

GRID CONNECTED 25 MW P V SOLAR POWER PROJECT AT CHARANKA IN GUJARAT



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Summary:

M/s GMR Gujarat Solar Power Private Limited has commissioned the TÜV NORD JI/CDM Certification Program to carry out the VCS verification of the project “Grid connected 25 MW P V solar power project at Charanka in Gujarat” with regard to the requirements of VCS 3.3.

The VCS project undertaken has an installed capacity of 25 MW. The project activity is the installation of a 25 MW Solar Photo Voltaic power plant located at Charanka Village, Patan District Gujarat India. The power project consists of Photo Voltaic (PV) modules and inverters, which are power conditioning units. The PV modules used in the project activity use polycrystalline silicon. The PV modules of Canadian Solar make are based on Polycrystalline silicon technology. The inverters are SMA make, model 500 CP of maximum 1000V DC Voltage. The direct current electricity generated by the solar cells using the sunlight converted into AC electricity is exported to the NEWNE grid of India through Power Purchase Agreement (PPA)^{/PPA/} with Gujarat Urja Vikas Nigam Limited (GUVNL). The project activity is achieving GHG emission reductions by supplying the net electricity generated to the NEWNE grid of India, which is predominantly dependent on fossil fuel based power plants. The project activity results in avoidance of Greenhouse Gases (GHGs) emission and contributes to mitigation of global warming. The solar power project (i.e. green field project activity) has been commissioned on 04/03/2012.

Reporting period: **From 04/03/2012 to 31/12/2012 (both dates inclusive)**

In the course of verification 06 Corrective Action Requests (CARs) have been raised and closed successfully. No clarification request (CL) and forward action request (FAR) was raised for the present verification.

The verification is based on the registered CDM PDD^{/CDM-PDD/}, Final validation report of CDM^{/FVR-CDM/}, Monitoring report^{/MR/}, supporting emission reduction calculation sheet^{/XLS/} VCS Project Document^{/VCS-PD/} and other supporting documents like commissioning certificate^{/CC/} breakdown records^{/DGR/}, Calibration certificates^{/CAL/}, Invoices^{/INV/} etc. made available to the TÜV NORD JI/CDM CP by the project participant.

As the result of the VCS verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the project has achieved emission reductions of in the above mentioned reporting period (**From 04/03/2012 to 31/12/2012**) as follows:

Total Emission reductions	29,887 t CO₂e
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1 INTRODUCTION

The M/s GMR Gujarat Solar Power Private Limited has commissioned the TÜV NORD JI/CDM Certification Program to carry out the verification of the project:

“Grid connected 25 MW P V solar power project at Charanka in Gujarat” with regard to the relevant requirements of the Verified Carbon Standard 3^{VCS/}. The verifiers have reviewed the implementation of the monitoring plan (MP) in the registered CDM-PDD for the monitoring period 04/03/2012 to 31/12/2012 (both dates inclusive),

The applied CDM methodology is ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (version 12.3.0).

The project activity is the installation of a 25 MW Solar Photo Voltaic power plant located at Charanka Village, Patan District Gujarat India. The power project consists of Photo Voltaic (PV) modules and inverters which are power conditioning units. The PV modules used in the project activity use polycrystalline silicon. The PV modules of Canadian Solar make are based on Polycrystalline silicon technology. The inverters are SMA make, model 500 CP of maximum 1000V DC Voltage. The direct current electricity generated by the solar cells using the sunlight converted into AC electricity is exported to present Indian grid of India through Power Purchase Agreement (PPA)^{PPA/} with Gujarat Urja Vikas Nigam Limited (GUVNL). The project activity is achieving GHG emission reductions by supplying the net electricity generated to the Indian grid of India which is predominantly dependent on fossil fuel based power plants. The net electricity generated from the project activity is supplied to the state electricity board, which is a part of now Indian grid of India, thereby resulting in emission reductions. The project activity (i.e. green field project activity) has been commissioned on 04/03/2012.

It has been verified that the project is implemented as it is described in the validated project description/^{PDD/CC/}. All the measuring equipments required for the project monitoring are installed at the respective places of project site. The crediting period selected for the project activity as per the validated VCS PD/^{VCS-PD/} and registered CDM PDD. Verification team has also reviewed the documents related registered CDM PDD and validation report w.r.t prior reviewing the implementation status of the project activity.

The solar power project activity uses solar radiation i.e. renewable resources, thereby displacing fossil fuel based power plant generation leading to sustainable economic and environmental development. The project activity monitors the following monitoring parameter as part of the project activity.

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

The net electricity supplied to a grid is calculated as the difference between the measured quantities of the grid electricity export and the import. The same is a calculated value which is sourced directly from

the monthly Electricity generation report/certificate issued by Gujarat state distribution licensee^{/SLDC/}. The monthly electricity generation data for entire months of the monitoring period has been cross-checked by verification team with the invoices raised for sale of the electricity by the project proponent.

The project has been in the continual and successful operation during this monitoring period. None of the major technical equipment has been found to be exchanged during the monitoring period. The technical specification^{/TS/} of the Solar PV equipments and energy meters including serial numbers, rated capacity etc. have been verified during onsite verification conducted by the verification team. The commissioning certificate^{/CC/} of the Solar Power project is also verified and found to be appropriate. The technical specifications^{/TS/} of the measuring equipments were physically verified during onsite verification and found to be appropriate.

It was verified during the site visit and the subsequent review of the, Commissioning Certificates^{/CC/} in the course of this verification that the actual project activity was implemented in accordance with the CDM PDD

Essential data of the project is presented in the following Table 4-1a.

Table 1-1a: Project Characteristics

Item	Data			
Project title	Grid connected 25 MW P V solar power project at Charanka in Gujarat			
Project owner	M/s GMR Gujarat Solar Power Private Limited			
Any specific project categories	☐	Large project (> 300,000 t CO _{2eq} / a)		
	☒	Project (< 300,000 t CO _{2eq} / a)		
	☐	AFOLU project		
	☐	Grouped project		
	☐	No specific project category		
VCS PD dated	Draft:	05/05/2017	Final:	16/10/2018
Applied Methodology	ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources" (version 12.3.0)			
Project starting date	04/03/2012 – Date of commissioning of the Solar Power project activity			
Crediting period	Start date of the crediting period: 04/03/2012 (date of commissioning of Solar Project) and end date of the crediting period: 31/12/2012 (date one day prior to the start date of crediting period of CDM project activity)			
Start of crediting period	04/03/2012			

The details of the project location are given in table 4-1b:

Table 1-1b: Project Location

No.	Project Location
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Host Country	India
Region:	State: Gujarat
Project location address:	District: Patan, Village: Charanka
Latitude:	23°55'03.32"N
Longitude:	71°12'53.24"E

The key parameters of the project are given in table 4-1c:

Table 1-1c: Technical data of the Solar PV Project

Parameter	Unit	Value
PV Modules		
Manufacturer	-	Canadian Solar
Model	-	CS6P 235 P & 240P
Type	-	Polycrystalline silicon
Total installed capacity	MW	25
Number of Modules	No's	105,624
Peak power per module	Wp	235/240
Lifetime	yrs	25
Central Inverter		
Manufacturer	-	SMA
Nominal DC power	kW	500
MPP voltage range	V	430 to 820
Nominal AC voltage	V	270
Operational Temperature Range	°C	-20 to 50
Number of Inverters		45
Transformers		
Manufacturer	-	Voltamp Transformers Ltd
Rated power	MVA	10/12.5 & 6.3
Rated voltage HV side	kV	66
Rated voltage MV side	kV	kV
Number of Transformers		2 x 10/12.5 MVA 1 x 6.3 MVA

1.1 Objective

The purpose of this verification, by independent checking of objective evidence, is as follows:

- to verify that the project is implemented as described in the project description;
- to assess the implementation of the monitoring plan (MP) content in the VCS-PD;
- to assess the project's compliance with other relevant rules, including the host country legislation;
- to confirm that the monitoring system is implemented and fully functional to generate verified emission reductions (VERs / VCUs) or ERs without any double counting; and
- to establish that the data reported are accurate, complete, consistent, transparent and free of material errors or omissions by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The verification of this project is based on the validated project description ^{/VCS-PD/}, the monitoring report/MR/, emission reduction calculation spread sheet^{/XLS/}, supporting documents made available to the verifier and information collected through performing interviews and during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The TÜV NORD JI/CDM CP has employed a risk-based approach in the verification, focusing on the identification of significant risks and reliability of project monitoring and generation of emission reductions.

1.3 Level of Assurance

The verification has been planned and organized to achieve a

- ☒ Reasonable level of assurance
- ☐ Limited level of assurance

1.4 Summary Description of the Project

The project activity is the installation of a 25 MW Solar Photovoltaic power plant located at Charanka Village, Patan District Gujarat India. The power project consists of Photovoltaic (PV) modules and inverters which are power conditioning units. The PV modules of Canadian Solar make are based on Polycrystalline silicon technology. The inverters are SMA make, model 500 CP of maximum 1000V DC Voltage. The direct current electricity generated by the solar cells using the sunlight converted into AC electricity is exported to present Indian grid of India through Power Purchase Agreement (PPA)^{/PPA/} with Gujarat Urja Vikas Nigam Limited (GUVNL). The project activity is achieving GHG emission reductions by supplying the net electricity generated to the NEWNE grid of India which is predominantly dependent on fossil fuel based power plants. The electricity generated from this is exported to the Indian grid and thus

displace electricity produced from a thermal power plant which uses a fossil fuel and reduce 29,887 tCO₂e GHG emission during the said monitoring period.

As a result of this verification, the verifier confirms that:

- All operations of the project are implemented and installed as planned and described in the validated project design document
- The monitoring plan is in accordance with the applied approved CDM methodology, i.e., ACM0002 ver. 12.3.0
- The installed equipment essential for measuring parameters required for calculating emission reductions are calibrated appropriately
- The monitoring system is in place and functional. The project has generated GHG emission reductions.

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

The validation of the project consisted of the following steps:

- Contract review,
- Appointment of team members and technical reviewers,
- Desk review of the Project Document^{/PD/} submitted by the client and additional supporting documents,
- Validation planning,
- On-Site assessment,
- Background investigation and follow-up interviews with personnel of the project developer and its contractors,
- Draft validation reporting,
- Resolution of corrective actions, (if any)
- Final validation/verification reporting,
- Technical review,
- Final approval of the validation.

Table 3-1: Verification sequence

Topic	Time
Assignment of verification	14/10/2016
On-site visit	24/06/2017
Draft reporting finalised	24/06/2017
Final reporting finalised	01/10/2018
Technical review on final reporting finalised	16/10/2018
Final corrections	20/11/2018

2.2 Document Review

The monitoring report^{/MR/}, emission reduction sheet^{/XLS/} and supporting background documents like monthly Electricity generation report/certificate issued by distribution licensee on energy delivered to grid by project Solar Power project activity^{/SLDC/}, Calibration certificates^{/CAL/} of energy meter used in the project activity, power purchase agreement^{/PPA/}, commissioning certificates^{/CC/}, breakdown details^{/DGR/} etc. related to the project design and monitoring were reviewed.

Furthermore, the assessment team used additional documentation by third parties such as QA/QC procedures which is the responsibility of the O&M contractors i.e. M/s Indu Projects Limited. The O&M contractors have proper procedures for data handling and storage. The calibrations for the meters are carried out by the State Electricity Board officials. The CDM PDD mentions the calibration shall be conducted once in 3 years. The calibration certificates^{/CAL/} have been checked by the verification team and found them correct and working in safe conditions

The references used in the course of this verification are summarized in Appendix-1.

2.3 Interviews

The verification team has carried out interviews in order to assess the information included in the project documentation and to gain additional information regarding the compliance of the project with the relevant criteria applicable for the VCS. During verification the verification team has performed interviews to confirm selected information and to resolve issues identified in the document review. The main topics of the interviews were summarized in Table 2-4.

2.4 Site Inspections

The onsite visit was performed (date 24/06/2017) to check whether the project is implemented as per the description in the registered CDM PDD. The O&M personal were interviewed and the result is summarized in section 4 of this report.

Table 2-4: Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
Project proponent representatives: Pls. refer the list in annex 1.	- General aspects of the project - Technical equipment and operation - Changes since validation - Monitoring and measurement equipment - Calibration procedures - Quality management system - Involved personnel and responsibilities - Training and practice of the operational personnel - Implementation of the monitoring plan - Monitoring data management - Data uncertainty and residual risks - GHG calculation - Procedural aspects of the verification - Maintenance - Environmental aspects - Editorial issues of the Monitoring Report

2.5 Resolution of Findings

Material discrepancies identified in the course of the validation are addressed either as CARs, CLs or FARs. A Corrective Action Request (CAR) is established where:

- mistakes have been made in assumptions, application of the methodology or the project documentation which will have a direct influence the project results,
- the requirements deemed relevant for validation of the project with certain characteristics have not been met or
- there is a risk that the project would not be registered or that emission reductions would not be able to be verified and certified.

A Clarification Request (CL) will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A Forward Action Request (FAR) will be issued when certain issues related to project implementation should be reviewed during the first verification.

A detailed list of the CARs, CLs and FAR raised and discussed in the course of this validation is included in the next section 3 of this report.

2.5.1 Forward Action Requests

The final verification starts after issuance of the proposed corrective action (CA) of the CARs CLs and FARs by the project proponent. The project proponent has to reply on those and the requests are “closed out” by the assessment team in case the response is assessed as sufficient. In case of raised FARs the project proponent has to respond on this, identifying the necessary actions to ensure that the topics raised in this finding are likely to be resolved at the latest during the subsequent verification. The assessment team has to assess whether the proposed action is adequate or not.

In case the findings from CARs and CLs cannot be resolved by the project proponent or the proposed action related to the FARs raised cannot be assessed as adequate, no positive verification opinion can be issued by the assessment team.

3 VALIDATION FINDINGS

3.1 Project Details

Refer section 1.

3.2 Participation under Other GHG Programs

The project is registered under an approved GHG program, i.e. CDM registration no. 7128. The project has not participated under any other GHG program. An undertaking^{/UT/} to confirm the same was submitted by project proponent to the DoE during VCS validation of the project. This is evident from the validation report^{/VAL/} of the project.

3.3 Application of Methodology

3.3.1 Title and Reference

ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (version 12.3.0)

3.3.2 Applicability

The methodology applied for the project activity is ACM0002, Version 12.1.0 (EB 58) and the applicability conditions specified in the methodology have been evaluated with respect to the project activity. Kindly refer registered CDM PDD section B.2 at UNFCCC web link. <https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>.

3.3.3 Project Boundary

The project activity consists of the utilization of the solar radiation as input source of energy. This solar radiation is converted to direct current (DC) through Photo Voltaic cell modules and further converted to alternate current (AC) through inverters and fed into the regional grid. There are no sources of gas generation or involvement of gas either as fuel or as exhaust. For details refer registered CDM PDD section B.3 at UNFCCC web link <https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>.

3.3.4 Baseline Scenario

The details of Baseline Scenario are mentioned in registered CDM PDD section B.4 at UNFCCC web link <https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>.

3.3.5 Additionality

The details of additionally is mentioned in registered CDM PDD section B.5 at UNFCCC web link <https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>.

3.3.6 Quantification of GHG Emission Reductions and Removals

The details are mentioned in Registered CDM PDD section B.6.3
<https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>

3.3.7 Methodology Deviations

There is no deviation applied w.r.t methodology applied to the project activity.

3.3.8 Monitoring Plan

The details are mentioned in Registered CDM PDD section B.7.1
<https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>

3.4 Non-Permanence Risk Analysis

Not Applicable

4 SAFEGUARDS

4.1 No Net Harm

No potential environment or socio economic matter was found during the site visit. The project is renewable energy project and thus no negative impact observed in Air or water quality onsite. Being renewable power source and no environmental emissions involved, Solar projects are exempted from Environmental Impact Assessment (EIA) studies and environmental clearance vide EIA Notification 2006 & amendments thereof issued by Ministry of Environment, Forest & Climate Change (MoEFCC).

4.2 Environmental Impact

Not Applicable. The details are mentioned in Registered CDM PDD section D.2

<https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>

4.3 Local Stakeholder Consultation

The details are mentioned in Registered CDM PDD section E.
<https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>

4.4 Public Comments

The details are mentioned in Registered CDM PDD section E.
<https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1346316979.16/view>

5 VERIFICATION FINDINGS

In this section the assessments and findings from the desk review of the VCS PD, site visit, interviews and supporting documents as well as the final assessments are summarised. Table 4-1 includes an overview of all raised CARs, CLs and FARs.

Table 4-1: Overview of CARs, CLs and FARs issued

No.	Topic / Chapter	CAR	CL	FAR
5.1	Accuracy of GHG emission reduction or Removal calculations	3	0	0
5.2	Quality of Evidence to Determine GHG Emission Reductions and Removals	3	0	0
	Total	6	0	0

5.1 Accuracy of GHG Emission Reduction and Removal Calculations

Description

The baseline emissions reductions are based on the net electricity exported to the grid by the Solar power project activity. The project emissions are zero for the project activity. Also, as per the methodology the leakage emission need not be calculated for this project activity. Therefore the baseline emission equals the Emission Reductions. The formula used to calculate the baseline emission is as per the registered CDM PDD and applied methodology ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (version 12.3.0). The baseline emissions are calculated as a product of measured value of net electricity supplied to the grid and emission factor evaluated ex-ante for Indian regional grid of India.

The project activity is a 25 MW Solar power plant with internal electrical lines connecting the project activity with local evacuation facility. M/s Indu Projects Limited is responsible for operation and maintenance activities for this project which is also the technology and equipment supplier. According to the ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (version 12.3.0); quantity of net electricity generation supplied by the project activity to the grid in year y is monitored.

The proposed Solar power project envisages a power plant of capacity 25 MW in Charanka Village, Patan District Gujarat India which is connected grid substation of GETCO. Energy meters (3 main and 3 check meters) are installed at each feeder 1, 2 and 3 at the Solar PV substation. Details of the energy meters are checked by verification team during the site visit and review of the meter calibration certificate submitted by project proponent.

The emission reduction calculation is based on the actual monitoring values of the following monitoring parameters. The conformity of the monitoring parameters with the validated VCS PD is assessed as below.

Parameters	Measurement procedure	Source of the data	Means of verification
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Quantity of net electricity generation supplied by the project activity to the grid during the present monitoring period EG_{facility,y} in (MWh)	This is a calculated parameter based on the other monitoring parameter i.e. export and import values of each Feeder 1, 2 and 3. And is calculated as the difference of the monthly export and import electricity generation values to get the net electricity supplied to the grid.	Monthly share of electricity generation certificate for the entire monitoring period ^{/SLDC/}	The quantity of net electricity supplied to the grid on monthly basis is crosschecked with the monthly invoices raised by the project proponent.
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Net Electricity Exported to the grid by the project activity Solar Power project is calculated based on the following formula:

EG_{facility,y} is calculated as the difference between EG_{export,y} and EG_{import,y}

Where;

EG_{Export} = Electricity exported by the project activity (kWh)

EG_{Import} = Electricity Imported from the grid (kWh)

Therefore, EG_{facility,y} = 31,507 MWh

Baseline emission (BE_y) is calculated as per applied methodology ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (version 12.3.0), for new grid connected renewable power plant, the baseline emissions are the product of electricity produced by renewable energy generating unit multiplied by the emission factor of the grid which is as follows:

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

Where:

BE_y = Baseline emissions of the project activity in the year y (tCO₂)

EG_{PJ,y} = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

EF_{gridCM,y} = CO₂ emission factor of the grid in year y (tCO₂/MWh) = Combined margin CO₂ emission factor in year y (tCO₂/MWh).

Emission Factor for NEWNE grid, EF_{grid,y} = 0.9486 tCO₂/MWh

Hence,

$$BE_y = 31,507 \text{ MWh} \times 0.9486 \text{ tCO}_2/\text{MWh} \\ = 29,887 \text{ t CO}_2\text{e}$$

As provided in the methodology, emission reduction is calculated from the equation:

$$ER_y = BE_y - PE_y - LE_y$$

1. BE_y: Baseline emissions in the year y (tCO₂/y)
2. PE_y: Project emissions in the year y (tCO₂/y)
3. LE_y: Leakage emissions in the year y (tCO₂/y)
4. ER_y: Emission Reductions in the year y (tCO₂/y)

Since, project and leakage emissions are considered zero as per applied methodology and registered

CDM PDD. Therefore, Emission reductions for the current monitoring period are calculated as **ER = BE**

Hence, emission reduction for the present monitoring period (ER) = BEy = **29,887 t CO₂e**

PP is issuing the monthly invoices to distribution company (DISCOM) based on the net electricity generation value indicated in the monthly electricity share certificate/report. Based on the net electricity values indicated in invoice and in monthly electricity share certificate share certificate or report, DISCOM makes relevant payment to PP.

All the metering equipment at Solar yard substation at project site and all 6 main/check meters at feeder number 1, 2 and 3 are under the custody of state nodal agency and they are duly inspected & calibrated^{/CAL/} by state utility once in 3 years. Calibration and energy meter details for the meters are listed in section 4.3 of this report and emission reduction sheet. During the current monitoring period calibration of the both main and check meters installed at the Solar Power project yard substation is conducted on time as per defined calibration frequency. Verification team has verified all the calibration certificate of the main/check energy meters (at feeder 1, 2 and 3) and results of the calibration to confirm that the meters are working in safe and sound condition. Therefore, it is concluded by verification team that the emission reduction calculated for the current monitoring period are correct and conservative.

Further, there was not any significant period of shut-down or break-down period during the monitoring period.

All necessary monitoring instruments operating procedures for the project have been implemented in an appropriate manner. In this project, main/check energy meters with 0.2s accuracy have been installed for monitoring of the electricity export and import at feeder 1, 2 and 3 at Solar Power project yard substation.

Based on the above the values used in the emission reduction calculation^{/XLS/} are correct and formula and justification used for the calculation is consistent with the registered CDM PDD and applied methodology and related tools. Further the ex-ante fixed values and default values have been applied correctly in line with VVS version 1.0.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

MR and VCS PD	CAR 4.1.1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in un-ambiguous style; address</i>	1. Technical specification of Solar Power project activity is incomplete from the VCS monitoring report (VCS MR). 2. Date of commissioning of the all Solar Power activity is missing from		

the context (e.g. section)	section 1.5 of the VCS monitoring report (VCS MR)
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details. In case the PDD is changed as part of the CA, the PP is requested to indicate the revised sections as well as the new version No.</i>	1. Technical specification of Solar Power project equipments have been incorporated in the revised VCS MR, version 2 2. Commissioning date of solar power project has been mentioned in the revised VCS MR, version 2.
DOE Assessment #1 <i>The assessment shall encompass all open issues in annex A-1. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	1. Technical Specification of Solar power project equipment are now included in the revised version of the monitoring report. Revised VCS MR is verified by verification to be correct and in line with the registered PDD and onsite inspection of solar power project equipment. 2. Commissioning date of Solar Project been mentioned in the section 1.5 of revised VCS MR and same is crosschecked with commissioning certificate and registered PDD.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed

Monitoring Report	CAR 4.2.1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in un-ambiguous style; address the context (e.g. section)</i>	Monitoring Period duration is not consistent across the MR. Date format DD/MM/YY is not consistently used in the MR.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details. In case the PDD is changed as part of the CA, the PP is requested to indicate the revised sections as well as the new version No.</i>	The monitoring period details are updated in revised VCS MR. The correct format is also mentioned in revised in the revised VCS MR, version 2.		
DOE Assessment #1 <i>The assessment shall encompass all open issues in annex A-1. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	In revised MR Version 2.0 the monitoring period selected by project proponent i.e. 04/03/2012 to 31/12/2012 (first and last dates included) is consistently used. Also, the date format DD/MM/YY is now consistently used in the MR		
Conclusion <i>Tick the appropriate</i>	☐ To be checked during the first periodic verification ☐ Additional action should be taken (finding remains open)		

checkbox	☒ The finding is closed
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VSC MR and PD	CAR 4.2.2		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in un-ambiguous style; address the context (e.g. section)</i>	1. In Section 3 of the VCS monitoring report description used for data and parameters fixed ex ante or at renewal of crediting period (i.e. for $EF_{grid\ CM,y}$) is not consistent with the information given in registered PDD. 2. Avoid the use of “will be” “shall be” across the monitoring report as Monitoring Period includes the measures already implemented.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details. In case the PDD is changed as part of the CA, the PP is requested to indicate the revised sections as well as the new version No.</i>	1. The section 3 of revised VCS MR is updated for data and parameter fixed ex ante or at renewal of crediting period is not consistent with the information given in registered PDD. 2. Monitoring report has been revised by correcting grammatical error. Please refer to the revised VCS MR, Version 2.		
DOE Assessment #1 <i>The assessment shall encompass all open issues in annex A-1. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	1. Revised MR ver.2.0 now correctly explains the parameter $EF_{grid\ CM,y}$ included in section 3 of the VCS MR which is correct and in line with the registered PDD. 2. Revised MR now correctly updated w.r.t. use of “will be” “shall be” across the revised VCS monitoring report.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed		

Final Assessment

☒ The project is in line with the VCS requirements w.r.t this issue.

5.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

Description

Proper data management inclusive of data acquisition and aggregation, data management system is being followed for the project activity. All records needed for monitoring are archived in line with the requirements of the registered monitoring plan/^{PDD}. No significant lack of evidence and missing data were detected during on-site verification. It is evident from the monitoring data that the monitoring system ensures for

continuous (except some routine breakdowns or outage) operation details of same is provided in the annexure of the monitoring report. And this is also checked by verified by verification team during the site visit; review of daily generation report (DGR) and log database for entire months of the monitoring period and interview with the site personnel.

All internal data are subjected to QA/QC measures. M/s Indu Projects Limited is the O&M contractor and is ISO 9001:2008^{/ISO/} certified and has proper procedures for data handling which is cross checked by the verification team to ensure that the QA/QC procedure is followed as per the ISO standard.

The monitoring personnel at site are well trained and follow reproducible routines. The training records^{/TCR/} of the plant personals have been cross checked and found OK. Thus, they are competent to carry out the relevant tasks with sufficient accuracy. The net electricity exported to the grid by the project has been sourced from the monthly electricity generation report/certificate. The net electricity value has also been cross checked by the verification team with invoices raised and found OK.

The emission factor for the Indian grid to which the project activity exports power to is determined as 0.9486 tCO₂e/MWh, a value fixed ex-ante during the validation of the project activity and sourced from the official source for grid emission factor in India ("CO₂ Baseline Database for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India, Sector, Version 06" available at www.cea.nic.in). Thus the process of determining the emission reduction is appropriate and correct.

No significant, lack of evidence and missing data were detected during on-site verification. It is evident from the monitoring data that the monitoring system ensures for continuous (except some routine breakdowns or outage) operation.

The values of the net electricity supplied to grid by project activity have also been cross checked with invoices^{/INV/} raised by the PP on DISCOM and found correct. The calibration for the meters has been carried out once in 3 years which in line with the PDD. The metering equipment were inspected & tested by State Utility.

The main and check meters are tested for accuracy once every 3 years by state utility and in case of error; meters are calibrated by state utility. During the current monitoring period the Main and check meter at each feeder number 1, 2 and 3 are carried out on time as per defiend calibration frequency.

Further during the periodic meter testing, all the meters were under the permissible limit of error and accordingly none of the meter was replaced during the current monitoring period. The meters are assessed to be working in satisfactory condition. The calibration certificates^{/CAL/} are reviewed by the verification team and found to be appropriate for the current monitoring period. The errors identified during calibration are found to be within maximum permissible error of the energy meters. Based on the review of the calibration certificate report and the information included in the monitoring report and emission reduction sheet, the verification team can confirm that all installed monitoring equipment has been duly calibrated for this entire monitoring period.

Meter details & calibration details for the all the main and check meters are as follows:-

Monitoring equipment	Serial Number	Make	Accuracy Class	Previous calibration (last calibration before start of this monitoring period)	Validity of calibration(s)	Delay in calibration: yes/no
Feeder-1 Main Meter	GJ1196A	Secure	0.2s	26/12/2011	25/12/2014	☒ No ☐ Yes
Feeder-1 Check Meter	GJ1197A	Secure	0.2s	26/12/2011	25/12/2014	☒ No ☐ Yes
Feeder-2 Main Meter	GJ1440A	Secure	0.2s	26/12/2011	25/12/2014	☒ No ☐ Yes
Feeder-2 Check Meter	GJ1441A	Secure	0.2s	26/12/2011	25/12/2014	☒ No ☐ Yes
Feeder-3 Main Meter	GJ1190A	Secure	0.2s	26/12/2011	25/12/2014	☒ No ☐ Yes
Feeder-3 Check Meter	GJ1198A	Secure	0.2s	26/12/2011	25/12/2014	☒ No ☐ Yes

The allocation of responsibilities is documented in a written form and is followed as described in the CDM PDD and VCS PD. The project data will be archived for 2 years after the end of the crediting period (renewable crediting period) in the hard as well as soft copy format. Routines for the archiving of data are defined and documented.

The overall authority of the project site belongs to operation and maintenance contractor M/s Indu Projects Limited. Further project proponent has authorised M/s Indu Projects Limited who is responsible for regular monitoring and data compilation at the site. The Joint meter readings are noted in presence of representative of State Utility and representatives of O&M contractor (on behalf of Solar Power project activity owner).

The O&M contractor i.e. M/s Indu Projects Limited and the staff personnel of O&M contractor carries out activities for preventive maintenance and trouble free operation of the Solar Power project activity. The O&M service provider would be responsible for watch, ward and security of the Solar Power project, data logging for power generation, grid availability, machine availability, preparation & necessary documentation to be presented at the time of monthly joint meter reading. They are also responsible for visual inspection of Solar Power project equipments & all parts thereof and technical assistance including checking of various technical, safety and operational parameters of the equipment, trouble shooting and relevant technical services. The roles and responsibility of the different personal involved for the accurate determination of emission reduction is followed as per the registered PDD. The Management structure as presented in the monitoring report is also as per the registered PDD. The same is checked by the assessment team during the verification site visit and found correct and accurate

During the course of VCS verification process findings were raised by verification team related to quality of evidence to determine GHG emission reductions or removals and closed successfully.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

Monitoring Report	CAR 4.3.1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in un-ambiguous style; address the context (e.g. section)</i>	1. The calibration details w.r.t to project metering, i.e. calibration dates and validity are incomplete in the VCS MR. Appropriate correction is required. 2. In VCS monitoring report metering diagram for feeder wise meter details of main meters and check meters is missing.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details. In case the PDD is changed as part of the CA, the PP is requested to indicate the revised sections as well as the new version No.</i>	1. Calibration details of the project metering are now been incorporated in the revised MR, Version 2 & ER sheet. 2. Calibration details of feeder wise main and check meter located at the substation are submitted to the DOE. Details of the same also mentioned in the appendix of the revised MR, Version 2.		
DOE Assessment #1 <i>The assessment shall encompass all open issues in annex A-1. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	1. In MR Version 2.0 of the VCS monitoring report is now correctly updated w.r.t to source of data, "Monitoring equipment" type, accuracy class, and serial number and calibration frequency, as per calibration reports of feeder 1, 2 and 3 main and check meters. Verification team has checked the section 3 of the revised MR to confirm that the main and check meters are of accuracy class of 0.2S and the main and check meters are calibrated once in a period of three years as per PPA signed by PP. Further, verification team has checked the calibration certificate/ ^{CAL} of the main/check meter covering the entire monitoring period to be valid and accurate. Calibration certificate/ ^{CAL} results were also checked by verification team to confirm that the meters were working in safe conditions. In VCS MR Version 2.0, monitoring report now include the metering diagram for main/check meters for Feeder-1, Feeder-2 and Feeder-3. Metering diagram is now in line with the registered monitoring plan as well as per site visit observation by verification team.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed		

Monitoring Report	CAR 4.3.2		
Classification	☒ CAR	☐ CL	☐ FAR

Description of finding <i>Describe the finding in un-ambiguous style; address the context (e.g. section)</i>	Section C of the VCS Monitoring Report (MR) is incomplete w.r.t the monitoring system and line diagrams (graphical schemes) showing all relevant monitoring points and data collection procedures (information flow including data generation, aggregation, recording, and calculations and reporting), and emergency procedures for the monitoring system.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details. In case the PDD is changed as part of the CA, the PP is requested to indicate the revised sections as well as the new version No.</i>	Revised VCS MR is completed for monitoring system, line diagrams, data collection procedures and metering details.
DOE Assessment #1 <i>The assessment shall encompass all open issues in annex A-1. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	In revised MR Version 2.0 section C of the revised VCS Monitoring Report (MR) now updated w.r.t the following information related to 1. Monitoring system which include metering arrangement of energy meters used for metering of electricity supplied to the grid by the project activity. 2. Line diagrams showing all relevant monitoring points at each feeder which include main and check meters. 3. Data collection procedures (information flow including data generation, aggregation, recording, and calculations and reporting) followed on-site on daily and monthly basis for monitoring of electricity. 4. Emergency and QA/QC procedures for the monitoring system used by operation and maintenance personal ^{I/O&M/} on-site for perfect monitoring of the electricity generated from the project activity. Section 3.3 of the revised MR is checked by verification team to confirm that the changes are correctly updated.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed

Monitoring Report	CAR 4.4.1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in un-ambiguous style; address the context (e.g. section)</i>	The project proponent has to provide a written undertaking which states that "The project neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program, or that any such credit has been or will be cancelled from the relevant program for the monitoring period 04/03/2012 to 31/12/2012.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details. In case the PDD is changed as part of the CA, the PP is requested to</i>	The project has neither has nor intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Programme for the monitoring period 04/03/2012 to 31/12/2012. Undertaking is being submitted to DOE to ensure the same.		

indicate the revised sections as well as the new version No.	
DOE Assessment #1 The assessment shall encompass all open issues in annex A-1. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.	An undertaking ^{/UT/} regarding no double counting of emission reductions generated by this project activity has now attached with this submission for the monitoring period 04/03/2012 to 31/12/2012.
Conclusion Tick the appropriate checkbox	☐ To be checked during the first periodic verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed

Final Assessment

☒ The project is in line with the VCS requirements w.r.t this issue.

6 VALIDATION AND VERIFICATION CONCLUSION

M/s GMR Gujarat Solar Power Private Limited has commissioned the TÜV NORD JI / CDM Certification Program to carry out the verification of the Project “Grid connected 25 MW P V solar power project at Charanka in Gujarat” in Gujarat state of India with regard to the requirements of VCS 3.0 Standard.

The project activity is the installation of a 25 MW Solar Photo Voltaic power plant located at Charanka Village, Patan District Gujarat India. The power project consists of Photo Voltaic (PV) modules and inverters which are power conditioning units. The PV modules used in the project activity use polycrystalline silicon. The PV modules of Canadian Solar make are based on Polycrystalline silicon technology. The inverters are SMA make, model 500 CP of maximum 1000V DC Voltage. The direct current electricity generated by the solar cells using the sunlight converted into AC electricity is exported to present Indian grid of India through Power Purchase Agreement (PPA)^{/PPA/} with Gujarat Urja Vikas Nigam Limited (GUVNL). The project activity is achieving GHG emission reductions by supplying the net electricity generated to the Indian grid of India which is predominantly dependent on fossil fuel based power plants. The project activity results in avoidance of Green House Gases (GHGs) emission and contributes to mitigation of global warming. The Solar Power project activity (i.e. green field project activity) has been commissioned on 04/03/2012.

Reporting period: From 04/03/2012 to 31/12/2012 (both dates inclusive)

In the course of verification 06 Corrective Action Requests (CARs) and closed successfully. No clarification request (CL) and forward action request (FAR) was envisaged for present verification.

The verification is based on the registered CDM PDD^{/CDM-PDD/}, Final validation report of CDM^{/FVR-CDM/}, Monitoring report^{/MR/}, supporting emission reduction calculation sheet^{/XLS/} VCS Project Document^{/VCS-PD/} and other supporting documents like commissioning certificate^{/CC/} breakdown records^{/DGR/}, Calibration certificate^{/CAL/}, Invoices^{/INV/} etc. made available to the TÜV NORD JI/CDM CP by the project participant.

In detail the conclusions can be summarised as follows:

- all operations of the project are implemented and installed as planned and described in the validated project description.
- the monitoring plan is in accordance with the applied approved CDM methodology ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources" (version 12.3.0)
- the installed equipment essential for measuring parameters required for calculating emission reductions are calibrated^{/CAL/} once in 3 years as per the monitoring plan.
- the monitoring system is in place and functional. The project has generated GHG emission reductions.

As the result of the VCS verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the project has achieved emission reductions in the above mentioned reporting period as follows

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)
2012	29,887	0	0	29,887
Total	29,887	0	0	29,887

Vadodara, 20/11/2018



Mr. Indrapal Parmar

TÜV NORD JI/CDM Certification Program
Verification Team Leader

Essen, 20/11/2018



Mr. Stefan Winter

TÜV NORD JI/CDM Certification Program
Final Approval

APPENDIX 1: LIST OF REFERENCES

Table Annex 1.1: Documents provided by the project participant

Reference	Document
/CAL/	1. Calibration Certificate for Main/check meter for Feeder-1 (ref. section 4.3) 2. Calibration Certificate for Main/check meter for Feeder-2 (ref. section 4.3) 3. Calibration Certificate for Main/check meter for Feeder-3 (ref. section 4.3)
/CCI/	Commissioning Certificate issued by GEDA dated 09/03/2012
/DGR/	Daily plant reports and log sheet maintained at the project site (incl. Sample copy of project operation records; Equipment daily check log; Equipment mandatory maintenance records) for the entire monitoring period.
/INV/	Monthly invoices for electricity generation report called as State Energy Account (SEA) for the entire months of the monitoring period.
/ISO/	ISO 9001:2008 QMS certificate submitted by project proponent for QA/QC
/MR/	- Monitoring Report of the Project titled “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 1.0 dated 05/05/2017. - Monitoring Report of the Project titled “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 2.0 dated 20/06/2017. - Monitoring Report of the Project titled “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 3.0 dated 06/04/2018. - Monitoring Report of the Project titled “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 4.0 dated 17/07/2018. - VCS Joint Project Description & Monitoring Report, 5.0, dated 16/10/2018
/OMC/	Contract agreement for the operation and maintenance of Solar PV Plant dated 15/06/2011 between the GMR Gujarat Solar Limited and M/s Indu Projects Limited
/PPA/	Power Purchase Agreement dated 08/12/2010 between GMR Gujarat Solar Limited and GUVNL.
/SLDC/	Monthly electricity generation report called as State Energy Account (SEA) prepared by State Load Dispatch Centre- Gujarat Energy Transmission Corporation Ltd for the entire months of the monitoring period.
/TS/	Technical Particulars of Solar Modules, Inverter, Transformer, Energy Meters
/TR/	Train Project Responsibilities, Training and Competence Records - Project Organization Chart and responsibilities - Staff Training Records - Operator Certificates of the power plant - Internal audit record covering this monitoring period records of the operational and maintenance personnel maintained on-site
/UT/	An undertaking regarding no double counting of emission reductions generated by this project activity for the monitoring period 04/03/2012 to 31/12/2012
/VCS-PD/	VCS PD for the project activity “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 1.0 dated 05/05/2017.

	- VCS PD for the project activity “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 2.0 dated 25/04/2018. - VCS PD for the project activity “Grid connected 25 MW P V solar power project at Charanka in Gujarat” version 3.0 dated 17/07/2018.
/XLS/	- Excel calculation sheet w.r.t monitoring report version 1.0 dated 05/05/2017. - Excel calculation sheet w.r.t monitoring report version 2.0 dated 20/06/2017. - Excel calculation sheet w.r.t monitoring report version 3.0 dated 06/04/2018. - Excel calculation sheet w.r.t monitoring report version 4.0 dated 17/07/2018.

Table Annex 1.2: Background investigation and assessment documents

Reference	Document
/ACM0002/	ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” (version 12.3.0)
/CDM-PDD/	Registered Project Design Document for CDM project: “Grid connected 25 MW P V solar power project at Charanka in Gujarat”, version 7.0, dated 20/08/2012.
/CPM/	TÜV NORD JI / CDM CP Manual (incl. CP procedures and forms)
/FVR-CDM/	Validation Report for CDM project “Grid connected 25 MW P V solar power project at Charanka in Gujarat” Ver. 03.0, dated 21/08/2012.
/IPPC/	1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book
/ISO 14064/	Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions
/ISO14065/	Greenhouse gases -- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition
/VCS/	Verified Carbon Standard version 3.7
/VDS-PD-T/	VCS Joint project description and monitoring report template and Joint project

Reference	Document
	description and monitoring report Template Ver.3.1 VCS Joint validation and verification report template ver.3.1
/VVS/	UNFCCC Validation and Verification Standard (Version 1.0) VCS Validation and Verification Manual (Version 3.2)

Table Annex 1.3: Websites used

Reference	Link	Organisation
/CEA/	www.cea.nic.in	Central Electricity Authority
/ipcc/	www.ipcc-nggip.iges.or.jp	IPCC publications
/vcs/	http://verra.org/	VCSA
/unfccc/	http://cdm.unfccc.int	UNFCCC

Table Annex 1.4: List of interviewed persons

Reference	Mol ¹		Name	Organisation / Function
/IM01/	E, T	☒ Mr. ☐ Ms	Vivek Sadevra	Manager-EHS / M/s GMR Gujarat Solar Power Private Limited
/IM02/	V	☒ Mr. ☐ Ms	Rai Teja P	Site In-charge (Operation & Maintenance)/ M/s Indu Projects Limited
/IM02/	V	☒ Mr. ☐ Ms	Jatarali Vaghmara	Junior Engineer (Operation & Maintenance)/ M/s Indu Projects Limited
/IM02/	V	☒ Mr. ☐ Ms	Shabhir Ali	Jr. Engineer / M/s Indu Projects Limited
/IM02/	V	☒ Mr. ☐ Ms	Ajay P.G	Jr. Engineer / M/s Indu Projects Limited
/IM02/	V	☒ Mr. ☐ Ms	Devraj B.J	Jr. Engineer / M/s Indu Projects Limited

¹⁾ Means of Interview: (Telephone, E-Mail, Visit)