JCM Verification Report Form

A. Summary of verification

A.1. General Information

Title of the project	A HIGH EFFICIENCY AND LOW LOSS POWER TRANSMISSION AND DISTRIBUTION SYSTEM IN MONGOLIA
Reference number	MN005
Monitoring period	02/12/2017 – 31/12/2018
Date of completion of the monitoring report	14/02/2019
Third-party entity (TPE)	Lloyd's Register Quality Assurance Limited (LRQA)
Project participant contracting the TPE	Hitachi, Ltd.
Date of completion of this report	20/02/2019

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 *A HIGH EFFICIENCY AND LOW LOSS POWER TRANSMISSION AND DISTRIBUTION SYSTEM IN MONGOLIA* (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 eligibility criteria of the applied methodology	The TPE determines the conformity of the actual project and its operation with the eligibility criteria of 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 signature: [redacted]		Date: 20/02/2019

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_AM001_ver01.0 Installation of energy-saving transmission lines in the Mongolian Grid".

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 transmission line constitutes of a single or double circuit(s) directly connecting a substation and another substation within the country with no branching in between, and does not constitute a part of a loop.

Justification in the PDD: This project involves the placement of low-loss transmission lines in

between the new Oyu Tolgoi substation and Tsagaan Suvarga substation. There are no branch lines or loops present within the interval. Therefore, the project fulfils this criterion.
Steps taken for assessment: The verification team assessed the project documentation, technical specification, and conducted physical on site assessment.
Conclusion: Based on the verification processes taken, the verification team confirmed that the project transmission line is a single circuit line directly connecting new Oyu Tolgoi (NOT) and Tsagaan Suvarga (TS) Substations in southern Mongolia. There is no branching between the 2 substations and it does not constitute a part of a loop. Therefore the criterion is met by the project.

Criterion 2: The type of conductor is LL-ACSR/SA, which meets the following technical criteria.

Type of energy-saving conductors	unit	Equivalent to LL-ACSR/SA 279/20mm2	Equivalent to LL-ACSR/SA 337/27mm2	Equivalent to LL-ACSR/SA 445/36mm2
Outer diameter of conductor	mm	≦ 21.6	≦ 24.0	≦ 27.5
Direct current resistance (@20degC)	Ω/km	≦ 0.1063	≦ 0.0862	≦ 0.0659
Tensile strength	N	≧ 75,050	≧ 90,574	≧ 120,481
Weight	kg/km	≦ 921	≦ 1,132	≦ 1,490
Corresponding conductors currently in use that forms the basis of calculating the reference emissions		ACSR 240/32mm2	ACSR 300/39mm2	ACSR 400/51mm2

Justification in the PDD: The specifications of the transmission line to be placed in this project are as follows, and meet those outlined in the eligibility criterion.
Specification of low-loss conductor;
- External diameter：27.5 mm
- Direct-current resistance：0.064 Ω/km
- Tensile strength ：120,600N

- Weight : 1,490 kg/km

Steps taken for assessment: The verification team reviewed the technical specification, test reports, and conducted physical on-site assessment.

Conclusion: Based on the verification processes taken, the verification team confirmed that the project low loss transmission line of conductor equivalent to LL-ACSR/SA 445/36mm2 satisfies the specification. Therefore the criterion is met by the proposed 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 a high efficiency and low-loss power transmission line made in Japan that reduces transmission loss compared to a conventional transmission line, and contributes to reducing greenhouse gas (GHG) emissions. The project transmission line is a single-circuit transmission line spanning 159.4 km between NOT Substation in Omnogovi Province and TS Substation in Dornogovi Province in southern region of Mongolia. The project is implemented by NATIONAL POWER TRANSMISSION GRID State Owned Stock Company (NPTG) from Mongolia and Hitachi, Ltd. from Japan. The project receives financial support for JCM demonstration projects from the New Energy and Industrial Technology Development Organization (NEDO), 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.

The start date of project operation was changed from 01/10/2017 as indicated in the registered PDD to 02/12/2017 to reflect the actual implementation of the project. The verification team

confirmed the post registration change that do not affect applicability of the approved methodology based on the revised PDD as mentioned below.
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 with the post registration change. 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 with the post registration change.

The MR follows the Monitoring Plan (MP) of the registered PDD that have been established based on the approved methodology.
The parameters to be monitored ex-post are E_L,send,y Power sent from the point of origin/supply to the transmission line L in year y (in MWh/y), E_L,receive,y Power received at the point of receipt of the transmission line L in year y (in MWh/y), and EF_Grid,y CO2 emission factor of the grid in year y (in tCO2/MWh). The electrical power meters measure electricity transmission at the both ends of the project transmission line to determine the electrical power loss. The most recent data of CO2 emission factor of the grid available at the time of submission of the MR is applied.
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 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.
Please refer to CAR 1 and its resolution as detailed in below Section C.4. on the change of the start date of the project operation.
<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 with the post registration change and a revision requested for the start date of the project operation in accordance with the actual date.

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

<Means of verification>

The parameters No. 1. E_L,send,y and No. 2. E_L,receive,y apply the monitoring Option C and the monitoring of the parameters use electrical power meters as the measuring equipment. The electrical power meters installed at the two substations of the both ends of the project transmission line were initially calibrated on 13/02/2017. The electrical power meters are supposed to be recalibrated every year after start of the operation according to the registered MP, though the calibration of the subject measuring equipment is not a requirement of the national laws and regulations in the host country.

The first monitoring period covers the period from 02/12/2017 to 31/12/2018. Actual start date of project operation was confirmed as 02/12/2017. The PPs conducted the second calibration of the electrical power meters on 03/01/2019 after the end of the monitoring period. The verification team reviewed the records of the delayed calibration and confirmed that the instrumental errors identified in the delayed calibration test were less than 5% and no correction was required to the measured values to calculate emission reductions in line with the JCM Guidelines for Developing PDD and MR during the monitoring period.

Through the processes taken, CAR 2 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 2

Nature of the issue raised: The Measurement methods and procedures of the MRS did not include the information of the subsequent calibration of the measuring equipment conducted in January 2019.

Nature of responses provided by the PPs: The PPs added the information of the calibration conducted in January 2019 in the revised MR.

Assessment of the responses: The verification team reviewed the revised MR and confirmed that the information of the subsequent calibration of the electrical power meters conducted on 03/01/2019 has been incorporated.

<Conclusion based on reporting requirements>

Please state conclusion based on reporting requirements.

The verification team confirmed that the measuring equipment applied for the parameters satisfied the requirements of the MP concerning the regular calibration with the delayed calibration conducted 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 a low loss transmission line and emission source is transmission loss of the reference transmission line in the reference scenario and transmission loss of the project transmission line.

The REs and PEs are determined as a product of the transmission loss of the reference transmission line and the project transmission line and the CO2 emission factor. Transmission loss of the project transmission line is the difference of monitored power sent from the point of origin/supply to the transmission line and power received at the point of receipt of the transmission line. The transmission loss of the reference transmission line is calculated from the transmission loss of the project transmission line and the direct current resistance of transmission line applied to the reference transmission line at 0.0718 Ω/km and the project transmission line at 0.0640 Ω/km as determined at the validation and fixed ex-ante. The CO2 emission factor uses the most recent data at the time of submission of the MR. The Standardized Baseline ASB0039-2018 Grid emission factor for Mongolia's national electricity grid Version 01.0 was approved by the CDM Executive Board and made publicly available on 17/07/2018. The Combined margin CO2 emission factor for Mongolia's national electricity grid applicable to all project activities except wind and solar power generation for first crediting period as 0.859 tCO2/MWh is chosen and applied as appropriate.

The GHG emission reductions during the monitoring period are calculated as: ERp = REp - PEp = REp = Σ _L (LOSS_RF,L,y x EF_grid,y) - Σ _L (LOSS_PJ,L,y x EF_grid,y)

Year 2017: (78.61-77.49) x 0.0718/0.0640 x 0.859 - (78.61-77.49) x 0.859 = 1.08 – 0.96 = 0.12 tCO2e

Year 2018: (568.16-557.10) x 0.0718/0.0640 x 0.859 - (568.16-557.10) x 0.859 = 10.66 – 9.50 = 1.16 tCO2e

The verification team assessed the reported data with documented evidence and by means of on site visit.

The level of achieved ERs during the first monitoring period is much less than the ex-ante estimation under the circumstances below:
- Actual start of project operation was delayed from 01/10/2017 to 02/12/2017,
- Electricity demand at the receiving end of the project transmission line has been limited with the 2 nearby villages due to delay of the mining project, and
- Data of electricity transmitted was not monitored at the receiving substation from 05/08/2018 to 21/11/2018 due to bypass connection work required for modification work in NOT Substation and delay in installation of CTs on the bypass connection line that is assumed as zero for calculation of the ERs.

Achievement of the estimated ERs in the registered PDD depends on the progress of the mining project and increase of the electricity demand at the receiving end of the project transmission line in the subsequent monitoring period.

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.

Parameters	Monitored values	Method to check values in the monitoring report with sources
E_L,send,y	2017: 78.61 MWh/y 2018: 568.16 MWh/y	Assessment was conducted based on records of meter readings and on site assessment.
E_L,receive,y	2017: 77.49 MWh/y 2018: 557.10 MWh/y	Assessment was conducted based on records of meter readings and on site assessment.
EF_Grid,y	2017: 0.859 tCO2/MWh 2018: 0.859 tCO2/MWh	Assessment was conducted by confirming information announced by the national authority of the host country and reviewing the published document by the CDM Executive Board

<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 monitoring period was indicated starting from 06/12/2017 in the MR that was not from the start date of the project operation as indicated in the registered PDD and it did not consider the actual start of operation of the project that the monitored data

is available from 02/12/2017.
The end date of the monitoring period was indicated as 31/07/2018 in the MR but the data monitored until 31/12/2018 had been considered for calculating the ERs.
Nature of responses provided by the PPs: The PPs confirmed that the actual start date of operation is 02/12/2017 and submitted the revised PDD and MR for review by the verification team.
Assessment of the responses: The verification team reviewed the revised PDD and MR. The start date of the project operation is changed to 02/12/2017 to reflect the actual implementation of the project. The verification team confirmed the change as a post registration change that does not affect applicability of the approved methodology. The verification team also confirmed that the indication of the monitoring period has been amended in the revised MR.
<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 post registration changes as below. 1) The start date of the project operation was changed from 01/10/2017 as indicated in the registered PDD to 02/12/2017. 2) The parameter E_L,receive,y was not monitored in accordance with the registered MP from 05/08/2018 to 21/11/2018 due to the bypass connection at the receiving end of the project transmission line requested for modification work in NOT Substation and delay in installation of CTs on the bypass connection line. The verification team assessed the project documentation, conducted the on site visit and confirmed that the post registration changes from the registered PDD and MP do not prevent application of the approved methodology. The start date of the project operation changed in the revised PDD is in accordance with the available operational data collected by the measuring equipment. For the period a part of data is not monitored from 05/08/2018 to 21/11/2018, the PPs assumed the data is zero for calculation of the ERs and the verification confirmed that the treatment is conservative as the data is used for calculation of both REs and PEs. **<Findings>** *Please state if CARs, CLs, or FARs are raised, and how they are resolved.* Please refer to CAR 1 and its resolution as detailed in the above Section C.4. on the change of the start date of the project operation. **<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	1	1	0
2018	11	10	1
2019			
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027			
2028			
2029			
2030			
Total (tCO_2e)			1

F. List of interviewees and documents received

F.1. List of interviewees

National Power Transmission Grid State Owned Stock Company

D. Odkhuu, Shift engineer

N. Batnyam, Technician

Hitachi Ltd. Power Business Unit

Hiroshi Konno, Section Manager, Global T&D Engineering Group, System Engineering Department, Power Production Management Division

Masanori Furuya, Engineer, Global T&D Engineering Dept. Business Management Div., Transmission & Distribution Systems Division

Mongolyn Alt (MAK) Corporation
B. Munkhzaya, Electrical engineer
B. Byambosuren, Electrical engineer

J-Power Systems Corporation
Takayuki Nagai, Specialist, Design & Engineering Section, Overseas Project Department, Overhead Transmission Line Division

Sumitomo Electric Industries, Ltd.
Takahiro Yada, Information System Group Innovative Solution Department, Overhead Transmission Line Division

Environmental Resource Management (ERM) Japan Ltd.
Tsuyoshi Nakao, Group Leader, Sustainability Management Team

F.2. List of documents received

Category A documents (documents prepared by the PP)
- MR completed on 25/12/2018, 10, 15, 18/01/2019, 14/02/2019
- Revised PDD Version 03.0 drafted on 23/01/2019
- Sustainable Development Contribution Report completed on 17/01/2019
- Power meter measurement accuracy check sheet for NOT dated 03/01/2019
- Power meter measurement accuracy check sheet for TS dated 03/01/2019
- Single line diagram and photographs for bypass transmission line
- Specification, drawing and photographs of CT
- CT inspection report
- Procedures for Processing Monitoring Data
- Procedures for Checking Accuracy of Power Meter
- Flowchart of Monitoring
- CVT Secondary Wiring Diagram in New OT Substation
- CVT Secondary Wiring Diagram in TS Substation
- Declaration of avoidance of double registration
- Instruction Manual for measurement device (Ref. No. JTD52-14-256A)
- Specification for data process equipment
- System equipment structure drawing

- Measuring equipment system drawing
- Photos of measuring equipment
- Factory test report for Measurement Devices
- Instrument Calibration Certificate for temperature meter, pyranometer, ultrasonic aerovane, and power meter
- Mandatory Calibration, A Comprehensive List of Instruments, The regulations of calibration interval

Category B documents (other documents referenced)
- JCM_MN_AM001_ver01.0 Installation of energy-saving transmission lines in the Mongolian Grid
- JCM Project Cycle Procedure JCM_MN_PCP_ver06.0
- JCM Guidelines for Validation and Verification JCM_MN_GL_VV_ver01.0
- JCM Guidelines for Developing PDD and MR JCM_MN_GL_PDD_MR_ver03.1
- JCM Guidelines for Developing Sustainable Development Contribution Plan and Report JCM_MN_GL_SDCP_CR_ver01.0
- JCM Glossary of Terms JCM_MN_Glossary_ver01.0
- JCM Verification Report Form JCM_MN_F_Vrf_Rep_ver02.1
- Additional information to the Proposed Methodology MN_PM001 “Installation of energy-saving transmission lines in the Mongolian Grid”
- Approved CDM Standardized baseline ASB0039-2018 Grid emission factor for Mongolia’s national electricity grid Version 01.0
- JCM Mongolia website http://www.jcm-mongolia.com/?lang=en
- Approved CDM baseline and monitoring methodology AM0097 Installation of high voltage direct current power transmission line Version 01.0.0
- Approved Large-scale CDM methodology AM0118 Introduction of low resistivity power transmission line Version 01.0
- Approved Small Scale CDM Methodology AMS II.A. Supply-side energy efficiency improvements – transmission and distribution Version 10
- PDD, Validation Report and Verification Report of the registered JCM projects MN001, MN002, MN003 and MN004
- Proposed and registered projects under CDM, VCS, Gold Standard, and the other international schemes

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: A HIGH EFFICIENCY AND LOW LOSS POWER TRANSMISSION AND DISTRIBUTION SYSTEM IN (Ref# MN005)
Verification for the first monitoring period: 02/12/2017 – 31/12/2018

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
15/05/2018