



PAVAGADA SOLAR RENEWABLE POWER PROJECT BY GREENKO GROUP



Document Prepared by Infinite Solutions

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¹ <https://registry.terra.org/app/projectDetail/VCS/1791>

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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 sources. The project activity involves installation of a 90 MW solar power project in Karnataka state of India.

Over the 10 years of first crediting period, the project will replace anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 139,239 tCO_{2e} per year, thereon displacing 146,955 MWh/year amount of electricity from the generation-mix of power plants connected to the Indian grid, which is mainly dominated by thermal/fossil fuel-based power plant. The project is a bundled project activity by Greenko Group and the project is promoted by SEI Suryashakti Power Private Limited.

The details of the project and their location of installation are mentioned in the table below: -

Name of Investor	Capacity in MW	COD	Connection with Grid	State	Usage
SEI Suryashakti Power Private Limited	30 MW _{AC}	30-March-2017	Indian Grid	Karnataka	Sale to M/s. Bangalore Electricity Supply Company Limited (BESCOM)
SEI Bheem Private Limited	30 MW _{AC}	30-March-2017			
SEI Aditi Power Private Limited	30 MW _{AC}	30-March-2017			

The project is commissioned on 30-March-2017 and operating smoothly with schedule maintenance at regular intervals. The breakdown details are provided in appendix 2 of the MR

Total emission reductions achieved in this monitoring period:

During the Current Monitoring Period from 01-January-2021 to 31-December-2022 (Inclusive of both days), the project activity has supplied 311,251.38 MWh of electricity, and thus contributing to the GHG reductions 294,911 tCO_{2e}.

Audit Type	Period	Program	VVB Name	Number of years
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Validation+ Verification	(30-March-2017 to 31-July-2018) (First and last days included)	VCS	LGAI Technological Center S.A. (Applus+ Certification	01 year 04 months 02 days
Verification	(01-August-2018 to 01-October-2019) (First and last days included)	VCS	Earthood Services Private Limited	01 year 02 months 01 day
Verification	(02-October-2019 to 31-December-2020) (First and last days included)	VCS	TUV SUD South Asia Pvt. Ltd.	01-year 02 months 30 days
Verification	(01-January-2021 to 31-December-2022) (Current monitoring period) (First and last days included)	VCS	VKU Certification Private Limited	02 years 00 months 00 days
Total	30-March-2017 to 31-December-2022 (Inclusive of both the days)	VCS	-	05 years 09 months 02 days

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

Methodology: Grid-connected electricity generation from renewable sources ACM0002- Version 18.1 ²

The project is not a grouped project nor an AFLOU (Agriculture, Forestry and Other Land Use) project activity.

1.3 Project Proponent

Organization name	SEI Suryashakti Power Private Limited
Contact person	Murali Krishnam Raju M

² CDM: Grid-connected electricity generation from renewable sources --- Version 18.1 (unfccc.int)

Title	AGM - Commercial
Address	PLOT NO. #1131/A, ROAD NO. 36 JUBILEE HILLS, HYDERABAD – 500033. TELANGANA, INDIA.
Telephone	+91 40 40300100
Email	muraliraju.m@greenkogroup.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	214-215 Milinda Manor, Opp. Next Treasure Island, 2 RNT Marg, Indore – 452001, India
Telephone	+91-9644130430
Email	jimmy@infisolutions.org

1.5 Project Start Date

Start date of the project activity is the earliest date of interconnection with the grid i.e. 30-March-2017. This is the date of commissioning of 30 MW Solar Project activity by SEI Suryashakti Power Private Limited, 30 MW Solar Project activity by SEI Bheem Private Limited and a 30 MW Solar Project activity by SEI Aditi Power Private Limited.

The details of the commissioning dates of the individual project activity are mentioned in the section 1.1 of this report.

1.6 Project Crediting Period

Crediting Period Start date: 30-March-2017

Crediting Period End date: 29-March-2027

The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times. The current monitoring period is 4th verification under 1st crediting period.

1.7 Project Location

The details of the project locations are mentioned in the table below

Name of Investor	Capacity (MW)	Village(s)	Tehsil/ Mandal	District	State	Latitude (N)	Longitude (E)
SEI Suryashakti Power Private Limited	30 MW	Kamballahalli	Pavagada	Tumkur	Karnataka	14° 12' 18.9648"	77° 22' 48.2340"
SEI Bheem Private Limited	30 MW	Upparahalli & Agalmadke	Pavagada	Tumkur	Karnataka	14° 11' 33.8460"	77° 20' 46.1688"
SEI Aditi Power Private Limited	30 MW	Pallavalli	Pavagada	Tumkur	Karnataka	14° 08' 26.2104"	77° 18' 54.5796"

The project locations have been shown in the map below:



Project location as visible from google maps is given below:

30 MW Solar plant by SEI Suryashakti Power Private Limited



30 MW Solar plant by SEI Bheem Private Limited



30 MW Solar plant by SEI Aditi Power Private Limited



Figure 1 Satellite locations

1.8 Title and Reference of Methodology

Title : Grid-connected electricity generation from renewable sources

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 18.1³

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 system⁴ - Version 07.0 (EB 100, Annex 04)

³ <http://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP>

⁴ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

- Methodological Tool- Tool for the demonstration and assessment of additionality⁵- Version 07.0.0 (EB 70, Annex 08)

1.9 Participation under other GHG Programs

The project proponent hereby confirms that the project activity is not registered with any other GHG program.

The undertaking from PP has been submitted for no any double accounting for current monitoring period and project activity is not participated any other GHG program other than VCS.

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions

VCUs used for voluntary carbon market purposes don not require Paris Agreement Article 6 mechanism and other Paris-related program VCU labels, though labeled VCUs may be used for voluntary market transactions if desired. Since for this project activity the VCUs for this monitoring period are only to be used for the voluntary carbon market purposes, so project proponent is not required to demonstrate adherence to any of such requirements.

India is Non-annex1 country and there is no compliance with an emission trading program or to meet binding limits on GHG emissions for this project activity.

The emission reductions or removals generated during this monitoring period have not been used for compliance under an emissions trading program or any other mechanism that includes GHG allowance trading (as identified in the project description, or where such programs or mechanisms have subsequently emerged). The Project is used for compliance with an emission trading program or to meet binding limits on GHG emissions.

Other Forms of Environmental Credit: The project activity has not availed any other form of environmental credit as confirmed by the project proponent through the declaration of no double counting.

Also, the project is not claiming any benefits from CDM/GS/GCC/I-REC/UCR/RECs mechanism which can be confirmed from the link below –

https://www.recregistryindia.nic.in/index.php/publics/accredited_regens

<https://cdm.unfccc.int/>

⁵ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf>

<https://www.goldstandard.org/>

<https://projects.globalcarboncouncil.com/>

<https://www.ucarbonregistry.io/>

https://www.recregistryindia.nic.in/index.php/publics/accredited_regens

The project Activity is a solar power project and does not involve any supply chain involved in the project such as manufacturers, wholesalers, distributors and retailers. So, no indirect upstream and downstream GHG emissions are not involved in the project activity. Thus, the Scope 3 emissions are not applicable in this project activity.

1.11 Sustainable Development Contributions

Contribution to sustainable development:

Ministry of Environment, Forests and Climate Change, GoI, 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 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.

The project activity will generate power using zero emissions solar energy-based power generation, which helps to reduce GHG emissions and specific pollutants like SO_x, NO_x, and SPM associated with the conventional thermal power generation facilities.
- **Technological well-being:** The successful operation of project activity would lead to promotion of solar power generation and would encourage other entrepreneurs to participate in similar projects.
- **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.

The solar Project is located at Tehsil-Pavagada Tumkur district of Karnataka state, India. The main purpose of this project activity is to generate clean form of electricity through renewable solar

energy sources. The project activity involves installation of a 90 MW_{AC} solar power project in Karnataka state of India.

The project is contributing in sustainable development by generating electricity and reduction of CO₂ emissions due to implementation of project activity and generates employment to the local stakeholders. Through Project activity economic development has been achieved in the project location by creating opportunities of employment during the project lifetime. Project owner monitors the carbon emission with help of the record of electricity generated.

The project is solar power project, it has generated 311,251.38 MWh electricity and avoided 294,911tCO₂e of greenhouse gas emissions in the atmosphere during the current monitoring period. So, the project will contribute to the sustainable development and it is fulfilling SDG 07 and SDG 13.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	7.2.1: Renewable energy share in the total final energy consumption	Implemented activities to increase	About 311,251.38 MWh, renewable electricity has supplied to INDIAN Grid during the reported period that helps to increase the renewable energy share in the energy mix	Since Commissioning, about 719,139.66 MWh (63,143.17+148,517.11+196,228+311,251.38) ⁶ renewable electricity has been supplied to INDIAN Grid that helps to increase the renewable energy share in the energy mix.
.2)	13.0	13.0 Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By installation of 90 MW solar Energy Power Plant, project has prevented the release of 294,911 tCO ₂ e into the atmosphere during the monitoring period	Prevented the release of 681,378 tCO ₂ e (tons of carbon dioxide) (59,827+140,717+185,923+294,911) ⁷ into the atmosphere.

⁶ <https://registry.terra.org/app/projectDetail/VCS/1791>

⁷ <https://registry.terra.org/app/projectDetail/VCS/1791>

2 SAFEGUARDS

2.1 No Net Harm

The project activity does not involve any major construction activity. It primarily requires the installation of the solar PV panels, interfacing the generators with the State Electricity Board by setting up HT transmission lines and installation of other accessories.

The report on “Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects” prepared by MNRE dated September 2013. This report clearly mentioned that solar PV project activity operations do not result in direct air pollution, noise pollution. Please refer below web link for the same⁸

There are no negative environmental and/or socio-economic impacts due to the project activity hence no mitigation measure required. Thus, there are no any significant impacts due to implementation of project activity on air, water, soil quality and ambience are envisaged due to the project activity.

2.2 Local Stakeholder Consultation

The project has already been registered under VCS mechanism. The Stakeholders of the project activity were invited through submission of the invitation letter and Public Notice to attend the stakeholder meeting at the project site. The meeting was attended by Local community, Local village administration, Technology suppliers, Local vendors and representatives of PPs. The details of the Stakeholder Meetings are as follows:

Name of Investor	Capacity	Project Location			Date of invitation	Date of meeting
		Village	District	State		
SEI Suryashakti Power	30 MW	Kamballahalli	Tumkur	Karnataka	10-November-2015	10-November-2015

⁸ <http://164.100.94.214/sites/default/files/uploads/report-on-developmental-impacts-of-RE.pdf>

Private Limited						
SEI Bheem Private Limited	30 MW	Upparahalli & Agalmadke	Tumkur	Karnataka	13-July-2015	20-July-2015
SEI Aditi Power Private Limited	30 MW	Pallavalli	Tumkur	Karnataka	14-July-2015	21-July-2015

In the introductory speech, the representative of SEI Suryashakti Power Private Limited (Project Investor), welcomed the gathering and given a brief about the climate mitigation project activity. Subsequent to the introductory speech, stakeholders were explained about the electricity generation from solar project is an environmentally friendly power generation technology contributing to reduction in GHG emissions. They were also explained about the benefits of the solar power projects like, increasing energy availability and improving quality of power and its assistance to the local population by providing employment opportunities to both skilled & unskilled labours. The stakeholders were explained about the project activity and the various benefits arising out of the project activity. A discussion was held in which the views of the local stakeholders were addressed. No negative comments received.

As a part of continual improvement process, feedback from the associated stakeholders is vital, therefore a dedicated Visitor register cum grievance register has been placed at the project site which is accessible to stakeholders to provide their feedback on the project. It is appropriate publicly accessible location at which local stakeholders can provide their feedback on the project. This location is also conducive to continuous and regular checks for stakeholder comments.

Nevertheless, PP is open for the continuous stakeholder interaction and formed a grievance/suggestion register and a grievance box placed at the project site for the comments at any point of time during the project crediting period. PP has explained this mechanism for on-going communication to the local stakeholders and transparently kept the notice mentioning the grievance register and box at the project site.

The accounting of all and any input received during ongoing communication should be taken in consideration to take the appropriate measure to resolve the grievance.

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 have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals. However, no negative feedback received during the current monitoring period.

2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project activity involves the installation of solar project. The total installed capacity of the project is 90 MW Solar project located in Karnataka state of India. The project is a bundled project activity by Greenko Group and the project is promoted by SEI Suryashakti Power Private Limited. The O&M is done by Greenko itself.

The Project activity is a new facility (Greenfield) and the electricity generated by the project is exported to the Indian electricity grid. The project therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. The Project Proponent plans to avail the VCS benefits for the project.

In the Pre- project scenario the entire electricity, delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

The project shall result in replacing anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 139,239 tCO_{2e} per year, thereon displacing 146,955 MWh/year amount of electricity from the grid over the 10 years crediting period. During current monitoring period, the project activity(s) is operated continuously with schedule maintenance at regular intervals.

The Solar plants are under operation including scheduled shutdowns during the current monitoring period. The breakdown occurred is for a total of 0.54% of total hours of all solar panels and is beyond the control of PP. Therefore, due to this percentage variations of breakdown identified in the current monitoring period also it has no impact in the GHG emissions reductions.

The summary of breakdown details in the current monitoring period has been described in the below table and a detailed analysis of the same has been provided in APPENDIX 2.

S.No.	Plant Site	Total Hours	Net operational Hours	Breakdown Hours
1	SEI Suryashakti Power Private Limited	17,520 hours ⁹	17,441.77 hours/ 99.55% of total hours	78.23 hours/ 0.44% of total hours
2.	SEI Bheem Private Limited		17,502.66 hours/99.90% of total hours	17.34 hours/0.098% of total hours
Total			17,424.5 hours/99.45% of total hours	95.5 ¹⁰ hours/0.54% of total hours

Technical Specification

The technical specification for 90 MW_{AC} solar project is provided below:

Technical specification of 30 MW_{AC} solar project by SEI Suryashakti Power Private Limited

S.No.	Technical details of the equipment	Description
1	Technology Used	Solar PV technology (Poly-Crystalline)
2	Module Make, Number of modules and their capacity	Make- JA Solar Risen Energy RENO No. of Modules- 5853 for 310 Wp, 49199 for 315 Wp, 42124 for 320 Wp Module Capacity- 310 Wp, 315 Wp & 320 Wp
3	Number of Inverters, Inverter Make & Model	40 Inverters Make: TMEIC Model no: PVLO750 E (750 KW) – 40 nos
4	Technical specifications of power transformer, make, voltage, rated power, frequency	Make: Schneider Pvt. Ltd. Voltage: 380/33kV Rated power: 1.65 MVA Frequency: 50Hz
5	Tilt	Tracking

Technical specification of 30 MW_{AC} solar project by SEI Bheem Private Limited

S. No.	Technical details of the equipment	Description
1	Technology Used	Solar PV technology (Poly-Crystalline)

⁹ Total hours = 17520 (i.e., 730*24)

¹⁰ Strings and stackers maintenance are minor and not included in the above

2	Module Make, Number of modules and their capacity	Make- JA Solar Risen Solar Technology Total No. of Modules- 97,020 Module Capacity- 310 Wp
3	Number of Inverters, Inverter Make & Model	40 Inverters Make: TMEIC Model no: PVLO750 E (750 KW) – 40 nos
4	Technical specifications of power transformer, make, voltage, rated power, frequency	Make: Schneider Pvt. Ltd. Voltage: 380/33kV Rated power: 1.65 MVA Frequency: 50Hz
5	Tilt	Tracking

Technical specification of 30 MW_{AC} solar project by SEI Aditi Power Private Limited

Sl. No.	Technical details of the equipment	Description
1	Technology Used	Solar PV technology (Poly-Crystalline)
2	Module Make, Number of modules and their capacity	Make- JA Solar Risen Energy RENO No. of Modules- 97,020 Module Capacity- 310 Wp
3	Number of Inverters, Inverter Make & Model	40 Inverters Make: TMEIC Model no: PVLO750 E (750 KW) – 40 nos
4	Technical specifications of power transformer, make, voltage, rated power, frequency	Make: Raychem Pvt. Ltd. Voltage: 380/33kV Rated power: 1.65 MVA Frequency: 50Hz
5	Tilt	Tracking

3.2 Deviations

3.2.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

3.2.2 Project Description Deviations

Project description deviation applicable:

1. In the registered VCS Joint PD&MR, formula used in the calculation of net electricity supplied to the grid was not mentioned correctly, hence the same is corrected in line with the JMRs (Form-B). This correction is considered as project description deviation in the current monitoring period. The formula used in the monitoring plan for calculating the net electricity supplied to the grid is based on the B-Form values provided by KPTCL is as follows: -

$$EG_{PJ, y} = \text{Export (KWh)} - 115\% \text{Import (KWh)} - \text{Transmission losses (KWh)}$$

This is in line with the actual monitoring procedure followed on the project activity.

The Project deviation is in line with the guidance provided under Section 3.21.2 para no. 2 of the VCS standard, Version 4.5 and it does not impact the existing applicability conditions of the methodology, additionality or the appropriateness of the baseline scenario.

2. The technical specifications are different as per the registered Joint PD&MR and it has been updated as per the actual scenario and the same has been described below in the table:

The technical specification for 90MW_{AC} solar project is provided below:

Technical specification of 30MW_{AC} solar project by SEI Suryashakti Power Private Limited

S.No.	Technical details of the equipment	Description
1	Technology Used	Solar PV technology (Poly-Crystalline)
2	Module Make, Number of modules and their capacity	Make- JA Solar Risen Energy RENO No. of Modules- 5853 for 310 Wp, 49199 for 315 Wp, 42124 for 320 Wp Total modules- 96936 Module Capacity- 310 Wp, 315 Wp & 320 Wp
3	Number of Inverters, Inverter Make & Model	40 Inverters Make: TMEIC Model: PVLO750 E (750 KW) – 40 nos
4	Technical specifications of power transformer, make, voltage, rated power, frequency	Make: Schneider Pvt. Ltd. Voltage: 380/33kV Rated power: 1.65 MVA Frequency: 50Hz
5	Tilt	Tracking

Technical specification of 30MW_{AC} solar project by SEI Bheem Private Limited

S. No.	Technical details of the equipment	Description
1	Technology Used	Solar PV technology (Poly-Crystalline)
2	Module Make, Number of modules and their capacity	Make- JA Solar Risen Solar Technology Total No. of Modules- 97,020 Module Capacity- 310 Wp
3	Number of Inverters, Inverter Make & Model	40 Inverters Make: TMEIC Model: PVLO750 E (750 KW) – 40 nos
4	Technical specifications of power transformer, make, voltage, rated power, frequency	Make: Schneider Pvt. Ltd. Voltage: 380/33kV Rated power: 1.65 MVA Frequency: 50Hz
5	Tilt	Tracking

Technical specification of 30MW_{AC} solar project by SEI Aditi Power Private Limited

Sl. No.	Technical details of the equipment	Description
1	Technology Used	Solar PV technology (Poly-Crystalline)

2	Module Make, Number of modules and their capacity	Make- JA Solar Risen Energy RENO No. of Modules- 97,020 Module Capacity- 310 Wp
3	Number of Inverters, Inverter Make & Model	40 Inverters Make: TMEIC Model: PVLO750 E (750 KW) – 40 nos
4	Technical specifications of power transformer, make, voltage, rated power, frequency	Make: Raychem Pvt. Ltd. Voltage: 380/33kV Rated power: 1.65 MVA Frequency: 50Hz
5	Tilt	Tracking

3.3 Grouped Projects

The project is not a grouped project thus this is not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF _{grid, OM, y}
Data unit	tCO ₂ /MWh
Description	Operating margin CO ₂ e emission factor for the project electricity system in year y
Source of data	Calculated from CEA database, Version 13, June 2018 ¹¹
Value applied	0.9726
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07” as 3-year generation weighted average using data for the years 2014-15, 2015-16 & 2016-17. The data are obtained from “CO ₂ Baseline Database for Indian Power Sector” version 13, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	EF _{grid, BM, y}
Data unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor for the project electricity system in year y

¹¹ https://cea.nic.in/old/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

Source of data	Central Electricity Authority (CEA) of India Database Version 13 ¹²
Value applied	0.8723
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07” as per the latest data available for the most recent year 2016-17. The data is obtained from “CO2 Baseline Database for Indian Power Sector “version 13, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	Calculation of baseline emissions
Comments	The above value is fixed and it is same for the entire crediting period

Data / Parameter	$EF_{grid, CM, y}$
Data unit	tCO ₂ /MWh
Description	Combined margin CO ₂ e emission factor for the project electricity system in yearly
Source of data	Calculated from CEA database, Version 13, June 2018 ¹³
Value applied	0.9475
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid, CM, y} = EF_{grid, OM, y} * W_{OM} + EF_{grid, BM, y} * W_{BM}$ Where: $EF_{grid, BM, y}$ = Build margin CO₂ emission factor in year y (tCO₂e/MWh) $EF_{grid, OM, y}$ = Operating margin CO₂ emission factor in year y (tCO₂e/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM} = Weighting of build margin emissions factor (%) = 25%
Purpose of Data	Calculation of baseline emissions
Comments	The above value is fixed and it is same for the entire crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ, y}$
Data unit	MWh/y

¹² https://cea.nic.in/old/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

¹³ https://cea.nic.in/old/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)
Source of data	Monthly joint meter reading reports/Form B reports
Description of measurement methods and procedures to be applied	The difference of final value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations.
Frequency of monitoring/recording	Continuous measurement & monthly recording
Value monitored	311,251.38 MWh
Monitoring equipment	The electricity exported / supplied by the plant to pooling substation and further to substation. The meter also measures electricity imported by the plant from the grid and the meter details are provided in appendix 1 of the MR.
QA/QC procedures to be applied	The meters are approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years¹⁴. The monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness of metering. The metering arrangement, accuracy class of meters, calibration frequency is under control of state electricity board and PP does not have any control on it. PP is getting value of net electricity supplied to grid and the same is considered the monitoring parameter. The billing is raised based on substation meters at 33kV.
Purpose of the data	Calculation of baseline emissions
Calculation method	Thus, Net electricity supplied to the grid by the project plant will be calculated on the difference between calculated values of “export”, “import” and “transmission loss” on the EB energy meter and at substation. The net electricity in a given month is given by: Net electricity = Export (kWh) – 115% import (kWh) – transmission loss

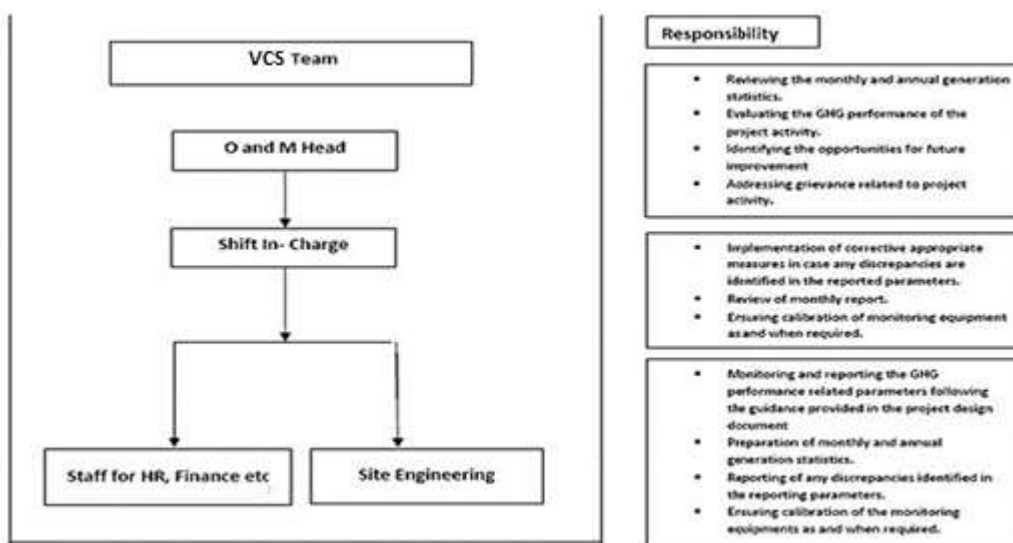
¹⁴ https://cea.nic.in/wp-content/uploads/2020/04/review_regulation.pdf

	The net electricity will be calculated by State electricity board and provided in the monthly generation statement/JMR. Hence, the net electricity reading will be directly sourced from the monthly generation statement/ JMR.
Comments	Data will be archived in paper & electronic form for two years after the end of crediting period or of the last issuance of VCUs for this project activity, whichever occurs later.

4.3 Monitoring Plan

The monitoring plan is developed in accordance with the modalities and procedures for Carbon project activities and is proposed for grid-connected wind power project being implemented. The monitoring plan, which is implemented by the project participant 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 participant. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipment for this project activity. The team comprises of the following members:



Data Measurement

The export and import energy is measured continuously using above-mentioned Main and Check meters located at the substations. Readings of the meter are taken on monthly basis (FORM-B) by authorized officer of SEB in the presence of PP or representative of PP. Based on the Meter Reading Statement to PP, invoices are raised. These invoices are used for cross checking the meter readings (FORM-B) taken for the respective project activity. The Net Electricity generation

is calculated after deducting the Imports & transmission loss from the Export i.e., Net Electricity supplied to the grid = Export – 115% Import – Transmission loss.

In the state of Karnataka, the current value for assessment of Transmission loss is calculated based on the actual line losses assessed each month and the value is sourced from the B-form. Further the import value is also sourced from B-form however the grid considers 115% of import value (taking into the transmission losses) while considering the financial transactions (invoicing). These values (import and Transmission losses) are regulated by KPTCL and may be revised upon discretion of the KPTCL. Thus, they shall be revised considering the latest applicable guideline at the time of monitoring.

Data collection and archiving

Readings from meters are collected in the presence of the plant in-charge. Export and Import data are recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of VCUs for the project activity whichever occurs later.

Emergency preparedness

The project activity does not result in any unidentified activity that results in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

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 above event if the Main meter is not in service as a result of maintenance, repairs or testing, the Check meter is used for readings. During the monitoring period the main meter and check meter were operating in the acceptable limits of accuracy and there were no issues identified during the monitoring period.

Personnel training

In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff are trained. The plant helpers are being trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.

QA/QC procedures

The meters are approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. Calibration of all the meters is undertaken at required intervals and faulty meters are duly replaced immediately based on CEA guidelines which specifies calibration, and the

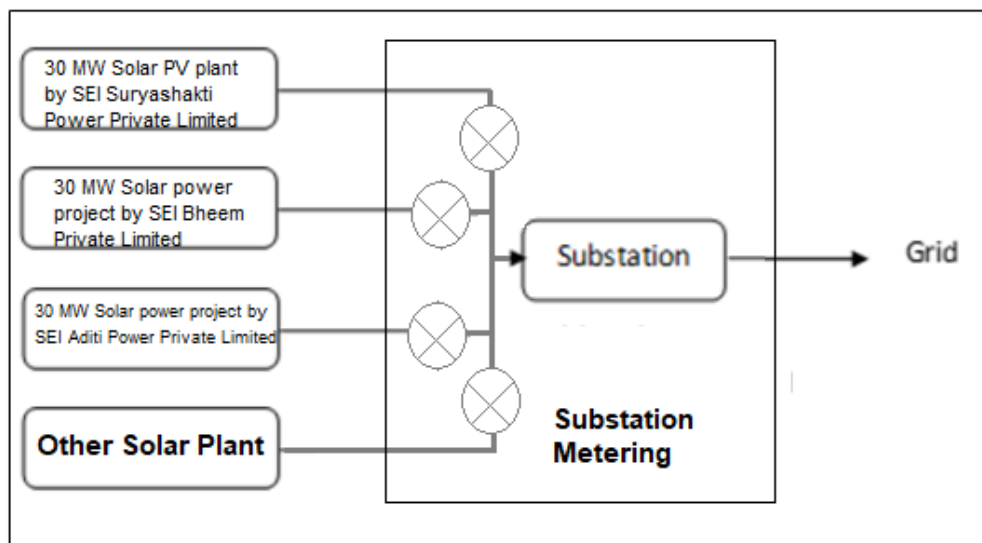
frequency of calibration is once in 5 years.¹⁵ The monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale. In the absence or delay in the meter calibration appropriate Guidelines are applied appropriately to confirm the conservativeness of metering.

The metering arrangement, accuracy class of meters, calibration frequency is under control of state electricity board and PP does not have any control on it. PP is getting value of net electricity supplied to grid and the same is considered in the monitoring parameter. The billing is raised based on substation meters.

All the data items monitored under the monitoring plan is being kept for 2 years after the end of crediting period or till the last issuance of VCUs for this project activity, whichever occurs later. The data is archived both electronically and manually, and kept in safe storage by PP.

Metering Arrangement

Line diagram with metering arrangement for the solar project activity is shown below.



The metering arrangement for all the three solar sites are the same. Each solar plant has their own dedicated metering arrangement at the substation end at 33kV. There are two meters i.e., main and check and no standby meter is there at the metering location site. The metering arrangement is under control of state electricity board and may change in future.

The project activity metering is done at the PSS (input (33kV) and output (220kV)).

All the electricity received at the PSS through input 33kV meters is stepped up to 220kV and recorded at the output meter means bulk meter (Meter Y). While stepping up the power from

¹⁵ https://cea.nic.in/wp-content/uploads/2020/04/review_regulation.pdf

33kV to 220kV, there is some transformation/transmission loss. For record purpose it is termed as "Transmission loss"/Z.

Apportioning Procedure: -

M/s. SEI Aditi Power Pvt. Ltd., M/s. Bheem Pvt. Ltd. & M/s. Suryashakti Power Pvt. Ltd. 90MW Solar plant in comprehensive manner at Pallavalli village, Pavagada Taluk, Tumkur district 220kV Bulk Metering point at 220/66/11kV KPTGL substation at KOTAGUDDA. Apportioning of net electricity generation & Line Losses (in %) from No of Project Developers connected to the Substation is then determined as follows:

X1 - Project Proponent -1

X2 - Project Proponent -2

X3 - Project Proponent-3

$$Y = X1 + X2 + X3$$

Z = Line Losses (in %)

$$Z = \frac{(X1 + X2 + X3) - Y}{(X1 + X2 + X3)} * 100$$

$$(X1 + X2 + X3)$$

Date adjustment in case of monitoring period different from billing period:

The net electricity supplied to the grid would be reported as the difference between the net export and import from the solar plant. The electricity export and import data are monitored via main, check and standby meters connected to the sub-station.

Data Adjustment in case of monitoring period different from billing period:

In case the dates of a particular monitoring period do not match with the dates of the billing period, the net electricity exported to the grid would be calculated as follows:

$$D = (A/B) * C$$

Where: A = Difference of number of days which are not matching of billing period and monitoring period.

B = Number of days of the billing period/ month which was not matched with the monitoring period.

C = Net Electricity supplied to the grid for that given billing period/ month

The calculated value after apportioning would be used for calculation of emission reductions during that period.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per the approved consolidated Methodology ACM0002 (Version 18.1) para 42: Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid- connected power plants and the addition of new grid- connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y= Baseline emissions in year y (tCO₂/yr)

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

EF_{grid,CM, y}= Combined margin CO₂ 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)

Calculation of EG_{PJ,y}¹⁶

If the project activity is the installation of a Greenfield power plant, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

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)

EG_{facility,y} = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr).

Vintage-wise calculation	SEI Aditi (Generation, MWh)	SEI Bheem (Generation, MWh)	SEI Suryashakti (Generation, MWh)
Year			

¹⁶ <https://cdm.unfccc.int/methodologies/DB/5725LCHYPYM4I1V8OD9SFYVAMFFWNP>

2021 (01-January-2021 to 31-December-2021)	52,029.12	51,952.66	52,754.77
2022 (01-January-2022 to 31-December-2022)	51,865.88	50,880.88	51,768.07
Total	103,895.00	102,833.54	104,522.84

Thus, $EG_{PJ,y} = 311,251.38$ MWh

Grid Emission Factor

The GEF is fixed ex-ante in the Joint PD&MR as given below:

Parameter	Value
OM	0.9726 tCO ₂ /MWh
BM	0.8723 tCO ₂ /MWh
CM	0.9475 tCO ₂ /MWh

Therefore,

$$BE_y = 311,251.38 \times 0.9475$$

$$= 294,911 \text{ tCO}_2\text{e (Round down values)}$$

5.2 Project Emissions

Not Applicable, since emissions from the project activity is zero as per para 34 of ACM0002 methodology version 18.1. Hence, $PE_y = 0$.

5.3 Leakage

Not Applicable, since leakage emissions from the project activity is zero as per section 5.6 ACM0002 methodology version 18.1. Hence, $LE_y = 0$.

5.4 Net GHG Emission Reductions and Removals

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

$$ER_y = BE_y - PE_y$$

Where,

ER_y = Emission Reduction in tCO₂/year

BE_y = Baseline emission in tCO₂/year

PE_y = Project emissions in tCO₂/year

LE_y = Leakage Emissions in tCO₂/year

For the project activity during the current monitoring period, as per section 5.1

$$BE_y = 294,911 \text{ tCO}_2\text{e}$$

$PE_y = 0 \text{ tCO}_2\text{e}$
 $LE_y = 0 \text{ tCO}_2\text{e}$

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
Year 2021 (01-January-2021 to 31-December-2021)	148,508	0	0	148,508
Year 2022 (01-January-2022 to 31-December-2022)	146,403	0	0	146,403
Total	294,911	0	0	294,911

The achieved GHG emission is 5.90% higher than the estimated value. This is due to the higher number of sunshine hours. The generation of electricity depends upon many other climatic conditions, and not within the control of the project participant.

<u>Ex-ante emissions reductions /removals</u>	<u>Achieved emissions reductions /removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
278,478 (tCO ₂ e)	294,911 (tCO ₂ e)	5.90%	It is to be noted that estimated emission reduction achieved from the project activity for the current monitoring period is 278,478tCO ₂ e, whereas actual emission reductions achieved is 294,911 tCO ₂ e, which is 5.90% higher than the estimated value. This is due to the higher number of sunshine hours. The generation of electricity depends upon many other climatic conditions, and not within the control of the project participant. The actual PLF for the generated energy in this monitoring period is 19.74% whereas as per the VCS Joint PD&MR breaching value of PLF would be 59.42% which is still higher than actual PLF hence project is additional. Refer tab PLF analysis in ER sheet.

APPENDIX 1: CALIBRATION RECORDS

Meter and Calibration details¹⁷ of 30 MW_{AC} Solar power project by SEI Suryashakti Power Private Limited.

Meter Details	Main Meter	Check Meter
Meter Serial No	17010290	17010296
Meter Make	L & T	L & T
Accuracy Class	0.2s	0.2s
Date of Subsequent Calibration	16-September-2020	16-September-2020
Due date of Calibration	15-September-2025	15-September-2025

Meter and Calibration details of 30 MW_{AC} Solar power project by SEI Bheem Private Limited

Meter Details	Main Meter	Check Meter
Meter Serial No	17010285	17010251
Meter Make	L & T	L & T
Accuracy Class	0.2s	0.2s
Date of Subsequent Calibration	16-September-2020	16-September-2020
Due date of Calibration	15-September-2025	15-September-2025

Meter and Calibration details of 30 MW_{AC} Solar power project by SEI Aditi Power Private Limited

Meter Details	Main Meter	Check Meter
Meter Serial No	17010234	17010245
Meter Make	L & T	L & T
Accuracy Class	0.2s	0.2s
Date of Subsequent Calibration	16-September-2020	16-September-2020
Due date of Calibration	15-September-2025	15-September-2025

¹⁷ As per registered VCS joint PD&MR & CEA guideline the calibration frequency is once in 5 years.

APPENDIX 2: BREAKDOWN DETAILS

Breakdown details of 30 MW Solar power project by SEI Suryashakti Power Private Limited.

S. No.	Month	Hrs. of breakdown	Reason
1	20-January-21	6:55 hrs	Due to Pole no-14 B phase conductor Span joint opened
2	2-February-21	2:03 hrs	Pin insulator failure
3	1-March-21	3:45 hrs	LC taken from Atria power (site) due to line stringing purpose
4	4-June-21	1:00 hrs	220KV Line Grid failure
5	18-July-21	2:13 hrs	220KV Line Grid failure
6	30-July-21	4:40 hrs	220KV Line Grid failure
7	23-September-21	1:27 hrs	Line LC taken for KPTCL 66kv line string work purpose near Bheem site
8	25- September -21	1:16 hrs	Line LC taken for KPTCL 66kv line string work purpose near Bheem site
9	13- September -21	0:37 hrs	PSS side snake hitting for isolator side
10	8-October-21	1:30 hrs	220KV Line Grid failure
11	24-October-21	0:30 hrs	220KV Line Grid failure
12	17-November-21	10:20 hrs	Pin insulator damaged 3 no's
13	11-December-21	2:09 hrs	220KV Line Grid failure
14	21-February-22	0:32 hrs	220KV Line Grid failure
15	8-April-22	2:03 hrs	220kv GSS Swith yard maintenance
16	5-May-22	3:48 hrs	220kv GSS grid failure
17	18-May-22	2:48 hrs	220kv GSS grid failure
18	19-May-22	1:25 hrs	220kv GSS grid failure
19	20-May-22	4:07 hrs	b phase Jumper opened
20	1-August-22	2:20 hrs	GSS grid failure
21	2-August-22	2:13 hrs	GSS grid failure
22	9-August-22	0:30 hrs	PTR-1 LV bushing Y-Phase PG clamp spark observed then we have taken shutdown
23	9-August-22	0:17 hrs	PTR-1 LV bushing Y-Phase PG clamp bolts & Nuts replaced after work completion breakers was charged
24	30-August-22	2:48 hrs	GSS grid failure
25	6-September-22	1:35 hrs	GSS grid failure
26	1-October-22	1:07 hrs	220 KV Main supply failure
27	2-October-22	4:26 hrs	220 KV Main supply failure
28	2-October-22	3:37 hrs	220 KV Main supply failure
29	20-October-22	0:38 hrs	33 kV PSS side LC taken Our end due to Pole no-286 conductor melted

30	2-November-22	0:59 hrs	220 KV Main supply failure
31	11-November-22	0:30 hrs	GSS side grid failure
32	11-November-22	1:15 hrs	220 kv main supply failure
33	11-December-22	3:00 hrs	220 kv main supply failure
Total		78:23 hrs	

Breakdown details of 30 MW Solar power project by SEI Bheem Private Limited

S. No.	Month	Hrs. of breakdown	Reason
1	19-December-21	0:12 hrs	Manually shut down taken due to PSS T/F -1 testing purpose
2	20-December-21	0:22 hrs	Manually shut down taken due to PSS T/F -1 testing purpose
3	5-January-22	0:37 hrs	MCR O/G Manually shut down taken due to ABT meter Calibration
4	11-January-22	0:50 hrs	Lc Taken by KPTCL due to 220 kV line stringing work
5	12-June-22	0:10 hrs	Grid failure
6	7-July-22	0:10 hrs	Grid failure while charging the Block-09 at aditi site
7	18-July-22	0:19 hrs	O/g tripped due to Under voltage
8	9-August-22	0:15 hrs	PTR-1 LV Bushing Y-Phase PG clamp observed small spark and load shifted to PTR-02
9	9-August-22	0:18 hrs	PTR-02 to PTR-1 load shifted
10	30-August-22	2:14 hrs	Grid failure
11	6-September-22	1:26 hrs	Grid failure due to Heavy Rain
12	1-October-22	1:00 hrs	220kv supply failure
13	2-October-22	3:45 hrs	220kv supply failure
14	2-October-22	3:50 hrs	220kv supply failure
15	11-November-22	0:25 hrs	220kv supply failure
16	11-November-22	1:16 hrs	220kv supply failure
17	28-November-22	0:25 hrs	PSS side Bheem site feeder CT Selector switch cable connection issue amp not shown so that observed the found slightly burnt.
Total		17:34 hrs	

Therefore, the total breakdown of both the plants is approx. 95.5 hrs and 0.54% of total hours of all solar panels.

APPENDIX 3: SDG CONTRIBUTION

SDG Contribution of 30 MW Solar power project by SEI Aditi Power Private Limited

Months	Total Net Generation (MWh)	Emission Factor(tCO ₂ /MWh)	Emission Reductions(tCO ₂ e)
	SGD 7		SGD 13
January-21	4160.03	0.9475	3941.63
February-21	4806.88	0.9475	4554.52
March-21	5899.42	0.9475	5589.70
April-21	5191.08	0.9475	4918.54
May-21	5194.42	0.9475	4921.72
June-21	4520.15	0.9475	4282.84
July-21	3760.08	0.9475	3562.67
August-21	3907.52	0.9475	3702.38
September-21	4364.61	0.9475	4135.46
October-21	3914.43	0.9475	3708.92
November-21	2477.64	0.9475	2347.56
December-21	3832.86	0.9475	3631.64
Vintage 2021	52,029.12	0.9475	49297.00
January-22	4487.60	0.9475	4252.00
February-22	4883.66	0.9475	4627.27
March-22	5309.90	0.9475	5031.13
April-22	5084.88	0.9475	4817.92
May-22	4473.06	0.9475	4238.22
June-22	4878.07	0.9475	4621.97
July-22	3590.70	0.9475	3402.19
August-22	4022.03	0.9475	3810.88
September-22	4120.76	0.9475	3904.42
October-22	3905.52	0.9475	3700.48
November-22	3409.32	0.9475	3230.33
December-22	3700.38	0.9475	3506.11
Vintage 2022	51,865.88	0.9475	49142.00
Total	103,895.00		98,439.00

SDG Contribution of 30 MW Solar power project by SEI Bheem Private Limited

Months	Total Net Generation (MWh)	Emission Factor(tCO ₂ /MWh)	Emission Reductions(tCO ₂ e)
	SGD 7		SGD 13

January-21	4148.71	0.9475	3930.00
February-21	4750.96	0.9475	4501.00
March-21	5879.68	0.9475	5570.00
April-21	5275.11	0.9475	4998.00
May-21	5332.37	0.9475	5052.00
June-21	4530.34	0.9475	4292.00
July-21	3691.56	0.9475	3497.00
August-21	3873.17	0.9475	3669.00
September-21	4322.79	0.9475	4095.00
October-21	3804.47	0.9475	3604.00
November-21	2473.50	0.9475	2343.00
December-21	3869.99	0.9475	3666.00
Vintage 2021	51,952.66	0.9475	49225.00
January-22	4435.00	0.9475	4202.00
February-22	4852.59	0.9475	4597.00
March-22	5266.54	0.9475	4990.00
April-22	4976.90	0.9475	4715.00
May-22	4433.03	0.9475	4200.00
June-22	4764.45	0.9475	4514.00
July-22	3435.69	0.9475	3255.00
August-22	3893.83	0.9475	3689.00
September-22	4023.32	0.9475	3812.00
October-22	3874.19	0.9475	3670.00
November-22	3331.64	0.9475	3156.00
December-22	3593.70	0.9475	3405.00
Vintage 2022	50,880.88	0.9475	48209.00
Total	102,833.54		97,434.00

SDG Contribution of 30 MW Solar power project by SEI Suryashakti Power Private Limited

Months	Total Net Generation (MWh)	Emission Factor(tCO ₂ /MWh)	Emission Reductions(tCO _{2e})
	SGD 7		SGD 13
January-21	4173.83	0.9475	3954.00
February-21	4857.15	0.9475	4602.00
March-21	5981.69	0.9475	5667.00
April-21	5334.59	0.9475	5054.00
May-21	5423.92	0.9475	5139.00
June-21	4580.78	0.9475	4340.00
July-21	3731.07	0.9475	3535.00
August-21	3972.09	0.9475	3763.00
September-21	4267.45	0.9475	4043.00

October-21	3919.53	0.9475	3713.00
November-21	2495.29	0.9475	2364.00
December-21	4017.38	0.9475	3806.00
Vintage 2021	52,754.77	0.9475	49985.00
January-22	4580.64	0.9475	4340.00
February-22	4949.79	0.9475	4689.00
March-22	5374.26	0.9475	5092.00
April-22	5107.94	0.9475	4839.00
May-22	4479.96	0.9475	4244.00
June-22	4759.06	0.9475	4509.00
July-22	3446.72	0.9475	3265.00
August-22	3967.66	0.9475	3759.00
September-22	4101.03	0.9475	3885.00
October-22	3903.18	0.9475	3698.00
November-22	3394.42	0.9475	3216.00
December-22	3703.42	0.9475	3508.00
Vintage 2022	51,768.07	0.9475	49050.00
Total	104,522.84		99,035.00