



Monitoring report form for CDM project activity
(Version 08.0)

MONITORING REPORT

| | | | |
|---|---|--|-------------------------------------|
| Title of the project activity | Solar PV based power generation by Voltas Green in Mauritius | | |
| UNFCCC reference number of the project activity | 10537 | | |
| Version number of the PDD applicable to this monitoring report | 04 | | |
| Version number of this monitoring report | 03 | | |
| Completion date of this monitoring report | 13/04/2021 | | |
| Monitoring period number | 01 | | |
| Duration of this monitoring period | 25/11/2019 – 31/12/2020 (both days included) | | |
| Monitoring report number for this monitoring period | 01 | | |
| Project participants | Voltas Green Limited | | |
| Host Party | Mauritius | | |
| Applied methodologies and standardized baselines | Methodology: AMS I.D-Grid connected renewable electricity generation, Version 18.0, valid from 28/11/2014 Standardized baseline: Not applicable | | |
| Sectoral scopes | Sectoral Scope 01 - 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 until 31 December 2020 | Amount achieved from 1 January 2021 |
| | 0 tCO ₂ e | 22,318 tCO ₂ e | 0 tCO ₂ e |
| Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD | 25,052 tCO ₂ e | | |

SECTION A. Description of project activity

A.1. General description of project activity

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The project activity involves installation and operation of 13.75 MW_{AC} Solar PV power project based on polycrystalline technology at Queen Victoria site, FUEL substation, District of Flacq, Mauritius by Voltas Green Limited. The project activity involves ground mount fix structure installation and operation of a green field solar photovoltaic (PV) power plant. The project activity consists 55728 PV module of capacity 270 Wp each at standard test conditions and 5 inverters manufactured by SMA Solar Technology having capacity 2750 kVA each with aggregated installed capacity of 13.75MW_{AC}. The export capacity as per power purchase agreement is 12.24¹ MW_{AC} (Source: Engineering, Procurement and Construction; Power Purchase Agreement; and Environmental Impact Assessment Report). As the capacity of the project activity is less than 15MW and its uses renewable resource to generate power, hence project qualifies as small-scale project Type-I, Renewable Energy Project.

The purpose of the project activity is to utilize the sunlight as energy source for carbon-neutral electricity generation. The net generated electricity from the project activity is being supplied to national grid through long-term power purchase agreement (PPA). The project activity displacing the net electricity generation from the national grid, which otherwise would have been generated by grid connected power plant. The project activity doesn't involve any GHG emission sources.

The construction of the project activity started dated 01/12/2017 and was commissioned on 12/12/2018 and operational since then with normal operation and maintenance. The project was operational during current monitoring period i.e. from 25/11/2019 to 31/12/2020 with normal operation and maintenance.

The project activity has generated and supplied **22,510.24 MWh** electricity to national grid, which has resulted GHG emission reductions of **22,318 tCO₂e** during current monitoring period.

A.2. Location of project activity

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The project is located at Queen Victoria site, Fuel Substation, District of Flacq, Mauritius. The project site is well connected to nearest town by road.

Geographic Coordinates:

S-20°13' 44.92" ; E-57°42'8.65"

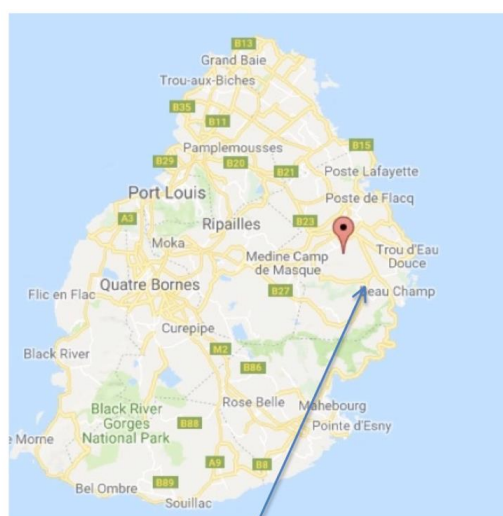


Fig: Project Site

¹ The same can also be checked at <https://ceb.mu/our-activities/production-facts-and-figures>

A.3. Parties and project participants

| Parties involved | Project participants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|------------------------|--------------------------------------|--|
| Mauritius (host Party) | Private entity- Voltas Green Limited | No |

A.4. References to applied methodologies and standardized baselines

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Following approved baseline & monitoring methodology is applied;

Title: Type-I, Renewable Energy Project

Methodology: AMS I.D. Grid Connected renewable electricity generation **Version:** 18, valid from 28/11/2014. Scope: 01, EB 81

Reference: The approved baseline methodology has been referred from the “Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories.”
<http://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK>

The tools referenced in this methodology used for the proposed project includes:

- Tool to calculate the emission factor for an electricity system Version 07.0.0, EB 100 Annex 4

Reference: <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

- Demonstration of additionality of small-scale Project activities” Version 12 EB 99 Annex 3

Reference: <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v12.pdf>

Guidelines:

- General guidelines for SSC CDM methodologies, Version 23.0, EB 104, Annex 5.

Reference:

[https://cdm.unfccc.int/filestorage/e/x/t/extfile-20210211212225503-](https://cdm.unfccc.int/filestorage/e/x/t/extfile-20210211212225503-MethSSC_Guid25ver23.1.pdf/MethSSC_Guid25ver23.1?t=Sm98cXF0ejFqfDBtp_iaMnb0yZdUSOh)

[MethSSC_Guid25ver23.1.pdf/MethSSC_Guid25ver23.1?t=Sm98cXF0ejFqfDBtp_iaMnb0yZdUSOh](https://cdm.unfccc.int/filestorage/e/x/t/extfile-20210211212225503-MethSSC_Guid25ver23.1.pdf/MethSSC_Guid25ver23.1?t=Sm98cXF0ejFqfDBtp_iaMnb0yZdUSOh)
 hqwOE

A.5. Crediting period type and duration

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This project activity has considered renewable crediting period of 7 years. The start date of first renewable crediting period is 25/11/2019 and crediting period is from 25/11/2019 – 24/11/ 2026.

SECTION B. Implementation of project activity**B.1. Description of implemented project activity**

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The project activity has operated as per registered PDD during current monitoring period.

The project consists of setting-up 55728 solar PV panels with aggregated installed capacity of 13.75 MW_{AC} to produce electricity and export capacity as per PPA 12.24MW_{AC} which is being supplied to the grid of the Central Electricity Board (CEB). The proposed project activity displaces fossil based electricity from the grid, thereby resulting in emission reduction as in absence of the project activity equivalent electricity would have been generated from fossil fuel based thermal power plants.

The PV modules installed are new with individual capacity of 270 Wp. They are of high-efficiency, poly- crystalline silicon solar cells with high transmission and tempered glass, which results in module efficiency of up to 16.5%.

The major components of the solar project are the solar modules, module mounting structures, transformer etc. The solar modules are mounted on the module mounting structures. The solar module is a packaged, connected assembly of solar cells which uses the incident photons from the sun light and converts it into electricity. The solar module generates DC power, which is converted to AC power with the help of inverters. The instant project encompasses the following:

| Particulars | Details |
|---|-----------------------------|
| Nominal power | 15.05 MW _{DC} |
| Export capacity as per PPA | 12.24MW _{AC} |
| AC power as per installed capacity of inverters | 13.75 MW _{AC} |
| No. of modules | 55728 |
| Modules Make | Q CELLS |
| Module Type | G5.0 G 270 |
| Module capacity | 270 Wp |
| Rated voltage | 31.1V |
| Rated current | 8.69 Amp |
| Mounting | Ground Mount |
| Inverter | 5 inverter of 2750 kVA each |
| Make | SMA Solar Technology |

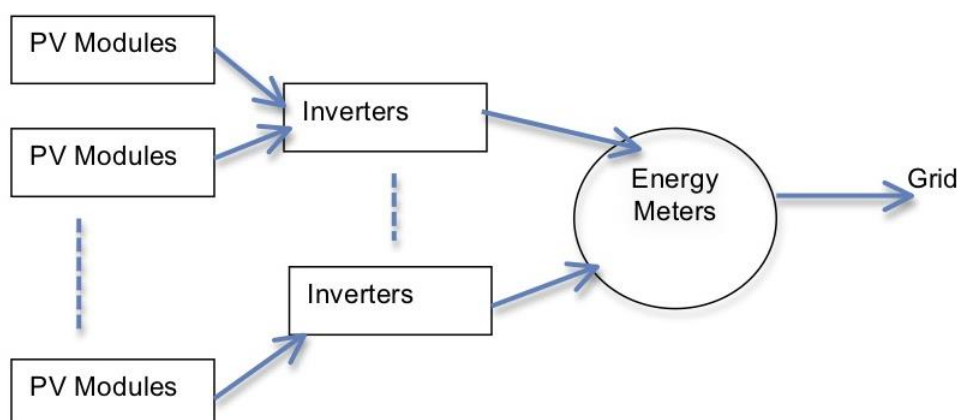


Fig 1: Schematic arrangements of systems and monitoring equipment

The schematic diagram of the project is provided above. The plant has been successfully commissioned on 12/12/2018. The plant has been in operation continuously since commissioning. No major equipment has been replaced or exchanged since commissioning. The plant was operational during current monitoring period i.e. 25/11/2019 to 31/12/2020. The inverter 4 was not functional from 25/11/2020 to 31/12/2020 and Inverter 1 was not functional from 12/12/2020 to 31/12/2020 due to technical issue during current monitoring period.

There are no changes that have happened in project activity, which may impact the applicability of the methodology.

B.2. Post-registration changes

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

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The meter reading for electricity export and import is taken on midnight of last day of the month, the daily reading of generation exported is available from internal meter installed at site, however the import data is available on monthly basis only. As the apportioning procedure is not indicated in monitoring plan and the monitoring period starts from 25/11/2019, to calculate the value of net

export of electricity for period from 25/11/2019 to 30/11/2019, the daily export reading from 25/11/2019 to 30/11/2019 is considered, however as daily import reading is not available the import value of electricity for whole month is deducted from daily reading sum from 25/11/2019 to 30/11/2019, which is conservative.

B.2.2. Corrections

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The installed capacity in registered PDD was mentioned was not clear, as there were 5 number of 2750 kV inverter to be installed site which gives aggregated value as 13.75MW_{AC}. Further, the power purchase agreement states the export capacity as 12.24 MW_{AC}. There was minor error in reporting the installed capacity, as in registered PDD the export capacity 12.24MW_{AC} is presented as installed capacity. The installed capacity is now corrected in revised PDD as 13.75MW_{AC} i.e. aggregated installed capacity of inverters and export capacity as per PPA is also indicated as 12.24MW_{AC}. The same has been corrected as there are no change in number/capacity of PV modules or number/capacity of inverters than mentioned in registered PDD. The correction above does not impact the annual CER estimation, applicability of the methodology and additionality of the project activity.

Further, the accuracy class of energy meters is also changed from 0.5s (as per registered PDD) to 0.2s (as per actual meters installed at site), the change will result more accurate value, hence is appropriate and it has no impact on compliance with monitoring plan or applicability of applied approved methodology.

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

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No change in start date of crediting period.

B.2.4. Inclusion of monitoring plan

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There is no inclusion of monitoring plan to the registered PDD that was not included during registration.

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

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There is no permanent change from registered monitoring plan or applied methodology.

B.2.6. Changes to project design

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There is no change in project design of registered project activity during current monitoring period.

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

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Not applicable as its renewable energy project

SECTION C. Description of monitoring system

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The project activity is operated and managed by the project proponent with the help of site in charge (personal from the project proponent) and site O&M contractor. The project proponent has entered into comprehensive Operation & Maintenance contract.

There are two meters installed at substation i.e. main meter and check meter of accuracy class 0.2s, where in case of failure of main meter reading from check meter shall be used for determination of net electricity exported to grid. The meters are tri-vector meters and are capable

of recording export as well as import. The electricity exported and imported by the project activity is being recorded on a monthly basis by the representative of the PP and Central Electricity Board.

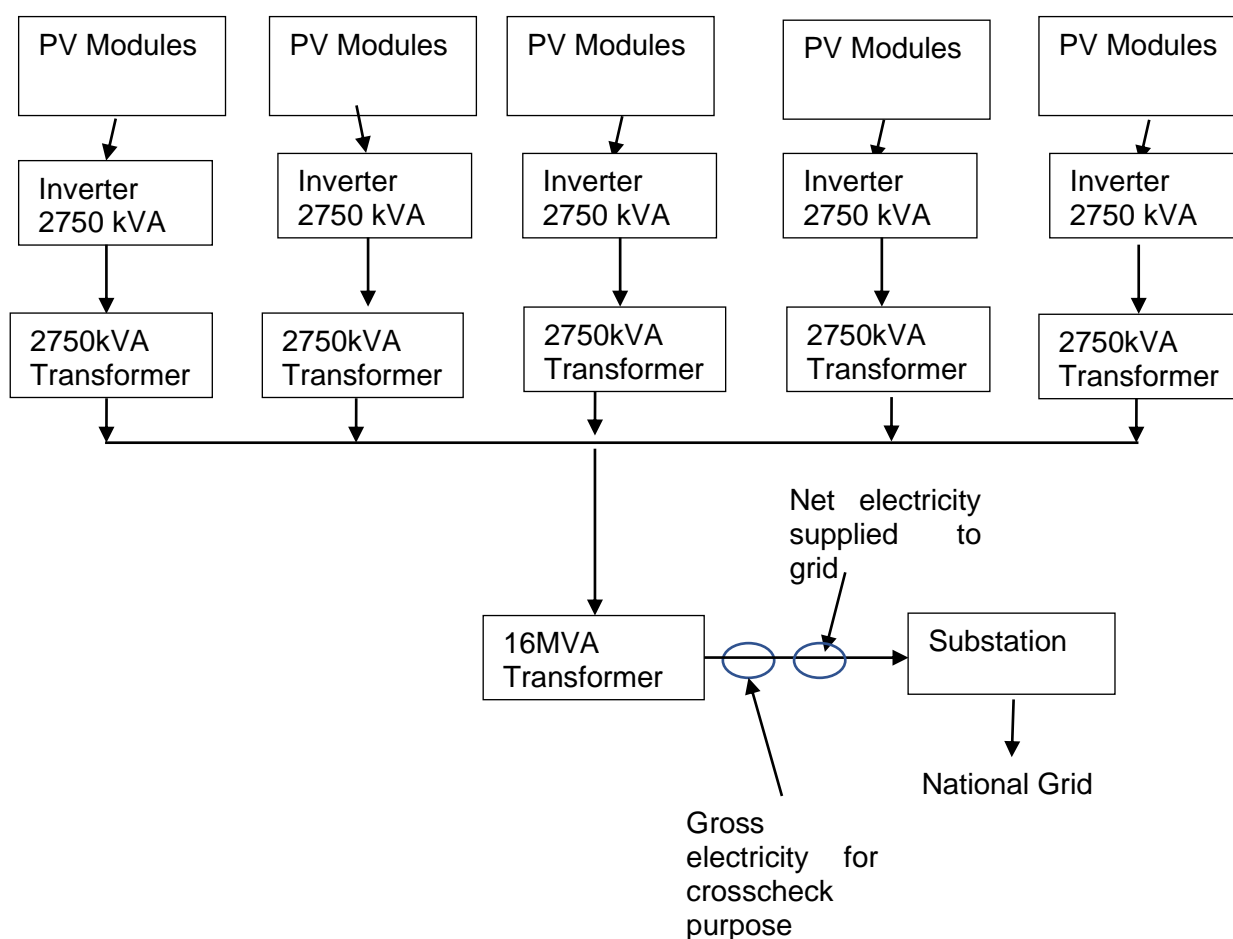


Fig: Line diagram with monitoring details

QA/QC Procedures

There are two meters (one main meter and one check meter) of 0.2s accuracy class at substation. If some defect occurs to any meter, the other meter can be used to obtain the reading. All meters calibrated at least once in three years by utility officials or its representatives.

The measurement results is crosschecked with records of electricity sold such as invoices.

Data Management and Data Archiving

Copies of the break-up sheet, invoices raised to CEB and sales receipts will be retained and archived for the entire crediting period plus two years by the project proponent.

Emergency preparedness plan

Operation and Maintenance team is trained for emergency situations.

Training

Operation and maintenance team has trained the staff on operation and maintenance aspects of the plant. The training ensures preventive maintenance and better operational control for the plant.

Data adjustments/uncertainties

- In case Main meter is found to be faulty/ damaged, during the monthly recording then the reading for that month would be taken from the back up meter for the purpose of billing. The defective main meter would be replaced and the subsequent readings would be taken from the new main meter.

- In case Backup meter is found to be faulty/ damaged, the defective backup meter would be replaced.
- During the calibration / accuracy testing of the main and backup meter if an error is observed to be outside the permissible limits of accuracy then both the Main & backup meter will be replaced immediately and the measured error from the recording meter would be applied to all the recorded readings conservatively since the date of last calibration/ accuracy test of that meter.

For the accurate execution of the Project activity a project team has been constructed. The project team is delegated with the responsibility of monitor and document the electricity generated and also safe keeping of the recorded data. The project team is also responsible for calculation of actual creditable emission reduction in the most transparent and relevant manner. The CDM monitoring team composed the following staff:

| Position | Report To |
|------------------------------------|----------------|
| Operator | Site Engineer |
| Site Engineer | Site In-Charge |
| Site In-Charge | Project Owner |
| CDM Monitoring and Project Manager | Project Owner |

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

| Data/Parameter | EF _{grid,OM,y} |
|--|---|
| Unit | tCO ₂ /MWh |
| Description | Operating Margin CO ₂ emission factor for the Grid in year y |
| Source of data | OM emission factor calculation sheet |
| Value(s) applied | 1.0282 |
| Choice of data or measurement methods and procedures | Calculated in line with " <i>Tool to calculate the emission factor for an electricity system (Version 07.0.0)</i> " using data from Grid Emission Factor, Mauritius prepared and provided by Central Electricity Board Mauritius dated July 2018. |
| Purpose of data/parameter | Calculation of combined margin emission factor |
| Additional comments | The value is fixed ex-ante |

| Data/Parameter | EF _{grid,BM,y} |
|--|---|
| Unit | tCO ₂ /MWh |
| Description | Build Margin CO ₂ emission factor for the Grid in year y |
| Source of data | BM emission factor calculation sheet |
| Value(s) applied | 0.8814 |
| Choice of data or measurement methods and procedures | Calculated in line with " <i>Tool to calculate the emission factor for an electricity system (Version 07.0.0)</i> " using data from Grid Emission Factor, Mauritius prepared and provided by Central Electricity Board Mauritius dated July 2018. |
| Purpose of data/parameter | Calculation of combined margin emission factor |
| Additional comments | The value is fixed ex-ante |

| Data/Parameter | EF _{grid,CM,y} |
|------------------|--|
| Unit | tCO ₂ /MWh |
| Description | Combined Margin CO ₂ emission factor for the Grid in year y |
| Source of data | CM emission factor calculation sheet |
| Value(s) applied | 0.9915 |

| | |
|--|--|
| Choice of data or measurement methods and procedures | This has been calculated based on Operating Margin (OM) and Build Margin (BM) calculated based on CEB data |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | The value is fixed ex-ante |

D.2. Data and parameters monitored

| | |
|---------------------------------------|---|
| Data/Parameter | EG_{PJ,y} |
| Unit | MWh/year |
| Description | Net quantity of electricity supplied to the grid by the project activity during the year y |
| Measured/calculated/default | Measured |
| Source of data | Measured directly with electricity meter(s) at CEB sub-station |
| Value(s) of monitored parameter | 22,510.24 |
| Monitoring equipment | Three Phase CT connected smart meter 1.Main Meter Make-EDMI Type-MK6E Serial No.-16538510 Accuracy- 0.2s Date of calibration- 15/10/2018 and 23/06/2020 Validity until- 22/06/2024 2.Check Meter Make-EDMI Type-MK6E Serial No.-16538511 Accuracy- 0.2s Date of calibration- 15/10/2018 and 23/06/2020 Validity until- 22/06/2024 |
| Measuring/reading/recording frequency | Continuous monitoring, hourly measurement monthly recording |
| Calculation method (if applicable) | The net electricity exported to the grid by solar plant is being ascertained by Central Electricity Board (CEB) on the basis of monthly Meter Reading (MR) using Tri-vector (TVM) energy meters with accuracy class 0.2s |
| QA/QC procedures | Cross check of measurement results with records for sold electricity. Meter Laboratory (ML) of CEB is solely responsible for the selection, installation, calibration, servicing, testing and repairing of all energy meters. As per PPA §8.4.4, CEB shall inspect each CEB Meter upon installation and at least once every year thereafter. CEB shall check the certification of CEB Meters through an accuracy test at least once every 4 (four) years thereafter or at any time the readings of Net Energy from the CEB Meter and Seller Back-up Meter differ by an amount greater than 0.5%. There is an internal meter at site for cross-check as well Electricity meter Tri-vector Make-Itron Type-SL7000 Serial No.-83974169 Accuracy- 0.2s Date of calibration- 16/10/2018 Validity until- 15/10/2022 |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | All the data will be archived till a period of two years from the end of the crediting period. The electricity generation from 25/11/2019 to 30/11/2019 is considered from daily generation report available on site is appropriate. |

D.3. Implementation of sampling plan

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All the parameters are monitored, hence no sampling plan used.

SECTION E. Calculation of emission reductions or net anthropogenic removals**E.1. Calculation of baseline emissions or baseline net removals**

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This is a renewable power generation project, the entire power generated from the project activity will be supplied to grid. This form of energy generation has no associated GHG emissions. So, the emission reductions just depend on the quantity of electricity being supplied to the grids, which would have been otherwise generated in grid.

Baseline emissions:

Baseline emission is calculated as per equation below

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

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

The electricity exported to national grid during current monitoring period i.e. from 25/11/2019 to 31/12/2020 is as below

| Month | Export to grid (kWh) | Import from grid (kWh) | Net export to grid EGBL,y (kWh) | Net export to grid EGBL,y (MWh) |
|--------|----------------------|------------------------|---------------------------------|---------------------------------|
| Nov-19 | 390,916 | 14,343 | 376,573 | 376.573 |
| Dec-19 | 1,924,446 | 14,650 | 1,909,796 | 1,909.796 |
| Jan-20 | 1,775,509 | 14,756 | 1,760,753 | 1,760.753 |
| Feb-20 | 1,936,971 | 13,964 | 1,923,007 | 1,923.007 |
| Mar-20 | 1,548,475 | 16,310 | 1,532,165 | 1,532.165 |
| Apr-20 | 1,698,552 | 15,905 | 1,682,647 | 1,682.647 |
| May-20 | 1,721,793 | 17,143 | 1,704,650 | 1,704.65 |
| Jun-20 | 1,473,619 | 16,938 | 1,456,681 | 1,456.681 |
| Jul-20 | 1,507,305 | 17,345 | 1,489,960 | 1,489.96 |
| Aug-20 | 1,734,950 | 17,056 | 1,717,894 | 1,717.894 |
| Sep-20 | 1,883,558 | 15,606 | 1,867,952 | 1,867.952 |
| Oct-20 | 1,904,344 | 14,633 | 1,889,711 | 1,889.711 |
| Nov-20 | 1,912,644 | 14,233 | 1,898,411 | 1,898.411 |
| Dec-20 | 1,313,028 | 12,985 | 1,300,043 | 1,300.043 |
| Total | 22,726,110 | 215,867 | 22,510,243 | 22,510.24 |

$$EG_{PJ, y} = 22,510.24 \text{ MWh}$$

Here,

$$EF_{grid, y} = 0.9915 \text{ tCO}_2/\text{MWh}$$

$$BE_y = 22,510.24 \times 0.9915$$

$$BE_y = 22,318 \text{ tCO}_2/\text{year (rounded down)}$$

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

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Not applicable as this is a solar PV based power generation project.

$$PE_y = 0$$

E.3. Calculation of leakage emissions

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No leakage emissions occur due to this project activity.

$$LE_y = 0$$

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 until 31/12/2020 | From 01/01/2021 | Total amount |
| Total | 22,318 | 0 | 0 | 0 | 22,318 | 0 | 22,318 |

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) |
|---|--|
| 22,318 | 25,052 |

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

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The ex-ante emission reduction estimated in PDD i.e. 22,690 tCO₂e/year based on estimated annual electricity generation. The value is calculated for number of days current this monitoring period i.e. 403 days, the value comes as 25,052 tCO₂e.

The annual estimated CER as per registered PDD = 22,690 tCO₂e/year

The corresponding CERs during current monitoring period = (22,690 x 403)/365.

The corresponding CERs during current monitoring period = 25,052 tCO₂e

E.6. Remarks on increase in achieved emission reductions

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The emission reduction achieved during current monitoring period is 10.91% lower than ex-ante estimates for the same period due to lower PLF. The lower PLF is due to malfunction of inverters during current monitoring period.

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

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There is no change in installed capacity of the project activity during current monitoring period and project has operated within small-scale limit i.e. installed capacity less than or equal to 15MW.

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Document information

| <i>Version</i> | <i>Date</i> | <i>Description</i> |
|----------------|-----------------|---|
| 08.0 | 6 April 2021 | Revision to: <ul style="list-style-type: none"> • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR). |
| 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. |

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