JCM Verification Report Form

A. Summary of verification

A.1. General Information

Title of the project	10 MW Solar Power Project in Darkhan City
Reference number	MN004
Monitoring period	01/01/2017 - 31/07/2017
Date of completion of the monitoring report	02/10/2017
Third-party entity (TPE)	Lloyd's Register Quality Assurance Limited (LRQA)
Project participant contracting the TPE	Sharp Corporation
Date of completion of this report	03/10/2017

A.2 Conclusion of verification and level of assurance

Overall verification opinion	☒ Positive ☐ Negative
☒ Unqualified opinion	Based on the process and procedure conducted, *Lloyd's Register Quality Assurance Limited (LRQA)* (TPE's name) provides reasonable assurance that the emission reductions for *10 MW Solar Power Project in Darkhan City* (project name) ✓ Are free of material errors and are a fair representation of the GHG data and information, and ✓ Are prepared in line with the related JCM rules, procedure, guidelines, forms and other relevant documents
(If overall verification opinion is negative, please check below and state its reasons.) ☐ Qualified Opinion ☐ Adverse opinion ☐ Disclaimer	<State the reasons> Not applicable

A.3. Overview of the verification results

Item	Verification requirements	No CAR or CL remaining
The project implementation with	The TPE determines the conformity of the actual project and its operation with the eligibility criteria of	☒

Item	Verification requirements	No CAR or CL remaining
the eligibility criteria of the applied methodology	the applied methodology.	
The project implementation against the registered PDD or any approved revised PDD	The TPE assesses the status of the actual project and its operation with the registered/validated PDD or any approved revised PDD.	☒
Calibration frequency and correction of measured values with related requirements	If monitoring Option C is selected, the TPE determines whether the measuring equipments have been properly calibrated in line with the monitoring plan and whether measured values are properly corrected, where necessary, to calculate emission reductions in line with the PDD and Monitoring Guidelines.	☒
Data and calculation of GHG emission reductions	The TPE assesses the data and calculations of GHG emission reductions achieved by/resulting from the project by the application of the selected approved methodology.	☒
Avoidance of double registration	The TPE determines whether the project is not registered under other international climate mitigation mechanisms.	☒
Post registration changes	The TPE determines whether there are post registration changes from the registered PDD and/or methodology which prevent the use of the applied methodology.	☒

Authorised signatory: Mr. ☒ Ms. ☐

Last name: Chiba First name: Michiaki

Title: Climate Change Manager - Asia & Pacific

Specimen signa [redacted] Date: 03/10/2017

B. Verification team and other experts

	Name	Company	Function*	Scheme competence*	Technical competence*	On-site visit
Mr. ☒ Ms. ☐	Michiaki Chiba	LRQA Ltd.	Team leader	☒	Technical competence authorised	☒
Mr. ☒ Ms. ☐	Stewart Niu	LRQA China	Internal reviewer	☒	N/A	☐
Mr. ☐ Ms. ☐				☐		☐
Mr. ☐ Ms. ☐				☐		☐

Please specify the following for each item.

* *Function: Indicate the role of the personnel in the validation activity such as team leader, team member, technical expert, or internal reviewer.*
* *Scheme competence: Check the boxes if the personnel have sufficient knowledge on the JCM.*
* *Technical competence: Indicate if the personnel have sufficient technical competence related to the project under validation.*

C. Means of verification, findings and conclusions based on reporting requirements

C.1. Compliance of the project implementation and operation with the eligibility criteria of the applied methodology

<Means of verification>

LRQA has determined during the verification process that the actual implementation and operation of the project has been conducted in conformance with the eligibility criteria of the applied methodology.

The project applied the approved methodology: JCM_MN_AM003_ver02.0 "Installation of Solar PV System, Ver. 02.0".

LRQA assessed by means of an on-site visit that the physical features of the project are in place and that the PPs have operated the project as per the eligibility criteria of the applied methodology. The steps taken to verify each eligibility criterion and the conclusions about implementation of the project are summarised as below.

Criterion 1: The project newly installs solar PV system(s).

Justification in the PDD: The project installs 10MW green-field solar power plant in Darkhan City.

Steps taken for assessment: The verification team assessed the project documentation, technical specification and production line test report of the project solar PV system, the power purchase

agreement (PPA), and conducted physical on site assessment.
Conclusion: The verification team confirmed that the project installs a new solar PV system and the criterion is met by the project. The project 10 MW solar power plant was constructed during July to December 2016 and started the commercial operation from 01/01/2017.

Criterion 2: The PV modules obtained a certification of design qualifications (IEC 61215, IEC 61646 or IEC 62108) and safety qualification (IEC 61730-1 and IEC 61730-2).
Justification in the PDD: The PV modules installed in the project have been certified for IEC 61215, IEC 61730-1 and IEC 61730-2).
Steps taken for assessment: The verification team reviewed the technical specification of the PV module and the quality certificates.
Conclusion: The verification team confirmed that the Sharp's PV module model ND-AF310 employed by the project has been certified with IEC 61215, IEC 61730-1 and IEC 61730-2 as appropriate. The criterion is met by the project.

Criterion 3: The equipment used to monitor output power of the solar PV system(s) and irradiance is installed at the project site.
Justification in the PDD: Electricity meter and pyranometer have been installed at the project site to monitor output power and irradiance respectively.
Steps taken for assessment: The verification team assessed the project documentation, technical specification of the monitoring system, and conducted physical on site assessment.
Conclusion: The verification team confirmed that the equipment to monitor output power of the solar PV system and irradiance has been installed at the project site. The criterion is met by the project.

The verification team confirmed that the eligibility conditions are satisfied by the project by reviewing the supporting documents and the on site assessment.
The details of the persons interviewed and the documents reviewed are shown in the Section F of this report.

<Findings>

Please state if CARs, CLs, or FARs are raised, and how they are resolved.

No issue was raised to the requirements of the section.

<Conclusion based on reporting requirements>

Please state conclusion based on reporting requirements.

The verification team confirmed that the project has been implemented in conformity with the eligibility criteria of the applied methodology.

C.2. Assessment of the project implementation against the registered PDD or any approved revised PDD

<Means of verification>

The project installed 10 MW grid connected solar PV system in Darkhan City, Darkhan-Uul Province, Mongolia. The electricity generated by the solar PV system is supplied to the Central Energy System of Mongolia (CES). The project solar PV system applies Sharp's crystalline silicon PV modules model ND-AF310. The project has been implemented by Solar Power International LLC from Mongolia and Sharp Corporation from Japan (the PPs).

The start date of project operation is on 01/01/2017 and the expected operational lifetime of the project is for 17 years.

The project has been selected as one of the JCM model projects by the Ministry of the Environment, Japan (MOE) and receives financial support from the Government of Japan.

The verification team assessed the Monitoring Report (MR) consists of Monitoring Report Sheet (MRS) parts of the Monitoring Spreadsheet and the supporting documents, conducted a physical site visit to assess the status of the actual project and its operation in accordance with the registered PDD. No revision to the registered PDD was requested.

The verification team determined through the verification process that the implementation and operation of the project has been in accordance with the description contained in the registered PDD. The verification team, by means of a desk review and an on-site visit, assessed that:

- all physical features of the JCM project described in the registered PDD are in place, and
- the PPs have operated the JCM project as per the registered PDD.

The MR follows the Monitoring Plan (MP) of the registered PDD that have been established based on the approved methodology. The parameter to be monitored ex-post is EGi,p Quantity of the electricity generated by the project solar PV system i during the period p (in MWh/p). The electricity meters measure the output power from the solar PV system consisting of 32,274 x 310 W PV panels in 8 blocks and each block has 2 x 630 kW power conditioners and 1,600 kVA transformer, and a 11 MVA main power transformer.

The roles and responsibilities of the persons are described in the Monitoring Structure Sheet (MSS) in accordance with the requirements of the applied methodology. There was no change in the organizational structure during the monitoring period.

The verification team checked the status of implementation of the environmental management plan (EMP) and confirmed the PPs have followed the EMP and measures for environmental improvement were implemented including tree planting in response to request of the local stakeholders. A report of EMP implementation will be prepared for approval by the local authority after one year operation of the project plant.

Through the processes taken, CL 1 and CL 2 were raised as the resolution detailed below.

The details of the persons interviewed and the documents reviewed are shown in the Section F

of this report.

<Findings>

Please state if CARs, CLs, or FARs are raised, and how they are resolved.

Grade / Ref: CL 1

Nature of the issue raised: The PPs were requested to clarify implementation of the procedures to keep the relevant data and information required for the verification and issuance.

Nature of responses provided by the PPs: The PPs provided the detailed procedures that clarify the data and information controls having been implemented.

Assessment of the responses: The verification team reviewed the detailed monitoring procedures and confirmed through the on site assessment that the data and information controls were implemented in accordance with the registered MP during the monitoring period. The procedures clarify that data monitored and required for the verification and issuance will be kept in electronic records for two years after final issuance of credits. The CL was closed.

Grade / Ref: CL 2

Nature of the issue raised: The PPs were requested to clarify the implementation of the monitoring procedures including the QA/QC procedures in use of the electricity meters, cross checking of the monitored data and responsibility of maintaining the monitoring equipment.

Nature of responses provided by the PPs: The PPs provided the detailed monitoring procedures that clarify the QA/QC procedures being implemented.

Assessment of the responses: The verification team reviewed the detailed monitoring procedures and confirmed through the on site assessment that the QA/QC procedures implemented during the monitoring period to fulfil the requirements of the registered MP. The project uses the main electricity meter (Meter 1) and the check meters. Meter 2 is multi-functional power meter installed in the project solar power plant, and Meter 3 is the trade meter installed in Darkhan Substation of the electricity grid. The measured data is cross checked and applied in the order of Meter 1, Meter 2 and Meter 3 if normal data is obtained. The verification team confirmed that the procedures were followed in particular to determine the amount of electricity generation when Meter 1 was replaced in February 2017 due to the initial technical trouble. The data of Meter 3 is used for January 2017 that was confirmed as reliable data and conservative for ERs calculation in consideration of transmission loss. Meter 2 was connected to SCADA and started recording the measured data from 25/01/2017 and the data of Meter 2 is used for February 2017 after checked with the data of Meter 3. Meter 1 provided normal data from March, 2017 as cross checked in accordance with the monitoring procedures. The procedures also clarify responsibility of maintenance and calibration of the electricity meters. The CL was closed.

<Conclusion based on reporting requirements>

Please state conclusion based on reporting requirements.
The verification team confirmed that the project was implemented and operated in accordance with the registered PDD and no revision to the same was requested for the monitoring period.

C.3. Compliance of calibration frequency and correction of measured values with related requirements

<Means of verification>

The parameter No. (1) EGi,p applies the monitoring Option C and the monitoring of the parameters use electricity meters as the measuring equipment. The main electricity meter installed at the substation of the project solar power plant was calibrated by Mongolian Agency for Standardization and Metrology on 27/02/2014. The meter will be recalibrated every 8 years in accordance with the requirement of the PPA and the current calibration is valid until 27/02/2022. No correction was required to the measured values to calculate emission reductions in line with the PDD and Monitoring Guidelines during the monitoring period.

The electricity generated by the project solar power plant is sold to the electricity grid company and the trade meter having the accuracy level of 0.2s is installed in Darkhan Substation of the grid company locating next to the project solar power plant. The trade meter is subject to re-calibration every 4 years as required in the host country regulation. The electricity meter installed in the project solar power plant is of the same model and accuracy level as the trade meter to check the amount of electricity supplied and received at the both ends as required in the PPA. The calibration frequency is differentiated as every 8 years for the meter installed at the project power plant as it is not a trade meter. The date of calibration is 27/02/2014 because the originally installed electricity meter faced an initial technical trouble and was replaced by the manufacturer on 13/02/2017 with an already calibrated spare meter. The electricity meter installed at the power plant and an electricity multi meter are both connected to SCADA system and checked to identify any abnormal data. A comparison is also conducted monthly with data of the trade meter in Darkhan Substation. All the meters are applied with the standard MNS IEC 62053-22.

Through the processes taken, CAR 1 was raised as the resolution detailed below.

The details of the persons interviewed and the documents reviewed are shown in the Section F of this report.

<Findings>

Please state if CARs, CLs, or FARs are raised, and how they are resolved.

Grade / Ref: CAR 1

Nature of the issue raised: The details of the electricity meter were not indicated in the MRS, including the accuracy level and calibration information (frequency, date of calibration and validity).

Nature of responses provided by the PPs: The information of electricity meter was added in the revised MRS. The accuracy level is 0.2s. The calibration was conducted on 27/02/2014 and the calibration frequency is every 8 years.

Assessment of the responses: The verification team reviewed the revised MR and confirmed the required details are provided for the electricity meter. The verification team also reviewed the technical specification of the electricity meters, the PPA, calibration certificates and conducted on site assessment. The electricity generated by the project solar power plant is sold to the electricity grid company and the trade meter having the accuracy level of 0.2s (Meter 3) is installed in Darkhan Substation of the grid company. The trade meter is subject to re-calibration every 4 years as required in the host country regulation. The electricity meter installed in the project solar power plant (Meter 1) is of the same model and accuracy level as the trade meter to check the amount of electricity supplied and received at the both ends as required in the PPA. The calibration frequency is differentiated as every 8 years for Meter 1 as it is not a trade meter. The date of calibration is 27/02/2014 because the originally installed electricity meter faced an initial technical trouble and was replaced by the manufacturer on 13/02/2017 with an already calibrated spare meter. The CAR was closed.

<Conclusion based on reporting requirements>

Please state conclusion based on reporting requirements.

The verification team confirmed that the measuring equipment applied for the parameter satisfied the requirements of the MP concerning the regular calibration and no correction was required to the measured values during the monitoring period.

C.4. Assessment of data and calculation of GHG emission reductions

<Means of verification>

The MR is developed using the MRS applied to the registered JCM project that is confirmed fulfilment of the requirements of the MRS of the applied methodology.

LRQA has determined that:

1. a complete set of data for the specified monitoring period is available,
2. information provided in the MR has been cross-checked with other sources such as plant log books, inventories, purchase records, laboratory analysis,
3. calculations of reference emissions (REs) and project emissions (PEs), as appropriate, have been carried out in accordance with the formulae and methods described in the MP and the applied methodology,
4. any assumptions used in emission calculations have been justified, and
5. appropriate emission factors, default values and other reference values have been correctly applied.

The project introduces solar PV system and emission source is consumption of grid electricity

in the reference scenario. PEs is not applicable for generation of electricity from solar PV systems in accordance with the applied methodology.
The REs are determined as a product of quantity of electricity generated by the solar PV system and the default reference CO2 emission factor of the applied methodology at 0.797 tCO2/MWh. The project system is not connected to a captive power generator.
The GHG emission reductions during the monitoring period are calculated as: ERp = REp - PEp = REp = Σ _i (EG_i,p x EF_RE,i) = 11,227 MWh x 0.797 tCO2/MWh = 8,947 tCO2e.
The verification team assessed the reported data with documented evidence and by means of on site visit.
Achieved electricity generation in first monitoring period of 7 months (212 days) is 11,227 MWh in total, that is 19,329.50 MWh (11,227 MWh x 365/212) in a whole year and 37% higher level than ex-ante estimate in PDD of 14,079 MWh. The ex-ante estimation was based on data provided by Meteonorm and 10-20 year historical average irradiation, but the database did not provide data in Darkhan and the accuracy of estimation was limited. When compared the data from January to July covered by the monitoring period, average irradiation is 24% higher for the actual data than the ex-ante estimated data, that resulted in 26% higher electricity generation. This variation is due to limitation of data for ex-ante estimation and it is also uncertain in outcomes of the rest of year, i.e. August to December, and the other years during the crediting period. Therefore the verification team concluded no amendment to the estimated ERs in the PDD is necessary to be requested at this stage.
The details of the persons interviewed and the documents reviewed are shown in the Section F of this report.

Parameters	Monitored values	Method to check values in the monitoring report with sources
EGi,p	11,227 MWh/p	Assessement was conducted based on records of monthly meter readings and on site assessment.

<Findings>

Please state if CARs, CLs, or FARs are raised, and how they are resolved.

No issue was raised to the requirements of this section.

<Conclusion based on reporting requirements>

Please state conclusion based on reporting requirements.

The verification team confirmed that appropriate methods and formulae for calculating REs and PEs have been followed. The verification team is of the opinion that all assumptions, emission

factors and default values that were applied in calculations have been justified.

C.5. Assessment of avoidance of double registration

<Means of verification> The verification team assessed and confirmed relevance of the written confirmation from the PPs that the project is not registered under the other international climate mitigation mechanisms. The team in addition to the interviews with the PPs checked publicly accessible information of Clean Development Mechanism (CDM), Joint Implementation (JI), Verified Carbon Standard (VCS) and Gold Standard (GS) and found no identical project as the proposed JCM project in terms of the name of entities, applied technology, scale and the location. The result of researches confirmed that the proposed project was not registered under the other international climate mitigation mechanisms than JCM and it will not result in a double counting of GHG emission reductions. The details of the persons interviewed and the documents reviewed are shown in the Section F of this report. **<Findings>** *Please state if CARs, CLs, or FARs are raised, and how they are resolved.* No issue was raised to the requirements of this section. **<Conclusion based on reporting requirements>** *Please state conclusion based on reporting requirements.* The verification team confirmed that the project is not registered under other international climate mitigation programs.

C.6. Post registration changes

<Means of verification> The verification team assessed the project documentation and through the on site visit and confirmed that there was no post registration change from the registered PDD or the approved methodology. **<Findings>** *Please state if CARs, CLs, or FARs are raised, and how they are resolved.* No issue was raised to the requirements of this section. **<Conclusion based on reporting requirements>** *Please state conclusion based on reporting requirements.* The verification team through the verification processes determined that there was no post registration change from the registered PDD or approved methodology which prevent from use of the applied methodology.

D. Assessment of response to remaining issues

An assessment of response to the remaining issues including FARs from the validation and/or previous verification period, if appropriate

No FAR was issued in the validation and this is the first verification of the project.

E. Verified amount of emission reductions achieved

Year	Verified Reference Emissions (tCO_2e)	Verified Project Emissions (tCO_2e)	Verified Emission Reductions (tCO_2e)
2013			
2014			
2015			
2016			
2017	8,947	0	8,947
2018			
2019			
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027			
2028			
2029			
2030			
Total (tCO_2e)	8,947	0	8,947

F. List of interviewees and documents received

F.1. List of interviewees

Solar Power International LLC

Baldan Mandalbayar, Executive Director

Bileguun Mandalbayar, General Accountant

Ideshtoytock Galkhuu, General Engineer

Sharp Corporation

Junichi Hara, Supervisor, Project Promotion Division, Engineering Business Unit, Energy Solutions BU

Shoko Fukahori, Supervisor, Global Sales and Marketing Division, Global Business Unit, Energy Solutions BU Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. Kikuko Shinchi, Senior Consultant

F.2. List of documents received

Category A documents (documents prepared by the PPs) - Monitoring report dated 25/08/2017, 26/09/2017 and 02/10/2017 - Monthly records of electricity generation - Monthly electricity production reports - Technical specification of project solar PV system - List of solar PV modules and photographs - Layout of solar power plant - Quality certificates for the solar PV modules - Technical specification of power conditioner - Technical specification of electricity meters - Calibration certificates of electricity meters, Mongolian Agency for Standardization and Metrology - Test report of multi-functional power meter - Technical specification of pyranometer - Permission of electricity grid connection and power sale - Single line diagram - SCADA system diagram - Power sales agreement - Training materials - Records of internal data checks - Operation and maintenance records - Declaration letters on no double registration - Mongolian Government Resolution No. 374, the Law on Environmental Impact Assessment - Environmental Management Plan - Result of the estimated output power from the 10,004.94 kW Solar PV system, Sharp Corporation, 07/10/2015 - Estimated power generation for 20 years calculation considering deterioration ratio, 21/02/2017

- Analysis of actual electricity generation during Jan. to Jul. 2017
- Report of environmental works 2017
- Certification of current transformer, Jiangsu Sieyuan Hertz Instrument Transformer Co., Ltd.
- Certification of capacitor voltage transformers, Jiangsu Sieyuan Hertz Instrument Transformer Co., Ltd.
- Historical irradiation data from Meteonorm
- Monitoring procedures
- Monthly report preparation procedures

Category B documents (other documents referenced)
- Registered PDD Version 03.0 dated 13/03/2017 and the Monitoring spreadsheet
- MoC dated 02/02/2017
- Validation report for the project dated 29/03/2017
- JCM_MN_AM003_ver02.0 Installation of Solar PV System, Ver.02.0
- JCM Project Cycle Procedure JCM_MN_PCP_ver04.0
- JCM Guidelines for Validation and Verification JCM_MN_GL_VV_ver01.0
- JCM Guidelines for Developing PDD and MR JCM_MN_GL_PDD_MR_ver03.0
- JCM Glossary of Terms JCM_MN_Glossary_ver01.0
- Monitoring reports and verification reports of JCM projects Ref #MN001 and MN002 (issued)
- Proposed and registered projects under CDM, VCS, Gold Standard, and the other international schemes
- VDE approved products database
- IEC 62053-22:2003, Electricity metering equipment (ac) - Particular requirements. Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)
- Meteonorm http://www.meteonorm.com/
- SCALING-UP RENEWABLE ENERGY PROGRAMME (SREP) Investment Plan for Mongolia, Government of Mongolia, December 2015
- Outline of Desert Solar Power Project, European Bank for Reconstruction and Development, November 2016

Annex Certificates or curricula vitae of TPE's verification team members, technical experts and internal technical reviewers

Please attach certificates or curricula vitae of TPE's validation team members, technical experts and internal technical reviewers.

Certificate of Appointment is attached to this report.

Joint Crediting Mechanism Certificate of Appointment

Title of Project: 10 MW Solar Power Project in Darkhan City
(Project #MN004)
Verification for the first monitoring period: 01/01/2017 – 31/07/2017

We hereby certify that the following personnel have engaged in the verification process that has fully satisfied the competence requirements of the verification of the JCM project.

Name of Person	Assigned Roles
Michiaki Chiba	Team Leader
Stewart Niu	Technical Reviewer

Signed by

Michiaki Chiba
Climate Change Manager – Asia & Pacific
15/08/2017