

JCM Verification Report Form

A. Summary of verification

A.1. General Information

Title of the project	Introduction of Solar PV Systems on Rooftops of Factory and Office Building
Reference number	TH001
Monitoring period	From 20/06/2016 to 01/10/2017
Date of completion of the monitoring report	20/10/2017
Third-party entity (TPE)	Lloyd's Register Quality Assurance Limited (LRQA)
Project participant contracting the TPE	Pacific Consultants Co., Ltd.
Date of completion of this report	28/01/2018

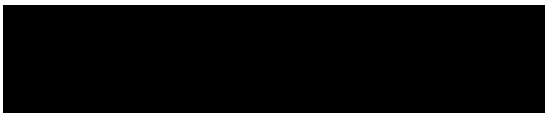
A.2 Conclusion of verification and level of assurance

Overall verification opinion	<input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative
<input checked="" type="checkbox"/> Unqualified opinion	<p>Based on the process and procedure conducted, <i>Lloyd's Register Quality Assurance Limited (LRQA)</i> (TPE's name) provides reasonable assurance that the emission reductions for <i>Introduction of Solar PV Systems on Rooftops of Factory and Office Building</i> (project name)</p> <ul style="list-style-type: none"> ✓ 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
<p><i>(If overall verification opinion is negative, please check below and state its reasons.)</i></p> <input type="checkbox"/> Qualified Opinion <input type="checkbox"/> Adverse opinion <input type="checkbox"/> Disclaimer	<p><State the reasons> Not Applicable</p>

A.3. Overview of the verification results

Item	Verification requirements	No CAR or CL remaining
The project	The TPE determines the conformity of the actual	<input checked="" type="checkbox"/>

Item	Verification requirements	No CAR or CL remaining
implementation with the eligibility criteria of the applied methodology	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.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>
Avoidance of double registration	The TPE determines whether the project is not registered under other international climate mitigation mechanisms.	<input checked="" type="checkbox"/>
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.	<input checked="" type="checkbox"/>

Authorised signatory:	Mr. <input checked="" type="checkbox"/>	Ms. <input type="checkbox"/>
Last name: Chiba	First name: Michiaki	
Title: Climate Change Manager - Asia & Pacific		
Specimen signature:		Date: 28/01/2018

B. Verification team and other experts

	Name	Company	Function*	Scheme competence*	Technical competence*	On-site visit
Mr. <input checked="" type="checkbox"/> Ms. <input type="checkbox"/>	Michiaki Chiba	LRQA Ltd.	Team leader	<input checked="" type="checkbox"/>	Technical competence authorised	<input checked="" type="checkbox"/>
Mr. <input type="checkbox"/> Ms. <input checked="" type="checkbox"/>	Mooklin Sutuntaphida	LRQA Thailand	Host country expert	<input type="checkbox"/>	N/A	<input checked="" type="checkbox"/>
Mr. <input checked="" type="checkbox"/> Ms. <input type="checkbox"/>	Stewart Niu	LRQA China	Internal reviewer	<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>
Mr. <input type="checkbox"/> Ms. <input type="checkbox"/>				<input type="checkbox"/>		<input type="checkbox"/>

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_TH_AM001_ver01.0 "Introduction of Solar PV System, Ver 01.0".

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 installs solar PV system(s).

Justification in the PDD: Two solar PV systems are installed at both Site A and B. The solar PV module employed is Panasonic HIT photovoltaic module VBHN240SJ25. The inverter employed is Huawei String Inverter SUN2000-20KTL.

Steps taken for assessment: The verification team assessed the project documentation, technical specification, the test and commissioning reports, and conducted physical on site assessment.

Conclusion: The verification team confirmed that the project installed solar PV systems at the 2 sites of Siam Steel International Public Company Limited (SSI) and the criterion is met.

Criterion 2: The solar PV system is connected to the internal power grid of the project site and/or to the grid for displacing grid electricity and/or captive electricity at the project site.

Justification in the PDD: The solar PV system of each site is connected to the internal power grid of each site and to the grid.

Steps taken for assessment: The verification team assessed the electricity diagram and conducted physical on site assessment.

Conclusion: The verification team confirmed that the project solar PV systems are connected to the internal electricity supply systems of the factory and the building of SSI. The electricity supply systems of SSI are connected to the public power grid system and no captive electricity exists in the project sites. The project was confirmed to displace consumption of grid electricity. The systems to prevent reverse power flow from the project solar PV systems to the public power grid systems have been installed and the electricity generated by the project solar PV systems is only consumed at the project sites. The criterion is met by the proposed project.

Criterion 3: The PV modules have 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 installed PV module (Panasonic HIT photovoltaic module VBHN240SJ25) has obtained a certification of design qualifications (IEC 61215) and safety qualification (IEC 61730-1 and IEC 61730-2).

Steps taken for assessment: The verification team reviewed the technical specification, certificates of design qualifications and safety qualification, the test and commissioning reports, and conducted physical on site assessment.

Conclusion: The verification team confirmed that the PV modules of the project solar PV system have obtained the certificates in compliance with the international standards IEC61215, IEC61730-1 and IEC61730-2 as appropriate. The criterion was therefore fulfilled.

Criterion 4: The equipment to monitor output power of the solar PV system and irradiance is installed at the project site.

Justification in the PDD: For each site, two electricity meters are installed to measure output power of the solar PV system. A pyranometer is installed at each site to measure irradiance.

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

Conclusion: The verification team confirmed that the monitoring equipment has been installed for output power of the solar PV systems as well as irradiance at each project site. Thus the criterion was confirmed as satisfied 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 this 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 introduces total 994.56 kW solar PV systems on rooftops of A-14 Factory Building (Site A) and Head Quarters Building (Site B) of SSI in Samutprakharn, Thailand. The electricity generated by the project PV systems is self-consumed without being fed to the public electricity grid system and reduces GHG emissions from generation of grid electricity that is imported by SSI in the absence of the JCM project. The project solar PV systems employ Panasonic HIT photovoltaic module VBHN240SJ25.

The project is implemented by SSI and Pacific Consultants Co., Ltd. (PCKK) from Japan. The start date of project operation is on 27/06/2016 for Site A and 20/06/2016 for Site B. The expected operational lifetime of the project is for 10 years.

The project receives financial support for JCM model projects from the Ministry of the Environment, Japan (MOE).

The verification team assessed the Monitoring Report (MR) that 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 has been established based on the approved methodology. The parameter to be monitored ex-post is $EG_{i,p}$ the total quantity of the electricity generated by the project solar PV system i during the period p (in MWh/p). Total four electricity meters are installed to directly and continuously measure electricity supply from 1,600 PV panels on A-14 Westward (A14-1), 1,728 PV panels on A-14 Eastward (A14-2), 192 PV panels (HQ-1) and 624 PV panels (HQ-2) on the Headquarter building respectively.

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.

Through the processes taken, CL 1, CL 2 and CL 3 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 when connection of electricity supply system of Site B (HQ-1 and HQ-2) to the part of electricity consumption in the A-1 Factory Building was completed so that the impact to the electricity generation data can be cross checked with the information of change during the monitoring period.

Nature of responses provided by the PPs: The PPs provided the certificate of completion for the work as the evidence.

Assessment of the responses: The verification team confirmed that the cabling work from PV system of Site B to facilities of A-1 Factory Building was completed on 31/08/2017 based on the certificate of completion. The impact of the work was checked by comparison of the electricity generation data and interviewing the PPs. The CL was closed.

Grade / Ref: CL 2

Nature of the issue raised: The PPs were requested to clarify how the monitoring procedures were implemented and records are kept for checking of monitored data.

Nature of responses provided by the PPs: The PPs provided record of checking the monitored data for confirmation by the verification team.

Assessment of the responses: The verification team reviewed the record and confirmed the data check implemented by the PPs during the monitoring period. The CL was closed.

Grade / Ref: CL 3

Nature of the issue raised: The PPs were requested to clarify how records are kept for staff training in particular in the event of change of personnel.

Nature of responses provided by the PPs: The PPs provided record of instructions made for the staff training including that at an event of personnel change.

Assessment of the responses: The verification team reviewed the record of relevant instructions and confirmed the training implemented by the PPs. 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 parameter uses electricity meters as the measuring equipment. The electricity meters measure electricity generated and supplied from the project solar PV systems to the internal consumption at the sites of factory and office building, that are not for trade measurement and subject of regulations in the host country or the power companies. The electricity meters are certified according to IEC 62053-22 (class 0.5s) and will be replaced or tested for accuracy every 10 years in accordance with the registered MP. The meters started measurement in June 2016 and were not required to be replaced or tested during the monitoring period. 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 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 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 supplies electricity generated by solar PV systems installed on the rooftops of the factory and office building for the self-consumption and displaces electricity purchased from the public power grid system. The source of GHG emissions is consumption of grid electricity and CO₂ emissions in the reference scenario are considered to determine the reference emissions (REs), while the project emissions (PEs) is assumed to be zero for the solar PV system in accordance with the applied methodology.

The REs are determined as a product of total electricity generation (sum of measured data by four electricity meters) and the default reference CO₂ emission factor of the applied methodology at 0.319 t-CO₂/MWh.

The GHG emission reductions during the monitoring period (each for year 2016 and 2017) are calculated as: $ER_p = RE_p - PE_p = RE_s = \sum_i EG_{i,p} \times EF_{RE}$

From 20/06/2016 to 31/12/2016

$$(171.80 + 189.70 + 16.27 + 53.80) \times 0.319 \text{ tCO}_2/\text{MWh} = 431.57 \times 0.319 = 137 \text{ tCO}_2\text{e.}$$

From 01/01/2017 to 01/10/2017

$$(189.80 + 208.98 + 26.50 + 87.99) \times 0.319 \text{ tCO}_2/\text{MWh} = 513.27 \times 0.319 = 163 \text{ tCO}_2\text{e.}$$

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 16 months (469 days) is 944.84 MWh in total, that is 735.32 MWh (944.84 MWh x 365/469) in a year and 48% of ex-ante estimate in PDD of 1,540.98 MWh. The project sites are applied functions to prevent reverse electricity flow to the connected public power grid systems that have interrupted utilising capacity of the project solar PV systems as designed. Under the current conditions, electricity generation of project solar PV systems is stopped when electricity consumption of specified building areas is low or less than electricity supply from the solar PV systems, and the power

demand is met by import of grid electricity. The PPs implemented installation of power cable to connect the solar PV system of the Headquarters Building (Site B, HQ-1 and HQ-2) to facilities of A-1 Factory Building to add electricity demand of 80 kW and the work was completed on 31/08/2017 as confirmed through CL 1 in above section C.2. The electricity generation of HQ-1 and HQ-2 systems in September 2017 was 18% higher than that in September 2016. The PPs continue studying measures to improve the conditions that would be taken during the subsequent monitoring periods.

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
EGi,p (2016)	431.57 MWh/p	Assessment was conducted based on records of monthly meter readings and on site assessment.
EGi,p (2017)	513.27 MWh/p	Assessment 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.

Grade / Ref: CAR 1

Nature of the issue raised: Recording of monitored electricity generation data was not implemented in a complete manner in accordance with the established monitoring procedures. The Monitoring Manual requests recording of the monthly meter readings manually in the logbook on 1st working day of each month then the data is transferred into the electronic form. However, the information was not recorded in the logbook for July 2017.

Nature of responses provided by the PPs: The PPs filled the missed information in the logbook and re-confirmed implementation of the monitoring procedures in a right manner.

Assessment of the responses: The verification team confirmed that the missed information is filled in the logbook correctly based on the photograph of the meters and the data transferred to the electronic form is accurate. The CAR was closed.

<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, emissions

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 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 Emissions (tCO ₂ e)	Reference Emissions (tCO ₂ e)	Project Emissions (tCO ₂ e)	Verified Emission Reductions (tCO ₂ e)
2013				
2014				
2015				
2016		137	0	137
2017		163	0	163
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026				
2027				
2028				
2029				
2030				
Total (tCO ₂ e)				300

F. List of interviewees and documents received

F.1. List of interviewees

Siam Steel International Public Company Limited
 Thanyapong Sinsoongsud, Senior Manager
 Weera Wilaipornpanit, Project Manager
 Phatthrachai Charoensuk, Assistant Electrical Manager
 Natthapol Inchan, Engineer
 Nattakit Pacherat, Manager

Pacific Consultants Co., Ltd.
 Hirofumi Ishizaka, Senior Researcher, Global Environment Department, International Division

Shigezane Kidoura, Consultant, Global Environment Department, International Division

F.2. List of documents received

Category A documents (documents prepared by the PPs)

- Monitoring report dated 20/10/2017
- Background data on Monitoring Report
- Monthly reports of monitored data
- Technical specification of project solar PV system
- Photovoltaic Power Generation System Test & Commissioning Report
- Single Line Diagram
- Grid-Connected System: Simulation parameters
- Certificate of design qualifications and quality qualification
- Modified single line diagram HQ. and A-1
- Drawing for supply solar energy to Factory A-1 (80 kW)
- Metering Code, Energy Market Authority of Singapore, January 2014
- Certificate for Type Test of Energy Meters
- Certificate of Accreditation to the laboratory
- Supply information of EDM energy meters
- Inspection reports of energy meters, Provincial Electricity Authority
- Records of local stakeholders consultation meeting
- Chart of power generation by solar PV systems
- Letter of confirmation for registration of rooftop solar system for own use, Energy Regulation Commission (ERC)
- Explanatory of Power limit function
- Declaration letter on no double registration dated 10/11/2017
- Revised Monitoring Manual Ver. 2.0
- Logbook
- Certificate of completion dated 31/08/2017
- Record of checking monitored data
- Record for staff training

Category B documents (other documents referenced)

- Register PDD Version 02.0 dated 13/07/2017 with the Monitoring Spreadsheet
- Validation report for the project dated 08/08/2017
- JCM_TH_AM001_ver01.0 Installation of Solar PV Systems

- Additional Information to the Proposed Methodology “Installation of Solar PV System”
- JCM Project Cycle Procedure JCM_TH_PCP_ver02.0
- JCM Guidelines for Validation and Verification JCM_TH_GL_VV_ver01.0
- JCM Guidelines for Developing PDD and MR JCM_TH_GL_PDD_MR_ver02.0
- JCM Glossary of Terms JCM_TH_Glossary_ver01.0
- JCM Verification Report Form JCM_TH_F_Vrf_Rep_ver02.0
- Annual Report 2016 of Siam Steel International Public Company Limited
- Proposed and registered projects under CDM, VCS, Gold Standard, and the other international schemes
- 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)
- APLMF Economy Report Thailand, Central Bureau of Weights and Measures
- Weights and Measures Act B.E. 2542 (1999)
- Certificate of Accreditation for EDMI Limited, Singapore Accreditation Council

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

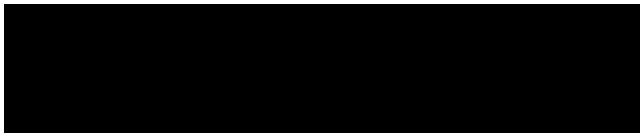
Title of Project: Introduction of Solar PV Systems on Rooftops of Factory and Office Building (Project #TH001)

Verification for the first monitoring period: 20/06/2016 – 01/10/2017

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
Mooklin Sutuntaphida	Host Country Expert
Stewart Niu	Technical Reviewer

Signed by



Michiaki Chiba
Climate Change Manager – Asia & Pacific
01/11/2017