isc (A)	2.48
Open circuit voltage Voc (V)	46.40
Cell Type	Calcium Telluride (CdTe)
Topray (240 W)	
Maximum Power Pmax (W)	176
Open circuit voltage-Voc (V)	34.10
Short Circuit Current Isc	7.24 A
Maximum Power Voltage-Vpm	26.40V
Maximum Power Current-Ipm (A)	6.65 A
Power Tolerance	+/-3%
Cell Type	Monocrystalline

Technical specifications of the transformers:

Rated capacity, kVA (Continuous)	1250
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Type of Cooling	ONAN
Short circuit level (HV) and duration	31.5 kArms 1 secs
Rated voltage / highest voltage for the equipment between phases, kV	
<i>HV</i>	36
LV	0.270+10% (insulated for 3.6 kV rms)
Rated frequency, Hz	50 Hz \pm 5%

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

There is no temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents.

B.2.2. Corrections

Not applicable

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

Start date of crediting period has been changed from 01/03/2015 to 01/01/2016.

B.2.4. Inclusion of monitoring plan

There is no inclusion of monitoring plan.

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

There is no permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents.

B.2.6. Changes to project design

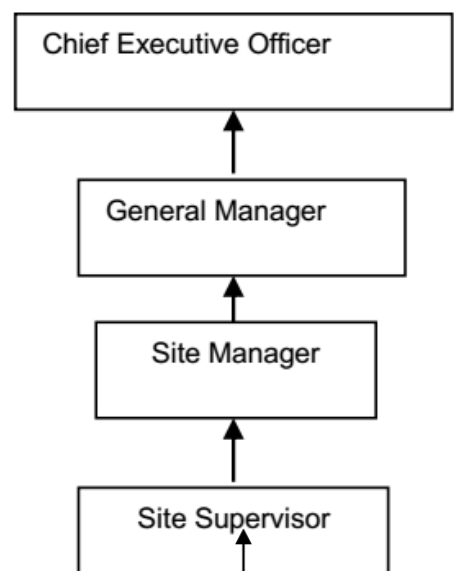
There is no change in project design.

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

This project is not an afforestation or reforestation project activity.

SECTION C. Description of monitoring system

The project proponent has the following operational & management structure in order to monitor the emission reduction. The organisation structure for the power plant envisages a General Manager as the in-charge for the entire power plant operations and maintenance. He is positioned at site and directly reports to the Chief executive officer. He is assisted by Site Manager and Site supervisor. The day-to-day operation like planning the routine maintenance, safety and environmental control are placed under the care of the Site manager. The organizational structure and responsibilities on project operation, monitoring, data recording and ER calculation has been mentioned below:



Organizational structure

Responsibilities:

The Chief Executive officer (CEO) holds complete control over monitoring aspects pertaining to the project. The monitoring report is reviewed and will keep a check on the proper training of staff, etc. Also, emission reduction calculation is maintained by the CEO for verification. The general manager controls the operation and maintenance of the entire power plant. A periodic checking of recorded and stored data and the emission reduction calculation sheet and monitoring report are prepared. The site manager and site supervisor records the day to day operation data and stores it in hard copy as well as soft copy.

Data Measurement:

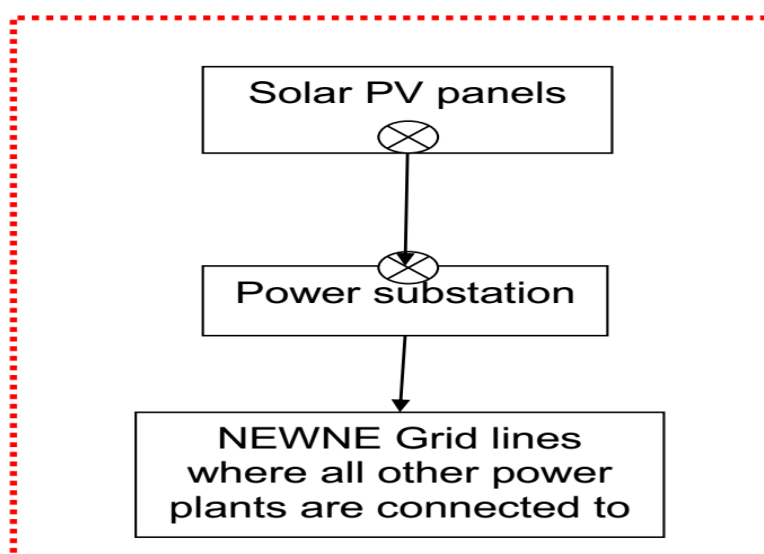
The Export and Import data are measured continuously. Export & Import readings of Main & Check meters, of accuracy class 0.2S, are taken on monthly basis at appointed day & hour (time) by authorized officer of Jodhpur Discom and a representative of OPG Energy Private Ltd. Check meter reading will be considered when Main meter is found to be defective or stopped. The main meter and check meters are calibrated once in three years as per provisions of the CEA Metering Regulations.

Data collection and archiving: Export & Import readings from main & check meter are collected under the supervision of the Site Manager. The net electricity supplied to grid is calculated based on export & import readings. Export and Import data are recorded and stored in logs as well as in electronic form. The records are checked periodically by the General Manager and discussed thoroughly with the Site Manager. 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 doesn't 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) is trained. The operator personnel is trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan. CEO is responsible for the training of the staff.

The schematic diagram for the Solar PV panels and the metering/substation system connected to NEWNE Grid.



⊗ Denotes the location of meters at the project site and at the substation.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	EF _{OM,y}								
Unit	tCO ₂ /MWh								
Description	Operational Margin of the NEWNE Grid								
Source of data	Central Electricity Authority(CEA) of India Database version 8.0								
Value(s) applied	0.972								
Choice of data or measurement methods and procedures	<p>Operating Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with "Tool to calculate the emission factor for an electricity system" version 04.0</p> <table border="1"> <tr> <th>Years</th><th>Operating margin emission factor of NEWNE Electricity Grid (t CO₂ e/MWh)</th></tr> <tr> <td>FY 2009-10</td><td>0.978</td></tr> <tr> <td>FY 2010-11</td><td>0.971</td></tr> <tr> <td>FY 2011-12</td><td>0.969</td></tr> </table>	Years	Operating margin emission factor of NEWNE Electricity Grid (t CO ₂ e/MWh)	FY 2009-10	0.978	FY 2010-11	0.971	FY 2011-12	0.969
Years	Operating margin emission factor of NEWNE Electricity Grid (t CO ₂ e/MWh)								
FY 2009-10	0.978								
FY 2010-11	0.971								
FY 2011-12	0.969								
Purpose of data/parameter	Calculation of Baseline emissions								
Additional comments	Fixed ex-ante for entire crediting period								

Data/Parameter	EF _{BM,y}
Unit	t CO ₂ e/MWh
Description	Build Margin Emission Factor of the NEWNE Electricity Grid
Source of data	The CO Baseline Database for the Indian Power Sector - Ministry of Power: Central Electricity Authority (CEA) Version 8.
Value(s) applied	0.916
Choice of data or measurement methods and procedures	Build Margin Emission Factor has been calculated by the Central Electricity Authority using the simple OM approach in accordance with "Tool to calculate the emission factor for an electricity system" version 04.0
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	Fixed ex-ante for entire crediting period

Data/Parameter	EF_y
Unit	t CO ₂ e/MWh
Description	CO ₂ emission Factor of the NEWNE Electricity Grid
Source of data	As per the Tool to calculate the emission factor for an electricity system, EF _y is calculated as the weighted average of OM emission factor (weight given is 0.75) and BM emission factor (weight given is 0.25)
Value(s) applied	0.958
Choice of data or measurement methods and procedures	The calculation has been done as per the Tool to calculate the emission factor for an electricity system, version 04.0 The fixed ex-ante combined margin emission factor from CEA database is used in the calculation of emission factor. This has been calculated as per the Tool to calculate the emission factor for an electricity system, version 04.0, with 3 years vintage data and option of ex-ante based on 75% of OM and 25% of BM values approach.
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	Fixed ex-ante for entire crediting period

D.2. Data and parameters monitored

Data/Parameter	EG _{BL,y, export}		
Unit	MWh		
Description	Quantity of electricity export to the grid during the year y.		
Measured/calculated/default	Measured		
Source of data	Monthly generation report		
Value(s) of monitored parameter	43,154.3		
Monitoring equipment	The electricity is exported to the grid by the project activity by a feeder line to the sub-station. The net electricity is measured by a two-way electronic meters of accuracy class 0.2s. There is a main meter and check meter on the feeder line. The Meter Details are given below:		
	Meter Type	Meter ID	Date of Calibration
	Main	ASH05816	26/11/2016, 20/11/2017, 29/11/2018, 02/12/2019
	Check	ASH05817	26/11/2016, 20/11/2017, 29/11/2018, 02/12/2019
	Main	RJB74568	01/12/2020
	Check	RJB74569	01/12/2020
	The Main Meter No. ASH05816 and Check Meter No. ASH05817 had been replaced by Main Meter No. RJB74568 and Check Meter No. RJB74569 respectively. The export energy is measured continuously using above mentioned Main & Check meters at the switchyard. Export readings of Main meter is taken on monthly basis at appointed day and hour (time) by authorized officer of Jodhpur Discom in the presence of PP or representative of PP.The meter reading is taken jointly and signed by the representatives of the Jodhpur Discom and OPG Energy Private Limited.		
Measuring/reading/recording frequency	Continuous monitoring with hourly measurement and monthly recording		
Calculation method (if applicable)	-		
QA/QC procedures	The main meter and check meter are calibrated atleast once in 3 years. The energy exported to the grid can be cross checked by the invoices raised by the PP.		

Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The data will be kept for two years after the crediting period or from last issuance.

Data/Parameter	EG_{BL,y, import}
Unit	MWh
Description	Quantity of electricity import to the grid during the year y.
Measured/calculated/default	Measured
Source of data	Monthly generation report
Value(s) of monitored parameter	551.6
Monitoring equipment	The import energy is measured continuously using above mentioned Main & Check meters at the switchyard. Import readings of Main meter is taken on monthly basis at appointed day and hour (time) by authorized officer of Jodhpur Discom in the presence of PP or representative of PP. The meter reading is taken jointly and signed by the representatives of the Jodhpur Discom and OPG Energy Private Limited.
Measuring/reading/recording frequency	Continuous monitoring with hourly measurement and monthly recording
Calculation method (if applicable)	-
QA/QC procedures	The main meter and check meter are calibrated atleast once in 3 years. The energy imported to the grid can be cross checked by the invoices raised by the PP.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The data will be kept for two years after the crediting period or from last issuance.

Data/Parameter	EG_{BL,y}
Unit	MWh
Description	Net quantity of electricity export to the grid during the year y.
Measured/calculated/default	Calculated
Source of data	Monthly generation report
Value(s) of monitored parameter	42602.7

Monitoring equipment	<p>The electricity is exported to the grid by the project activity by a feeder line to the sub-station. The net electricity is measured by a two-way electronic meters of accuracy class 0.2s. There is a main meter and check meter on the feeder line. Net electricity supplied to the grid is calculated based on export & import data ($EG_{BL,y} = EG_{BL,y, \text{ export}} - EG_{BL,y, \text{ import}}$).</p> <p>The Meter Details are given below:</p> <table><tr><th>Meter Type</th><th>Meter ID</th><th>Date of Calibration</th></tr><tr><td>Main</td><td>ASH05816</td><td>26/11/2016, 20/11/2017, 29/11/2018, 02/12/2019</td></tr><tr><td>Check</td><td>ASH05817</td><td>26/11/2016, 20/11/2017, 29/11/2018, 02/12/2019</td></tr><tr><td>Main</td><td>RJB74568</td><td>01/12/2020</td></tr><tr><td>Check</td><td>RJB74569</td><td>01/12/2020</td></tr></table> <p>The Main Meter No. ASH05816 and Check Meter No. ASH05817 had been replaced by Main Meter No. RJB74568 and Check Meter No. RJB74569 respectively.</p> <p>The export and import energy are measured continuously using above mentioned Main & Check meters at the switchyard. Export & Import readings of Main meter is taken on monthly basis at appointed day and hour (time) by authorized officer of Jodhpur Discom in the presence of PP or representative of PP. The meter reading is taken jointly and signed by the representatives of the Jodhpur Discom and OPG Energy Private Limited. Based on the readings, invoices for net electricity exported will be raised by OPG Energy Private Limited to Jodhpur Discom.</p>			Meter Type	Meter ID	Date of Calibration	Main	ASH05816	26/11/2016, 20/11/2017, 29/11/2018, 02/12/2019	Check	ASH05817	26/11/2016, 20/11/2017, 29/11/2018, 02/12/2019	Main	RJB74568	01/12/2020	Check	RJB74569	01/12/2020
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	Check	RJB74569	01/12/2020															
Measuring/reading/recording frequency	Continuous monitoring with hourly measurement and monthly recording																	
Calculation method (if applicable)	Net electricity supplied to the grid is calculated based on export & import data ($EG_{BL,y} = EG_{BL,y, \text{ export}} - EG_{BL,y, \text{ import}}$).																	
QA/QC procedures	The main meter and check meter are calibrated atleast once in 3 years. The net energy exported to the grid can be cross checked by the invoices raised by the PP.																	
Purpose of data/parameter	Calculation of baseline emissions																	
Additional comments	The data will be kept for two years after the crediting period or from last issuance.																	

D.3. Implementation of sampling plan

Monitored parameter of this project activity is not determined by any sampling approach. Hence, there is no specific sampling plan involved in the project activity.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

Baseline for the project activity is power generated from renewable energy source multiplied by the grid emission factor of NEWNE grid(now a part of Unified Indian Grid) calculated in transparent and conservative manner.

$$BE_y = EG_{BL,y} \times EF_{CO_2, \text{grid}, y}$$

For the current monitoring period, the baseline emission is calculated as follows:

$$\begin{aligned} BE_y &= 42602.7 \text{ MWh} \times 0.958 \text{ tCO}_2/\text{MWh} \\ &= 40,813 \text{ tCO}_2 (\text{Rounded Down}) \end{aligned}$$

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

As per AMS I. D, Version 17.0 project emissions for solar power project activities is zero. $PE_y = 0$

E.3. Calculation of leakage emissions

The project activity is a Greenfield project and there is no transfer of energy generating equipment from another activity. Hence there is no leakage within the project boundary as per para 22 of AMS I.D ver 17. $LE_y = 0$

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

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	40,813	0	0	0	40,813	40,813

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 ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
40,813	39,113

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

The present monitoring period is from 01/01/2016 to 31/12/2020 i.e 1,827 days. The annual estimated emission reduction as per PDD is 7,814 tCO₂. So, for the monitoring period, the estimated ex-ante for this monitoring period is = $(7,814/365) \times 1,827 = 39,113$ tCO₂.

E.6. Remarks on increase in achieved emission reductions

The actual emission reduction amount is 4.35% higher than the estimated ex-ante value. As it is a solar project, the power generation from solar PV is dependent on weather. So such deviation is acceptable. The project activity is auto additional and the increase in actual emission reductions do not have any impact on additionality of project.

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

It is small scale project activity.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
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).

<i>Version</i>	<i>Date</i>	<i>Description</i>
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		