216 MWAC KAMUTHI SOLAR POWER PROJECT

Document Prepared By: Infinite Solutions

Project Title	216 MWac Kamuthi Solar Power Project
Version	02
Report ID	Kumathi-2nd Verification
Date of Issue	22-October-2019
Project ID	1768
Monitoring Period	28-March-2018 to 30-September-2019 **(Both dates Inclusive)**
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The main purpose of this project activity is to generate clean form of electricity through renewable solar energy source for sale of electricity to the grid. Kamuthi Solar Power Limited (KSPL) is the promoter of the proposed project activity and is the holding company of both the project investors in this project activity

The project activity involves installation of 216 MW_{ac} (corresponding 261 MWp) solar power project in Tamil Nadu. In this process there is no consumption of any fossil fuel and hence the project does not lead to any greenhouse gas emissions. The net electricity generated in this monitoring period is 586,500 MWh which has been fed into the Indian grid thus replacing equivalent quantity of electricity from Indian grid, which is mainly dominated by thermal/fossil fuel-based power plants.

The date of project commissioning is 18 September 2016.

This is the second monitoring period which starts from 28-March-2018 to 30-September-2019 (Both dates inclusive). The total GHG emission reductions or removals generated in this monitoring period are 566,148 tCO_{2e}.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:

Sectoral Scope : 01 – Energy industries (renewable / non-renewable sources)
Project Type : I – Renewable Energy Projects

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	Kamuthi Solar Power Limited
Contact person	Mr. D Trivedi
Title	Sr. Manager – Business Development
Address	5B, Sambhav Press Building, Judges Bunglow Road, Bodakdev, Ahmedabad, Gujarat, India.
Telephone	+91 79 2555 7429
Email	cs@adani.com

1.4 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the project	Project Consultant
Contact person	Mr. Jimmy Sah
Title	Head – Sustainability

Address	611, Chetak Centre Main, 12/2 RNT Marg, Indore- 452001
Telephone	+91-9644130430
Email	jimmy@infisolutions.org

1.5 Project Start Date

Project Start Date: 18-September-2016.

The project start date is the date on which Solar Panels were commissioned under the Project activity.

1.6 Project Crediting Period

Crediting Period Start date: 18-September-2016

Crediting Period End date: 17-September-2026

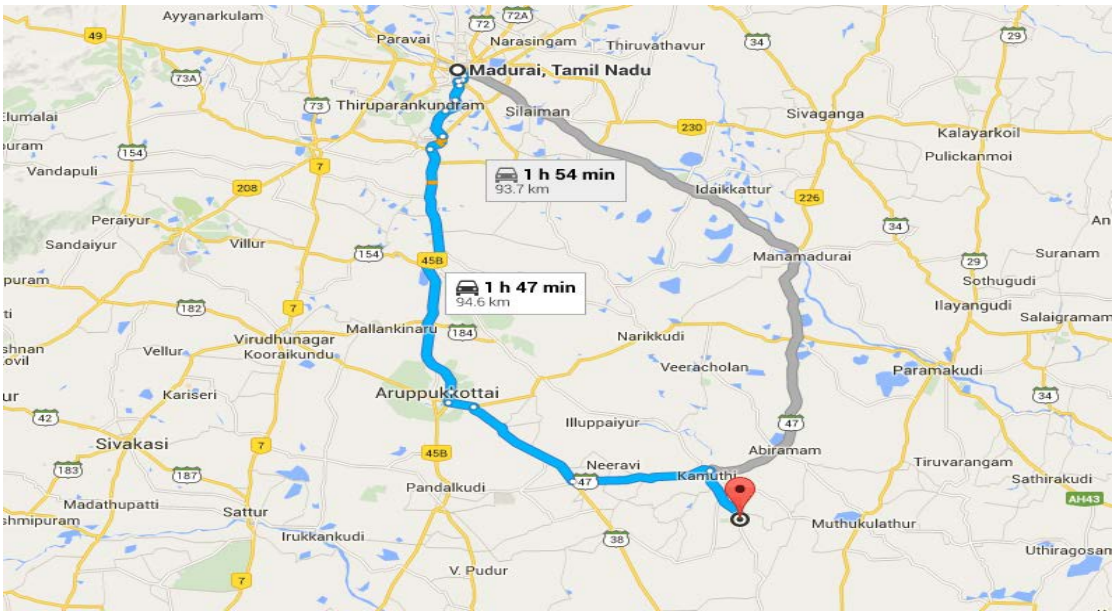
The project activity adopts renewable crediting period of 10 years period which can be renewed for 2 times.

1.7 Project Location

The proposed 216MWAC solar PV Plant site is located near Kamuthi village of Ramathapuram district, in the Indian state of Tamil Nadu. The site is well connected by state highway state highway (SH) 47 up to Arruppukottai and further national highway NH48 connects to Madurai.

The site lies around the coordinates- 9°18'21" N, 78°24'14" E and at an altitude of approximately 30m, above mean sea level.

The nearest commercial city remains Madurai, which is approximately 90km from the Project site location. The site wise preferred route from Madurai to the Project site location details of the project is given below in the figure:



1.8 Title and Reference of Methodology

Reference : The project activity meets the eligibility criteria of large-scale project as it is more than 15 MW

Methodology : ACM0002: Grid-connected electricity generation from renewable sources - Version 18.1[1]

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 – Version 06.0 (EB 97, Annex 07)[2]
Methodological Tool- Tool for the demonstration and assessment of additionality – Version 07.0.0 (EB 70, Annex 08)[3]

1.9 Other Programs

Emission Trading Programs and Other Binding Limits: Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits.

Other Forms of Environmental Credit: The Project has no intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

Participation under Other GHG Programs: The project has applied under CDM mechanism and is currently under development.

1.10 Sustainable Development

Contribution to sustainable development:

Ministry of Environment and Forests, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

- **Social well-being:** The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.

- **Economic well-being:** The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the state..
- **Technological well-being:** The successful operation of project activity would lead to promotion of solar based power generation and would encourage other entrepreneurs to participate in similar projects

[1] https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP
[2] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view
[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

- **Environmental well-being**: Solar being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the Project activity also helps in avoiding significant amount of GHG emissions.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project activity involves installation of 216 MW_{ac} (corresponding 261 MWp) solar power project in Tamil Nadu.

Project Investors' Name	Commissioning Date	Capacity in MW_{AC}/ MWp	Location (Village/State)
Kamuthi Solar Power Limited	18/09/2016	216/261	O. Karisalkulam Village, Ramanathpuram Dist., Tamil Nadu

The project shall result in replacing anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 566,148 tCO_2e per year, thereon displacing586,500 MWh/year amount of electricity from the gird.

The solar PV power plant will have solar PV modules, inverters, transformers and other protection system and supporting components as under:

Module Supplier	Module Type	Capacity (p)	Number	Total Capacity (MWp)
Canadian Solar International Limited	Poly C-Si	310	83,680	25.9408
		315	326,400	102.816
		320	155,040	49.6128
Trina Solar	Poly C-Si	310	56,000	17.36
		315	70,720	22.2768
Hanwha	Poly C-Si	310	46,080	14.2848
		315	33,920	10.6848
Suntech	Poly C-Si	310	26,880	8.3328
		315	23,040	7.2576
Total				**261.024**

Solar Power Project Technology Details

The technology employed, converts solar energy to electrical energy. In solar power generation, energy of solar is converted into mechanical energy and subsequently into electrical energy. The technology is an environment friendly technology since there are no GHG emissions associated with the electricity generation. There is no transfer of technology involved in the project activity.

Inverters

Make	ABB
Model	PV800

Rated Capacity	1000 KW
No. of Inverters	216
Rated Input Voltage	380

Transformers

Make	ABB	Schneider
Capacity	120 MVA	4 MVA
No. of Transformers	2	54
Voltage Ratio	33/230	380/33

The project activity is in continue operation since commissioning of the project activity. There is no such event occurred during this monitoring period which may impact the GHG emission reductions or removals and monitoring.

2.2 Deviations

2.2.1 Methodology Deviations

There are no methodology deviations applied during this monitoring period. Hence, this section is not applicable to the project activity.

2.2.2 Project Description Deviations

There is a project description deviation applied during this monitoring period.
During this Site Visit the Geo-Coordinates were assessed to be different from the one in registered Project Description; this MR is revised with the correct coordinates.
.

There are no project description deviations applied in previous monitoring reports reported.

2.3 Grouped Project

This is not a grouped project activity. Hence the same is not applicable to the project activity.

2.4 Safeguards

2.4.1 No Net Harm

There are no negative environmental and/or socio-economic impacts due to the project.

2.4.2 Local Stakeholder Consultation

Discussions with Local stakeholders is being carried out at periodic intervals. There are no negative comments received for the project. In line with VCS requirements all the processes has been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid, CM, y}$
Data unit	t CO_2 /MWh
Description	Combined margin emission factor for Indian grid connected power generation in year y calculated using the latest version of "Tool to calculate the emission factor for an electricity system"
Source of data	CO_2 baseline database (Version 12.0) published by CEA on 01-Nov-2017
Value applied:	0.9653
Justification of choice of data or description of measurement methods and procedures applied	This value is calculated using OM and BM values as per Version 6.0 of methodological tool to calculate the emission factor for an electricity system and using data base of CEA.
Purpose of Data	For the calculation of Emission Factor of the grid
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid, OM, y}$
Data unit	t CO2 /MWh
Description	Simple operating margin emission factor for Indian grid
Source of data	CO2 baseline database (Version 12.0) published by CEA on 01-Nov-2017
Value applied:	0.9843
Justification of choice of data or description of measurement methods and procedures applied	This value is calculated by taking weighted average of Simple Operating Margin of recent three years for Indian grid as per the "Tool to calculate the emission factor for an electricity system", version 06.0.0
Purpose of Data	For the calculation of Emission Factor of the grid
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid, BM, y}$

Data unit	t CO2 /MWh
Description	Simple build margin emission factor for NEWNE grid
Source of data	CO2 baseline database (Version 12.0) published by CEA on 01-Nov-2017
Value applied:	0.9083
Justification of choice of data or description of measurement methods and procedures applied	This value is calculated by taking weighted average of Simple build Margin of recent three years for Indian grid as per the "Tool to calculate the emission factor for an electricity system", version 06.0.0
Purpose of Data	For the calculation of Emission Factor of the grid
Comments	This parameter is fixed ex-ante for the entire crediting period.

3.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Monthly Credit Report by TANGEDCO

Description of measurement methods and procedures to be applied	Data Type: Measured Monitoring equipment: Energy Meters are used for monitoring Recording Frequency: Continuous monitoring and Monthly recording from Energy Meters, Summarized Annually Archiving Policy: Paper & Electronic Calibration frequency: 5 years Electricity exported/imported to the grid is in kWh. However, for the calculation purpose electricity exported is converted in MWh. The Net electricity supplied to the grid by the project activity will be calculated as a difference of electricity exported to the grid, electricity imported from the grid obtained from joint meter reading certificates/credit notes issued by Ramnad Electricity Distribution Circle as per below equation: $EG_{PJ,y} = EG_{Export} - EG_{Import}$ The calculation is done by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) and the PP has no say in the calculation. Based on the joint meter reading certificates/credit notes, the project shall raise the invoice. The electricity exported to the grid by the project activity connected to the sub-station is measured by electronic trivector meters of accuracy class 0.2s. The electricity exported will be measured continuously using Main & Check meters. Export readings of Main, Check meters shall be taken on monthly basis by authorized officer of TANGEDCO in the presence of PP or representative of PP. Cross Checking: Quantity of net electricity supplied to the grid will be cross checked from the invoices raised by the project participant to the grid.
Frequency of monitoring/recording	Monthly
Value monitored	586,500
Monitoring equipment	The two parameters, import and export to the grid, are measured at the same location near the connection to the grid, through standard electricity metering instrument. The metering instruments will be installed at the grid-connected point to measure the amount of electricity going from and to the grid. The readings of electricity will be continuously measured by

<table>
<tr><td></td><td>metering instrument itself and monthly recorded.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>This data will be directly used for calculation of emission reductions. Measurement results of electricity supplied to the grid and that delivered from the grid to the project will be crosschecked with records for sold electricity.
<table>
<tr><td>Sr.</td><td>Meter Type</td><td>Meter No</td><td>Calibration Date</td></tr>
<tr><td></td><td>Main</td><td>TNG64528</td><td>16/09/2016</td></tr>
<tr><td></td><td>Check</td><td>TNG64529</td><td>16/09/2016</td></tr>
<tr><td></td><td>Standby</td><td>TNG64484</td><td>16/09/2016</td></tr>
</table></td></tr>
<tr><td>Purpose of the data</td><td>The Data/Parameter is required to calculate the baseline emission.</td></tr>
<tr><td>Calculation method</td><td>N/A</td></tr>
<tr><td>Comments</td><td>Data will be archived electronically for a period of 2 years beyond the end of crediting period.</td></tr>
</table>

3.3 Monitoring Plan

Aim of monitoring:

The monitoring methodology specified in the methodology requires that the project-monitoring plan to consist of monitoring of quantity of net electricity supplied to the grid in the year y. In order to monitor the mitigation of GHG due to the project activity, the total energy exported needs to be measured. The net energy supplied to grid by the project activity multiplied by emission factor for regional grid, would form the baseline for the project activity.

Since the baseline emission factor is based on an ex-ante determination, monitoring of this parameter is not required. The sole parameter for monitoring is the net electricity exported to the grid.

Monitoring roles and responsibilities

The operational and management structure implemented for data monitoring is as follows:
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 Tamil Nadu, India. The monitoring plan, which will be implemented by the project proponent describes about the monitoring organization, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

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

***Responsibilities of O & M Head*:** Overall functioning and maintenance of the project activity and overall responsibility of compliance with the CDM Monitoring Plan.

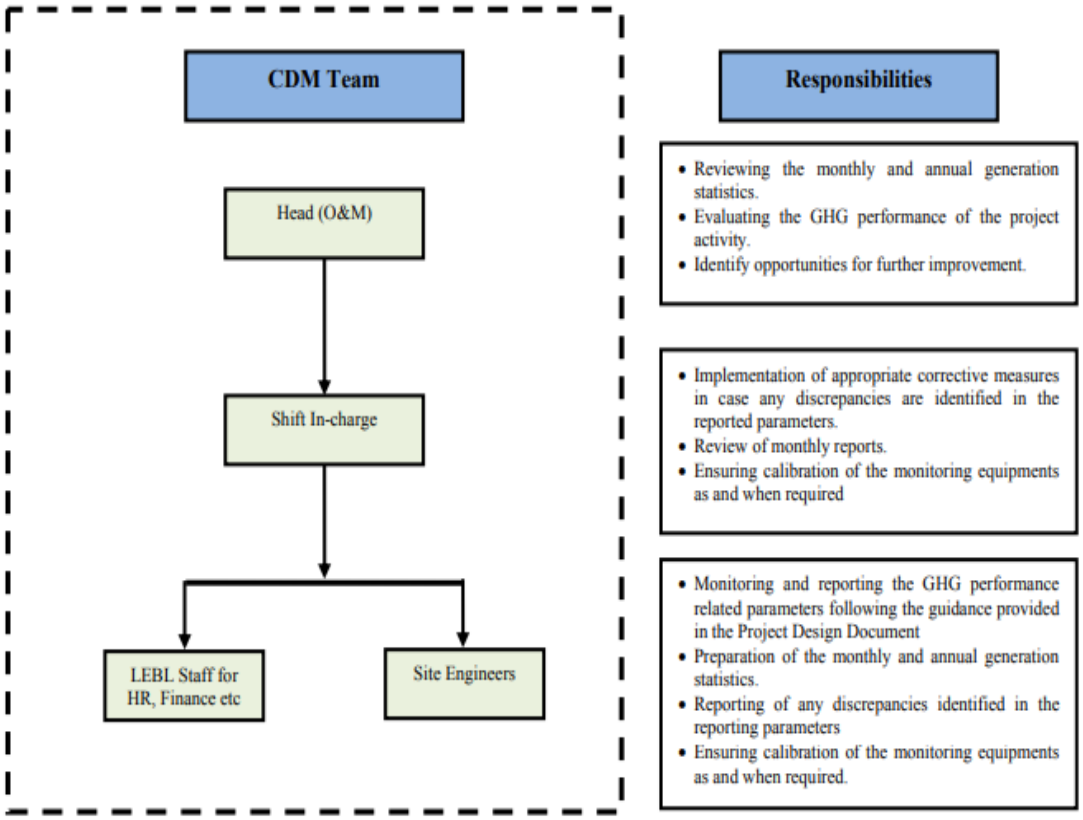
Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data. Regularly verifying the monthly energy generation date with energy sales receipt or installed meters reading for identification of any discrepancies in data collection and taking suitable action to rectify them.

Responsibilities of Shift In-charge*:*

- Responsibility for day to day data collection and maintains day to day log book for monitored data.
- Responsibility for monthly and annual report generation and quality assurance of the data/reports and preliminary check of data for any discrepancies.

QA/QC procedures: The energy meters at the feeders are maintained and owned by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO). Neither the project proponent nor the site personnel have any control over it. The records will be cross-checked with the records of sold electricity to Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO). The meters are calibrated by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) at-least once in five years.

Data Measurement*:* The export and import energy will be measured continuously using above mentioned Main & Check meters. Export & Import readings of Main & Check meters shall be taken on monthly basis by authorized officer of TANGEDCO in the presence of PP or representative of PP. The meter reading will be taken jointly and signed by the representatives of the TANGEDCO and project investors. Based on the readings, invoices will be raised by project investors. These invoices can be used for cross checking the meter readings taken for the project activity. It is to be noted though PP or PP representative is available during meter reading, the calculations of net electricity supplied to grid is completely under purview of TANGEDCO officer and PP do not have any control on it. Also, accuracy class of meters and calibration frequency is under purview of TANGEDCO officer and PP do not have any control on it. PP got the monthly credit report from where net electricity supplied to grid is obtained and used for emission reduction calculations.



Operation & Management Structure

Data Archiving:

Monthly data shall be archived electronically and in paper form and stored for the entire crediting period and two years thereafter.

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.

In the event that the main meter, which is used to record the net electricity exported by the project, is found to be faulty it will be repaired or replaced and the data from the check meter will be used in its place. In the unlikely event that the check meter fails it will also be repaired or replaced.

Training and maintenance requirements:

Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the solar plants, it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that O&M team is deft at handling technical snags on top of the turbine, the

necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. Each and every site personnel is provided with proper training to meet the requirements of the Operations and maintenance. This ultimately leads to creativity in problem solving.

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.

Apportioning:
In case of mismatch of date between the start date of the billing cycle and the start date of monitoring period the data will be apportioned in line to the daily generation values for the said mismatch period.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As per description earlier under this document:

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

$EF_{grid,CM,y}$: 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" (tCO2/MWh) (i.e., 0.9653 tCO_2/MWh).

$EG_{PJ,y}$: Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh/yr)

BE_y : Baseline emissions in year y (tCO_{2e}/yr)

Here,
Monthly calculations of baseline emissions:

Month*	Net Generation in MWh	Emission Factor (tCO2/MWh)	Emission Reduction (tCO2)
Mar-18	5,997	0.9653	5,789
Apr-18	30,799	0.9653	29,730
May-18	27,951	0.9653	26,981
Jun-18	32,443	0.9653	31,317
Jul-18	30,824	0.9653	29,755

Aug-18	32,781	0.9653	31,644
Sep-18	35,554	0.9653	34,320
Oct-18	25,643	0.9653	24,753
Nov-18	27,111	0.9653	26,170
Dec-18	28,077	0.9653	27,102
Jan-19	35,855	0.9653	34,611
Feb-19	34,676	0.9653	33,472
Mar-19	42,542	0.9653	41,065
Apr-19	31,414	0.9653	30,324
May-19	34,186	0.9653	33,000
Jun-19	34,425	0.9653	33,230
Jul-19	30,912	0.9653	29,839
Aug-19	36,231	0.9653	34,974
Sept- 19	29,080	0.9653	28,071
Total	**586,500**	**0.9653**	**566,148**

4.2 Project Emissions

The project activity involves in harnessing Solar power. So, the emissions from the project are zero.

4.3 Leakage

No leakage emissions have been considered and hence the leakage emission is zero.

4.4 Net GHG Emission Reductions and Removals

As per the applied methodology, emission reductions are calculated as follows:

ERy = BEy-PEy - LEy

Where,

ERy = Emission Reduction in tCO2/year

BEy = Baseline emission in tCO2/year

PEy = Project emissions in tCO2/year

LEy = Leakage Emissions in tCO2/year.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2018 (28/03/2018 to 31/12/2018)	267,561	0	0	267,561
2018 (01/01/2019 to 31/09/2019)	298,587	0	0	298,587
Total	566,148	0	0	566,148

Further, the comparison for estimated emission reductions as per validated VCS PD and actual observed are detailed below.

Parameters	tCO2e
Emission Reductions for the monitoring period (552 days)	566,148
Emission reductions achieved in monitoring period	523,441
Percentage of variation when compared with estimated ERs in VCS PD	7.54%

The actual emission reductions for the current monitoring period is 7.54% higher than the estimated values in the registered VCS PD corresponding to the similar period.

This is because of higher PLF observed. The Values are within the sensitivity analysis carried out for the project activity. Detailed calculation is provided in ER calculation sheet.