



GRID CONNECTED ELECTRICITY GENERATION PLANT USING NATURAL GAS AT JURONG ISLAND IN SINGAPORE



Document Prepared By

LGAI Technological Center S.A. (Applus+ Certification)

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Summary:

Verification purpose: LGAI Technological Center S.A. (Applus+ Certification) (Hereafter referred as Applus+ Certification) has been appointed^{2/} by “PacificLight Power Pte. Ltd.” to perform the 4th verification (01-January-2021 to 31-December-2022(inclusive of both dates)) of the “Grid connected electricity generation plant using natural gas at Jurong Island in Singapore” (VCS ID 1736)^{1/4/}. The main purpose of this verification activity is to have an independent third party for the assessment of the project design, monitoring report to ensure a thorough assessment of the proposed project activity against the applicable VCS requirements.

The purpose of the project activities to construct and operate 800 MW natural gas based powerplant. The electricity generated is exported to the Singapore national grid. The project activity helps to reduce carbon intensity. Therefore, the project activity is displacing an equivalent amount of electricity which would have been otherwise generated in fossil fuel dominant electricity grid. The project activity is installation and operation of a 800 MW natural gas fired combined cycle power plant. located near City & District: Jurong Island, Singapore. At the site ambient conditions and a frequency of 50 Hz, the rated capacity of the plant is 800 MW (two units 400 MW each). Each of the two units has one combustion turbine, one Heat recovery Steam Generator (HRSG) and one Steam Turbine Generator (STG). The heat content of the exhaust gas from the combustion turbine is recovered in individual heat recovery steam generators. The steam generated is then expanded in a condensing type steam turbine driving an electric generator. The Project Activity was commissioned on 29-June-2013. ^{/01/}. The monitoring period for this VCS verification is 01-January-2021 to 31-December-2022(inclusive of both dates) and the project activity achieved 459,175 tCO_{2e} emission reductions during this monitoring period thereon displaced 10,650,253 MWh amount of electricity from the generation-mix of power plants connected to the Indian Grid, which is mainly dominated by thermal/fossil fuel-based power plant.

The scope of the verification is the independent and objective review of the Monitoring Report (MR)^{5/}. The MR is reviewed against the relevant criteria (see above) and decisions by the CDM

¹ <https://registry.terra.org/app/projectDetail/VCS/1736>

Executive Board and VCS executive board, including the approved baseline and monitoring methodology. The verification was based on the guidance given in the CDM validation and verification standard for project activities, version 03.0/^{13/}, review against registered CDM PDD/^{4/} and final validation report, CDM validation and verification standard for project activities, version 03.0/^{13/}, VCS program guide version 4.3/^{8/} and VCS Standard Version 4.4/^{8/}

A risk-based approach has been followed to perform this verification activity. In the course of verification, 06 Corrective Action requests (CAR), 03 Clarification Requests (CLs) were raised and successfully closed. No FAR was raised during this verification. The review of the Monitoring report and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and PP have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

The assessment team has employed a risk-based approach to assess the completeness and accuracy of the claims and conservativeness of the assumptions in the MR. The main focus of the assessment team is to identify the significant risks for the project implementation and the generation of VCU. The verification is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring report combined.

The only purpose of the verification is its usage during the issuance process as part of the VCS project cycle. Therefore, LGAI Technological Center S.A. (Applus+ Certification) can't be held liable by any party for decisions made or not made based on the verification opinion, which will go beyond that purpose.

The verification has been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. No sampling procedure applied for document verifications. The entire documents checked/verification conducted to arrive at positive verification conclusions.

CONTENTS

contents	4
1. Introduction	6
1.1 Objective	6
1.2 Scope and Criteria	6
1.3 Level of Assurance.....	7
1.4 Summary Description of the Project	7
2. Verification Process	7
2.1 Method and Criteria.....	7
2.2 Document Review	9
2.3 Interviews.....	10
2.4 Site Visits.....	10
2.5 Resolution of Findings	10
2.5.1 Forward Action Requests.....	11
2.6 Eligibility for Validation Activities	12
3. Validation Findings	12
3.1 Participation under Other GHG Programs	12
3.2 Methodology Deviations.....	12
3.3 Project Description Deviations.....	13
3.4 Grouped Project	14
4. Verification Findings	14
4.1 Project Implementation Status	14
4.2 Safeguards	17
4.2.1 No Net Harm	17
4.2.2 Local Stakeholder Consultation.....	19
4.3 AFOLU-Specific Safeguards	19
4.4 Accuracy of GHG Emission Reduction and Removal Calculations	19
4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals	29
4.6 Non-Permanence Risk Analysis.....	30
5. Verification OPINION	31

APPENDIX 1: Documents Reviewed or Referenced	33
APPENDIX 2: CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS (CAR/CL/FAR)	35
APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS.....	41
APPENDIX 4: ABBREVIATIONS	43
APPENDIX 5: Calibration details	44
APPENDIX 6: Major Breakdown Details	45

1. INTRODUCTION

1.1 Objective

LGAI Technological Center S.A. (Applus+ Certification) (Hereafter referred as Applus+ Certification) has been appointed by “PacificLight Power Pte. Ltd.” to perform the 4th verification of the “Grid connected electricity generation plant using natural gas at Jurong Island in Singapore” under VCS Project guide, version 4.3 and VCS standard, version 4.4. The objective of this verification activity is to have an independent third party for the assessment of the project design, Monitoring Report and Final Verification report and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- The project's baseline is assessed against AM0029, version 03 /¹⁵/
- The project's monitoring plan is assessed against “AM0029, version 03 /¹⁵/
- the projects compliance with the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS program guide, version 4.3 and VCS standard, version 4.4
- CDM validation and verification standard for project activities, version 03.0/¹³/
- VCS program guide version 4.3/⁸/
- VCS standard version 4.4/⁸/

Verification is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of verified carbon units.

1.2 Scope and Criteria

The scope is defined as an independent and objective review of the Monitoring report (MR)/⁵/ prepared as per the registered CDM PDD /⁴/ and registered approved methodology AM0029, version 03 /¹⁵/. The MR is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board and VCS standard, version 4.4 and programme guide, version 4.3, including the approved baseline and monitoring methodology AM0029, version 03. The verification was based on the requirements in the CDM validation and verification standard for project activities, Version 03.0 and VCS program guide version 4.3 and VCS Standard Version 4.4.

The verification is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the Monitoring report. In line with Guidelines for Application of materiality in verifications, the verification team has conducted a complete verification of all the information presented in the monitoring report and data monitored as presented in the emission reduction

calculation spread sheet. It follows the paper trail back to the raw data such as meter reading records and invoices. There are no material errors, overestimation of ER, omission or misstatement. Verification team conducted onsite audit to verify metering/monitoring arrangement. The verification team has reviewed all the documents like commissioning certificates/^{1/}, technical specification/^{16/}, Fuel records/^{7/}, Energy generation records/^{9/}, invoices/^{9/}, grievance register/^{12/} etc.

1.3 Level of Assurance

Applus + Certification has planned and performed the verification by obtaining evidence and other information and explanations that assessment team considers necessary to give reasonable assurance that reported estimated GHG emission reductions are fairly stated. All documentary evidences were checked, a site audit was conducted to verify metering/monitoring arrangement to arrive at a verification conclusion by the assessment team.

In our opinion, the estimated GHG emissions reductions were calculated correctly on the basis of the approved baseline and monitoring methodology AM0029, version 03 and the VCS Standard Version 4.4.

1.4 Summary Description of the Project

The project activity is a natural gas fired combined cycle power plant. The project activity involves installation of 800 MW natural gas fired combined cycle power plant located near City & District: Jurong Island, Singapore. The purpose of the project activity is to construct and operate an 800 MW natural gas-based power plant. The electricity generated is exported to the Singapore national grid. The project activity helps to reduce carbon intensity. The Project activity is promoted by Pacific Light Power Pte. Ltd. The monitoring period this VCS verification covered from 01-January-2021 to 31-December-2022 (inclusive of both dates) and the project activity achieved 459,175 tCO₂e emission reductions during this monitoring period. The start date of the Project Activity is 29-June-2013. Assessment team checked the commissioning status of the project activity with the commissioning Certificates and during on-site visit and found correct. The project is implemented as per the description in the registered CDM PDD /^{4/}. No event observed during the current monitoring period which can alter or deviate from the methodology requirement.

2. VERIFICATION PROCESS

2.1 Method and Criteria

Verification Process: The project assessment is based on the “CDM validation and verification standard for project activities, Version 03.0, VCS standard, version 4.4, VCS program guide version 4.3 and is conducted using standard auditing techniques to assess the correctness of

the information provided by the project participants. Before the assessment begins, members of the team covering the technical scope(s), sectoral scope(s), and relevant host country experience for evaluating the VCS project activity are appointed.

Once the project is received by the assessment team, the members of the assessment team carried out: -

1. A desk review of the Monitoring report against the registered CDM PDD /04/ and final validation report;
2. Site Visit;
3. The resolution of outstanding issues and the issuance of the final verification report and opinion.

The prepared verification report and other supporting documents then undergo an internal quality control at the HQ (Accredited office) before being submitted to the VCS executive board.

In order to ensure transparency, assumptions must be clear and stated explicitly and background material must also be referenced. Applus+ Certification has developed a specific checklist customized for the project. The checklist demonstrates, in a transparent manner, the project criteria (requirements), discussion on each criterion by the assessment team, and the results from validating the identified criteria.

Appointment of the assessment team

According to the sectoral scope / technical area and experience in the sectoral or national business environment, Applus+ Certification has composed a project assessment team in accordance with the appointment rules in the internal Quality Management System of Applus+Certification.

The composition of audit team shall be approved by the Applus+ Certification ensuring that the required skills are covered by the team.

The four qualification levels for team members that are assigned by formal appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A) / Auditor in Training (AiT).
- Technical Expert (TE).
- Technical Reviewer (TR).

The sectoral scope / technical area knowledge linked to the applied methodology/ies shall be covered by the assessment team.

Name	Role	SS Coverage	TA Coverage	Financial aspect	Host country experience
Mr. Pankaj Kumar	LA/TE	YES	YES	NA	YES
Mr. Denny Xue	TR	YES	YES	NA	YES

The detail regarding the assessment team is provided below in this report as Appendix 3.

Document review

The Monitoring report version 01/05/ submitted by the PP was reviewed against the approved methodology/^{15/}, approved registered CDM PDD /^{04/}, final validation report and other relevant criteria to verify the correctness, credibility, and interpretation of the presented information.

Further, a cross-check between information provided and information from other sources has been done. A complete list of all documents and evidence material reviewed is included in this report below in Appendix 1.

Site Visit

An Onsite Inspection is conducted by Applus+ Certification. Audit team performed physical interview with project stakeholders to confirm selected information and to resolve issues identified in the document review. The detail is provided in this report.

Resolution of Clarification and Corrective Action Request

The objective of this phase of the Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for Applus+ Certification positive conclusion on the Monitoring report. The Corrective Action Requests and Clarification Requests raised by Applus+ Certification were resolved during communications between the Client and Applus+ Certification to guarantee the transparency of the verification process, the concerns raised and responses given are summarized below in the Appendix 2.

The final MR Version 05/05/ submitted by PP, serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Internal quality control

As final step of a verification of the final documentation including the verification report and the checklist have to undergo an internal quality control by the technical review committee, i.e., each report has to be finally approved either by the head of the technical review committee or the deputy. In case one of these two persons is part of the assessment team approval can only be given by the other one to avoid any conflict of Interest.

After confirmation of the PP the positive verification opinion and relevant documents are submitted to the VCS board through the VCS web-platform.

2.2 Document Review

The details of the document observed during the verification process are listed below in

Appendix 1 of this report

2.3 Interviews

2.4

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Ravi Kumar	Mr. PVS	DGM, Operations	16-March-2023	Project Implementation, Energy generation records & invoicing procedure, calibration, grievance mechanism, Management practices, data storage, QA/QC	Mr. Pankaj Kumar
2.	Cuevas	Mr. Leonard Andrew	Assistant Manager, Regulations			
3.	Clare	Mr. Saverieux	Senior Manager,			
4.	Thakur	Richa Singh	Consultant, Infinite Environmental Solutions LLP			

Duration of on-site inspection: 16-March-2023

No.	Activity performed on-site	Site location	Date	Team member
1.	Assessment team checked the implementation of the project, Baseline emission, Emission reduction calculation, technical description of the project and Monitoring. Assessment team also checked that whether the monitoring plan as described in the CDM PDD is actually practised onsite. Also, assessment team checked any change in host country criteria which may affect the baseline of the project activity.	Jurong Island, Singapore	16-March-2023	Mr. Pankaj Kumar

2.5 Resolution of Findings

The objective of this phase of the Verification was to resolve the requests for corrective actions and clarification and any other outstanding issues from verification which need to be clarified for Applus+ Certification's positive conclusion on the Monitoring report. The Corrective Action Requests and Clarification Requests raised by Applus+ Certification were resolved during

communications between the Client and Applus+ Certification to guarantee the transparency of the verification process, the concerns raised and responses given are summarized below in the Appendix 2.

The final MR Version 05/05/ submitted by PP serves as the basis for the final assessment presented. Additional changes to the project during the verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of validation and verification findings	No. of CL	No. of CAR	No. of FAR
Project design document and Monitoring report	01	01	00
Description of project activity	01	02	00
Application of selected baseline and monitoring methodology and selected standardized baseline			
Applicability of methodology and standardized baseline	00	00	00
Deviation from methodology	0	00	00
Clarification on applicability of methodology, tool and/or standardized baseline	01	00	00
Project boundary	00	00	00
Establishment and description of baseline scenario	00	00	00
Demonstration of additionality	00	00	00
Emission reductions	00	01	00
Calibration details	00	01	00
Monitoring plan	00	00	00
No Net harm assessment	00	00	00
Local stakeholder consultation	00	01	00
Others (please specify)	00	00	00
Total	03	06	00

The list of findings and the resolution is presented in Appendix 2 of this report.

Forward Action Requests

This is 4th verification of the project activity and no FAR has been raised in the current verification. However, one FAR was raised in previous verification regarding no double counting and CAR 2 was raised for the same and PP has submitted undertaking for no double counting and no participation in other GHG program other than VCS to the assessment team and same is found correct. Thus, Closed.

2.6 Eligibility for Validation Activities

This section is not applicable for present verification, as Applus+ Certification holds the accreditation for Validation of projects under this Sectoral Scope.

3. VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The project activity has participated under other GHG program i.e, Project has been registered with UNFCCC under Clean Development Mechanism (CDM) program. Registration reference number is 9687². The project proponent has not claimed any GHG credits under CDM mechanism during current monitoring period. The CDM Monitoring reports are only web hosted from 14-July-2014 till 31-December-2017 and the current monitoring period is 01-January-2021 to 31-December-2022. There is no any overlapping of current VCS monitoring period and CDM monitoring period as per web hosted CDM Monitoring Reports.

Thus, there is no any double accounting occurred during current VCS monitoring period & for the same declaration has been submitted. Found acceptable.

3.2 Methodology Deviations

This section is not applicable for present verification as no methodology deviation sought during this verification and also in the earlier verifications by project participant. Further no deviation obtains by PP during previous verification too.

² <https://cdm.unfccc.int/Projects/DB/BV011373973780.44/view>

3.3 Project Description Deviations

The below project description deviations were requested & approved in previous monitoring period.

1. The complete gas metering equipment is installed at consumer end (PP side) only and within the project activity premises. There are no separate meters for PP side and separate meter for supplier side, hence deviation is requested. Flow measured through these instruments is transmitted to supplier as well as to Plant DCS. Thus, it is ensured that cross verification of gas flow is done by supplier. Gas bill generated by supplier at the month end is finally cross checked by both parties before settlement. Thus, supplier ensures that gas data is accurately monitored and there is no any impact on data measurement.
2. As per registered PDD, the diesel consumption should be monitored by using mass flow meter, however at actual site there is no any mass flow meter and diesel consumption is measured through fuel oil tank level drop. Thus, deviation is requested for this change in monitoring approach for diesel consumption.
3. As per registered PDD, source of data for Net Calorific Value of Natural Gas is invoice from gas supplier. However Gross Calorific Value (GCV) is used from onsite GC for gas heating value measurement. The GCV was converted to NCV by using conversion factor of Natural Gas. Thus, deviation is requested for this change in monitoring approach for NCV of gas.
4. Though CDM registered PDD states calibration frequency as annual, the national regulation of Singapore states calibration frequency as once in two years. As per metering code by Energy Market Authority of Singapore, Jan 2014 and April 2016, the generation facility should have meter test cycle as once in every two years. Thus, deviation is requested for this change in calibration frequency and once in two-year calibration frequency is considered for the project activity.
5. Emission Factor of Natural Gas ($EFCO_{2,NG,y}$) and Oxidation Factor ($OXID_{NG}$) is included in section 4.1 Data and Parameters available at Validation as well as in 4.2 Data and Parameters Monitored. However, both values are taken as ex-ante, hence both the parameters were now removed from the section 4.2.

There is two deviation requested in the current monitoring period as below:

1. The seconds (") is 4" instead of 24" in the actual latitude. The approved coordinates are 1°17'24" N and 103°43'30" E, however the actual coordinates of the site location are 1°17'4" N and 103°43'30"E. The revision has been made in the relevant section for the deviation.

2. In the Registered PDD, the parameters the Build Margin emission factor ($EF_{BM,y}$), Operating Margin emission factor ($EF_{OM,y}$) and Combined margin emission factor ($EF_{BL,CO2,y}$) are included in Section 4.1 'Data and Parameters fixed ex ante'. However as per the methodology AM0029 Version 3, project participants shall use for $EF_{electricity,y}$ the lowest emission factor among the build margin and combined margin. If either option 1 (BM) or option 2 (CM) are selected, they will be estimated ex post. Therefore, since the values are taken as ex-post, hence all the three parameters were now removed from the section 4.1 and is included in section 4.2 Data and Parameters Monitored. Therefore, in the current monitoring period, a deviation is requested for this change in monitoring approach of all the 3 parameters.

The applied deviation doesn't have any impact on the project applicability, baseline scenario, additionality etc. Hence, accepted.

3.4 Grouped Project

This is not applicable, as the project is not a grouped project

4. VERIFICATION FINDINGS

4.1 Project Implementation Status

During the Onsite Inspection with PP representatives & plants in-charge and subsequent document verification; commissioning certificates, Electrical Generation Reports, statutory clearances Energy generation record sheet and invoices, it was concluded that the project is implemented as per the requirement of the registered CDM PDD and approved monitoring plan. During the current monitoring period, it was observed that the break down log is checked and it was observed that there is a breakdown during the monitoring period (refer Appendix-4). This is due to the technical issue at the project site and hence there was no production of renewable energy which could lead to emission reductions, which is acceptable to the assessment team and evident from Electrical Generation Reports. The project activity involves NG based power generation. At the site ambient conditions and a frequency of 50 Hz, the rated capacity of plant is 800 MW (two units 400 MW each). Each of the two units has one combustion turbine, one Heat recovery Steam Generators (HRSG) and one Steam Turbine Generator (STG). The heat content of the exhaust gas from the combustion turbine is being recovered in individual heat recovery steam generators. The steam generated is then expanded in a condensing type steam turbine driving an electric generator.

The Project Activity was commissioned on 29-June-2013. Unit's commissioning started in June-2013 & Aug-2013 and completed by Dec-2013 & Jan-2014, respectively for Unit 10 & Unit 20. Unit 10 was synchronized to grid for the first time on 29-June-2013 and Unit 20 was first time synchronized on 30-August-2013. Subsequent to testing & commissioning, Units were declared as commercial operating facility (also called as GRF: Generation Registered facility) on 15-January-2014 & 06-February-2014 respectively for Unit 10 & Unit 20.

The start date of the project activity is the initial date of commissioning of the first unit of the plant namely 29-June-2013.

Assessment team checked the commissioning certificate/^{1/} and confirmed that the dates of Commissioning for the plant unit are correct. Assessment team also confirm during interview with the PPs representatives that there is no change in project design and the project is implemented as per the description provided in the CDM PDD.

Assessment team also checked the technical details of the plant installed onsite from documents submitted by PP and previous verification reports. The same is cross checked from the photographs of the name plates, module capacity etc. submitted by PP & also cross checked from the technical details from Manufacturer.

Technical details is given below:

The project activity has chosen advanced Siemens Gas Turbine SGT5-4000F. The project activity plant has two units of net capacity of 385.5 MW each. The plant uses natural gas and / or re-gasified LNG as primary fuel. Diesel oil is used as back up fuel for which LPG is start up fuel. The HRSG is unfired type and no supplementary fuel firing is happened in it. No other start- up or auxiliary fuel is envisaged for the plant. The plant generates electricity which is sold to the Singapore grid.

Main Systems and equipment involved:

- Gas Turbines - two numbers;
- Heat recovery steam generators – two numbers;
- Steam turbine generator – two numbers;
- Two Power transformers;
- Auxiliary equipments of Gas Turbines and Generators, HRSGs and Steam Turbines and Generators; meters (gas, electricity) and gas supply pipelines.

The assessment team confirmed that there is no proposed or actual change to the project design during this monitoring period. The project design as mentioned in the registered CDM PDD is implemented and thus the same is acceptable to the assessment team. All required monitoring equipment's and procedures as mentioned in the registered CDM PDD are available and implemented in an appropriate manner.

Geo-coordinates of the project location are: 1° 17' 4" N and 103° 43' 30" E.

Geo coordinates were checked on the google earth and also cross-checked with validation report and verification team concluded that the geo coordinates of project locations are consistent with registered CDM PDD.

The organisational role and responsibility as mentioned in the registered CDM PDD is followed onsite confirmed during onsite visit. All the emergency preparedness as mentioned in the registered CDM PDD is followed onsite and no discrepancies were found regarding the same.

Meters are calibrated as per calibration frequency in registered CDM PDD ^{/4/}. All the emergency preparedness as mentioned in the VCS registered CDM PDD is followed onsite and no discrepancies were found regarding the same. Thus, completeness of the monitoring plan confirmed and there are no any material discrepancies between the actual monitoring system and the plan provided in the registered CDM PDD.

CAR 01 is raised for the inconsistency with respect to MR template guidelines and CAR 02 is raised for supporting evidences for No-Double counting and closed successfully after proper response of PP.

Assessment team confirms following during the verification Onsite Inspection:

1. Start date of the project activity is 29-June-2013 as mentioned in the registered CDM PDD ^{/4/}.
2. An undertaking letter dated 08-June-2023 has been submitted by PP for no double counting with any other GHG program. PP also has given a written declaration that project has not claimed other form of GHG credit for the concerned monitoring period. PP has given a written declaration that the credit claimed under VCS for the current monitoring period is not claimed under any other GHG mechanism^{/10/}. Further, Assessment team confirms that given project activity is not a supply chain project. Hence, not applicable.
3. Assessment team confirms that this is the 4th monitoring under VCS and covers the activity from 01-January-2021 to 31-December-2022 (inclusive of both dates). The project activity adopts renewable crediting period of 10 years period. The project start date for this project is 29-June-2013. 01-January-2014 is the start date and 31-December-2023 will be end date of the crediting period.

The GHG credits from 01-January-2021 to 31-December-2022 (inclusive of both dates) will be claimed under VCS only. At any point of time during the crediting period, the project proponent will abide by the “No Double Counting”^{/10/}.

4. Assessment team checked and found that the Project proponent of the project activity mentioned in Section 1.3 of monitoring report is correct^{/5/}:

Organization name	PacificLight Power Pte. Ltd.
Contact person	Clare Savereux
Title	Senior Manager, Regulations & Corporate Communications
Address	PacificLight Power Pte. Ltd, 47 Jurong Island Highway Singapore 627626
Telephone	-
Email	clare.savereux@pacificlight.com.sg

5. Assessment team also checked the details of other entity mentioned in Section 1.4 of monitoring report and found correct.
6. The quantified emission reduction calculation for the monitoring period is correct and conservative. Assessment team also compared actual VER with the estimated VER and found that the actual VER is 459,175 tCO₂e which is -24.66% lower than the estimated emission reductions 609,476 tCO₂e (304,738 tCO₂e/365 days x 730 days) during this monitoring period which is due to the fact that the plant shutdown, and hence there was no production of energy which could lead to emission reductions. Hence accepted.

Sustainable development indicators

As a part of regional development efforts associated with the project, PP has supported many education, health & infrastructure related needs for local people. These are funded from the revenue generated from the operation of the project activity. In the absence of project activity, there would be no revenue generated from the project and hence the activity would have not occurred in the absence of the project activity.

Thus, the project activity contributes to the sustainable development of the country.

4.2 Safeguards

No Net Harm

No potential environment or socio-economic matter was found during the documents review of CDM PDD and grievance register/^{12/} etc. The project is energy project and thus no negative impact observed due to project activity.

The project activity promotes environmental and socio-economic well-being as it results in zero GHG emissions due to installation and operation of clean, renewable energy technology for electricity generation.

However, assessment team still conducted the No net harm assessment for some of the parameters and the result is described below:

SL.NO	Indicator	Assessment team opinion
1	Air quality	The project activity leads to reduction of GHG emission and also the particulate emission is reduced to permissible limits by use of an ESP. Adequate measures were taken to mitigate the envisaged impacts like spraying water on the road side to reduce dust level etc. This was confirmed by the local stakeholders. Therefore, it is validated that mitigation measures were robustly implemented on ground for air quality issues project will have a positive impact on air quality.
2	Soil condition	For mitigating the impacts during construction, various mitigation measures were taken which is validated from the plant records of PP and the interview with local stakeholders. It was also confirmed that, the vegetation planted at project site helps to reduce soil erosion. The same is confirmed during the stakeholder meetings during Onsite audit. Therefore, it can be concluded that the project has no effect on soil conditions during its operation because it has no waste coming out.
3	Biodiversity	During the Onsite audit it was observed that the condition of ground vegetation will be gradually improved; No rare species has been found in the around area. The project site is not on the migration route of migratory bird. As such plant do not have any obstruction in the path of migratory birds. Nor project is affecting aquatic life with the implementation of Project, the greening water will be increased significantly; the biodiversity in the vicinity will be improved with the vegetation improvement. No negative impact envisaged.
4	Employment Generation	The project activity employed local population as skilled workers as well as security guards which were envisaged during the Onsite audit. The personnel employed by the project activity are also

SL.NO	Indicator	Assessment team opinion
		provided trainings and exposed to various awareness programs therefore a positive indicator has been accepted.

Local Stakeholder Consultation

Local stakeholder consultation has been conducted at the time of project registration. For on-going stakeholder's communication, PP have maintained grievance register^{12/} at the site office. All the stakeholders are happy with the implementation and operation of the project activity and no negative comments envisaged for the project activity. Complaint/suggestion/feedback register is maintained at site as a part of ongoing communication with stakeholders in line with clause 3.18.19 of VCS Standard, version 4.4 and appropriate actions taken time to time by PP.

Assessment team checked the grievance register provided by PP and found that local stakeholders can anytime lodge their grievances if any in the register over the operational life time of the project. During current monitoring period no grievance was received. Thus, assessment team is of the opinion that the ongoing stakeholder mechanism is adequate and appropriate. CAR 04 was raised during the verification process and closed successfully. Please refer Appendix 2 of this report for the detail closure of the CAR.

4.3 AFOLU-Specific Safeguards

This section is not applicable as this project activity is a non-AFOLU project activity.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

Means of verification	The verification team assessed whether the data and calculations of GHG emission reductions achieved resulting from the MR. The verification team has checked whether calculations of baseline GHG emissions, project GHG emissions and leakage GHG emissions have been carried out in accordance with the formulae and methods described in the monitoring plan of the CDM PDD/ ^{4/}		
Findings	CAR 05 was raised during the verification process and closed successfully. Please refer Appendix 2 of this report for the detail closure of the CAR.		
Conclusion	Ex-ante Parameter:		
	Parameter	Description	Value

	EF _{NG, Upstream,CH4}	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, in tCH ₄ per GJ fuel supplied to final consumers.	296 tCH ₄ /PJ
	EF _{CO2, Upstream, LNG}	Emission factor for upstream CO ₂ emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system	6 tCO ₂ /TJ
	EF _{BL, Upstream,CH4}	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in terms of ton of methane per MWh	0.00228 t CH ₄ /MWh
	EF _{CO2,FF,y}	Emission Factor of diesel	74,100 kgCO ₂ e/TJ
The above given Parameter is fixed ex-ante for the entire crediting period and as			

per the validated CDM PDD/³. Verification team found same was used in the baseline emission calculations.

Ex-post Parameter:

EG_{Export,y} = (Net electricity exported by the project plant in year y). The value monitored is 10,650,253 MWh.

The verification team has checked the entire monthly Energy generation records applicable for the monitoring period as per the project activity applied for verifications and found the monitoring parameter is monitored and recorded as per the monitoring plan in the registered CDM PDD. As per plant records – there are two transmission lines (capable of export to grid and import from grid). Each of the two lines have separate main and check meter. These meters can monitor the total export and total import from grid. The net export used here will be calculated from ‘export – import’. The details of the meters are Accuracy: 0.2s, Recording frequency: continuous measurement, monthly recording, Calibration frequency: Once in 2 years, Responsible entity: plant head. Meters are calibrated as per the standard procedures and documents for the same are maintained throughout. Cross check by recipient of sales.

The verification team has reviewed the emission reduction sheet and monitoring report data with the energy generation reports and found all the values are consistent.

FC_{NG,y} = Quantity of Natural Gas combusted in the project plant.

The total fuel consumption is monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity at project site. The monitored data is cross verified by PP and gas supplier. Same was verified in onsite audit and through submitted documents. The monitored value is 1,640,787,367.39 m³

Year	FC _{NG,y} (m ³)
2020	815,431,628.55
2021	825,355,738.84
Total	1,640,787,367.39

The details of the meters are Meter type: ultrasonic gas flow meter Accuracy: As per latest Gas Metering code³ as it is regulation requirement for the company. Recording frequency: continuous monitoring with daily recording, Calibration frequency: Once in six months Responsible entity: plant head.

The pressure and temperature transmitter will follow six months calibration frequency as per gas metering code.

³ <https://www.ema.gov.sg/cmsmedia/Gas/Gas%20Metering%20Code%202017%20Jan.pdf>

	The verification team has reviewed the emission reduction sheet and monitoring report data with the Continuous monitoring done at project boundary and the fuel consumption is cross checked by PP and Gas supplier (PP's gas flow meter at the gas skid/ receiving station) for cross verification and found all the values are consistent. NCV_{NG,y} = Net Calorific Value of Natural Gas (GJ/m³). The calorific value of the gas would be based on the measurement readings recorded by Gas Chromatograph located at the PP plant boundary. The data is sourced from onsite GC as per deviation request during previous verification. The monitored value for 2021, NCV_{NG,y} = 0.03907 for 2022, NCV_{NG,y} = 0.03896. Please refer deviation requested for monitoring approach of this parameter. The parameter is measured continuously and daily recorded in the plant logbook which were checked during onsite-audit along with the analysis reports. The verification team has reviewed the emission reduction sheet and monitoring report data for monthly value and found all the values are consistent. COEF_{NG,y} = CO₂ emission coefficient. The value monitored is for 2021: 0.002192 tCO₂/m³. for 2022: 0.002186 tCO₂/m³ The CO₂ Emission Co-efficient of natural gas is calculated as per equation number-2a of AM0029 Values of sub-variables. It is calculated under project activity for the calculation of Project Emission. The verification team has reviewed the same and found correct. EF_{CO₂,NG,y}: Emission Factor of Natural Gas, The value monitored is 56,100. The data is obtained from Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories. It is calculated under project activity for the calculation of Project Emission. The verification team has reviewed the same and found correct. PE_y = Project emission due to combustion of fuel i.e., Diesel and Natural Gas. The value monitored is 3,591,775 t CO₂. It is calculated under project activity for the calculation of Project Emission. The verification team has reviewed the same and found correct. EF_{BL,CO₂,y} = Baseline CO₂ emission factor. The value monitored is 0.4024. The data is obtained as per latest published document "Information on Emission Factors (For CDM projects in Singapore) dated December 2020⁴. As per the methodology section para 29, The baseline emission factor for electricity supplied to the grid shall be determined as the minimum among emission factors EF1 and EF2. As per the calculation, the EF2: The combined margin is minimum and hence the
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same is used for the calculation.

$FC_{FF,y}$ = Quantity of fossil fuel (diesel) consumed in the project activity in year y.
(348.073Tons)

Year	$FC_{FF,y}$ (Tons)
2020	164.140
2021	183.933
Total	348.073

The totalizer values are measured manually with the change in level of tank as per deviation request already approved during previous MP. Fossil fuel metering to the project is subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.

The verification team has reviewed the emission reduction sheet and monitoring report data and it is cross checked with the purchase invoice/ receipts and found correct.

$NCV_{FF,y}$ = Net Calorific Value of fossil fuel (0.04300 GJ/ m³)

The Net Calorific Value of fossil fuel is monitored with Suppliers' analysis/ report.

The verification team has reviewed the emission reduction sheet and monitoring report data and Invoice from the fossil fuel supplier and found correct.

$OXID_{NG}$ = Oxidation Factor of NG. The value applied is 1.

The data is obtained from Table 1.4, Chapter 1, Volume 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories⁵. In absence of country specific data; IPCC default value used as recommended in methodology. This value is used for estimation and is being monitored ex-post throughout the crediting period. It is calculated under project activity for the calculation of Project Emission. The verification team has reviewed the same and found correct.

$EF_{BM,y}$ = The Build Margin emission factor of Singapore national grid (tCO₂/MWh)

The value applied is 0.4057. The value is taken from the latest Singapore Government agency 'Information on emission factors

⁵ [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf](https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)

	https://www.ema.gov.sg/Statistics.aspx https://www.ema.gov.sg/cmsmedia/Publications_and_Statistics/Statistics/18RSU.pdf The value is monitored ex post and based on the available database published in the latest Singapore Government agency 'Information on emission factors'. The verification team has reviewed the same and found correct. EF_{OM,y} = The Operating Margin emission factor of Singapore national grid (tCO₂/MWh) The value applied is 0.3992. The value is taken from the latest Singapore Government agency 'Information on emission factors' https://www.ema.gov.sg/Statistics.aspx https://www.ema.gov.sg/cmsmedia/Publications_and_Statistics/Statistics/18RSU.pdf. The value is monitored ex post and based on the available database published in the latest Singapore Government agency 'Information on emission factors'. The verification team has reviewed the same and found correct. EF_{electricity,y} = The Baseline CO₂ emission factor of Singapore national grid. The value monitored is 0.4024 tCO₂/MWh. EF2: The combined margin, calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system", using a $w_{OM} = 0.5$ and $w_{BM} = 0.5$ weight ($EF_{BL,grid,CO_2,y} = EF_{grid,CM,y}$) Calculated as per monitoring methodology AM0029 Version 3.0. The verification team has reviewed the same and found correct. Source of gas for project activity: This parameter is monitored to establish that gas is used from imported LNG from the new SLNG terminal and not diverted from existing users in the host country. Frequency of monitoring/recording is Once in monitoring period. As per the registered PDD and applied methodology, Formula used to calculate achieved emission reduction is as follow; ER_y = BE_y – PE_y – LE_y EF1: The build margin, calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system" ($EF_{BL,grid,CO_2,y} = EF_{grid,BM,y}$); (b) EF2: The combined margin, calculated according to the latest version of the "Tool to calculate the emission factor for an electricity system", using a $w_{OM} = 0.5$ and $w_{BM} = 0.5$ weight ($EF_{BL,grid,CO_2,y} = EF_{grid,CM,y}$) for the first crediting period. As per the latest EMA's 'Information on emission factors for year 2021 (for CDM projects in Singapore)⁶,
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⁶ https://www.ema.gov.sg/cmsmedia/Publications_and_Statistics/Statistics/18RSU.pdf

a). EF1: Build Margin (BM) = 0.4057 tCO₂/MWh, -----
----- (i)

Operating Margin (OM) = 0.3992 tCO₂/MWh

Combined margin (CM)= BM x 0.5 + OM x 0.5

=0.4057 x 0.5 + 0.3992 x 0.5

(b) EF2: Combined margin = 0.4024 tCO₂/MWh -----
----- (ii)

As per the methodology section para 29, The baseline emission factor for electricity supplied to the grid shall be determined as the minimum among emission factors EF1 and EF2

As per the calculation, the EF2: The combined margin is minimum and hence the same is used for the calculation.

Thus, EBBLCO_{2,y} = 0.4024 t CO₂/MWh. The baseline emissions are calculated as below

$$BE_y = EGPJ_y * EF_{BL,CO_2,y}$$

Year 2021

$$= 5,331,859.45 \text{ MWh} * 0.4024 \text{ t CO}_2 / \text{MWh}$$

$$= 2,145,540 \text{ t CO}_2$$

Year 2022

$$= 5,318,394.132 \text{ MWh} * 0.4024 \text{ t CO}_2 / \text{MWh}$$

$$= 2,140,121 \text{ t CO}_2$$

Project emissions:

As per registered PDD, the project emissions are calculated as below

Volume of Natural Gas combusted in project plant (FC_{NG}) in year 2021:

$$815,431,628.55 \text{ m}^3$$

Volume of Natural Gas combusted in project plant (FC_{NG}) in year 2022:

$$825,355,738.84 \text{ m}^3$$

Volume of Diesel combusted in project plant (FC_{diesel}) in year 2021: 164.14 tons

Volume of Diesel combusted in project plant (FC_{diesel}) in year 2022: 183.933 tons

Year 2021

$$PE_{y1} = \sum FC_{f,y} * COEF_{f,y}$$

$$COEF_{f,y} = NCV_{fy} * EF_{CO_2,f,y} * OXID_f$$

$$\text{COEF}_{f,y} = 0.03906 \text{ GJ/Sm}^3 * 0.0561 \text{ tCO}_2/\text{GJ} * 1$$

$$\text{COEF}_{f,y} = 0.002191 \text{ tCO}_2/\text{m}^3$$

$$\text{PE}_y1 = 815431628.55 \text{ m}^3 * 0.002191 \text{ tCO}_2/\text{m}^3$$

$$\text{PE}_y1 = 1786838.28 \text{ tCO}_2$$

$$\text{PE}_y2 = \text{FC Diesel}_y * \text{COEF Diesel}_y$$

$$\text{COEF Diesel}_y = \text{NCV Diesel}_y * \text{EF CO}_2 \text{ Diesel}_y * \text{OXID Diesel}$$

$$\text{COEF Diesel}_y = 0.043 \text{ TJ/tons} * 74.10 \text{ tCO}_2/\text{TJ} * 1$$

$$\text{COEF Diesel}_y = 3.18630 \text{ tCO}_2/\text{tons}$$

$$\text{PE}_y2 = 164.14 \text{ tons} * 3.18630 \text{ tCO}_2/\text{tons}$$

$$\text{PE}_y2 = 522.99 \text{ tCO}_2$$

Total project emissions due to NG and Diesel during the monitoring period

$$\text{PE}_{2021} = \text{PE}_y1 + \text{PE}_y2$$

$$\text{PE}_{2021} = \text{PE}_y = 1,787,362.00 \text{ tCO}_2$$

Year 2022

$$\text{PE}_y1 = \sum \text{FC } f,y * \text{COEF}_{f,y}$$

$$\text{COEF}_{f,y} = \text{NCV } f,y * \text{EF CO}_2 \text{ } f,y * \text{OXID } f$$

$$\text{COEF}_{f,y} = 0.03896 \text{ GJ/Sm}^3 * 0.0561 \text{ tCO}_2/\text{GJ} * 1$$

$$\text{COEF}_{f,y} = 0.002186 \text{ tCO}_2/\text{m}^3$$

$$\text{PE}_y1 = 825355738.84 \text{ m}^3 * 0.002186 \text{ tCO}_2/\text{m}^3$$

$$\text{PE}_y1 = 1803927.94 \text{ tCO}_2$$

$$\text{PE}_y2 = \text{FC Diesel}_y * \text{COEF Diesel}_y$$

$$\text{COEF Diesel}_y = \text{NCV Diesel}_y * \text{EF CO}_2 \text{ Diesel}_y * \text{OXID Diesel}$$

$$\text{COEF Diesel}_y = 0.043 \text{ TJ/tons} * 74.10 \text{ tCO}_2/\text{TJ} * 1$$

$$\text{COEF Diesel}_y = 3.18630 \text{ tCO}_2/\text{tons}$$

$$\text{PE}_y2 = 183.933 \text{ tons} * 3.18630 \text{ tCO}_2/\text{tons}$$

	$PE_{y2} = 586.07 \text{ tCO}_2$ Total project emissions due to NG and Diesel during the monitoring period is $PE_{2022} = PE_{y1} + PE_{y2}$ $PE_{2022} = 1,803,927.94 + 586.07$ $PE_{2022} = 1,804,515.00 \text{ tCO}_2$ Total project emissions: $PE_y = PE_{2021} + PE_{2022} = 1,787,362.00 + 1,804,515.00 = 3,591,877.00 \text{ tCO}_2$ Leakage Emission: $LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y}$ $LE_{CH_4,y} = (FC_{NG,y} * NCV_{NG,y} * EF_{NG,upstream,CH_4} - EG_{PJ,grid,y} * EF_{BL,upstream,CH_4}) * GWP_{CH_4} \text{ ---(1)}$ $LE_{LNG,CO_2,y} = FC_{LNG,y} * EF_{CO_2,upstream,LNG} \text{ ---(2)}$ Year 2021 $LE_{CH_4,y} = (815431628.55 * 0.03906023 * 0.0296 - 5331921.90 * 0.00228) * 28$ $LE_{CH_4,y} = -76,410.00 \text{ tCO}_2$ $LE_{LNG,CO_2,y} = 31850.95 \text{ TJ} * 6.00 \text{ t CO}_2 / \text{ TJ}$ $LE_{LNG,CO_2,y} = 191,105.70 \text{ tCO}_2$ $LE_{2021} = -76,410.00 + 191,105.70$ $LE_{2021} = 114,696 \text{ tCO}_2$ Year 2022 $LE_{CH_4,y} = (825355738.84 * 0.03895966 * 0.0296 - 5318394.13 * 0.00228) * 28$ $LE_{CH_4,y} = -73,020.85 \text{ tCO}_2$ $LE_{LNG,CO_2,y} = 32156 \text{ TJ} * 6.00 \text{ t CO}_2 / \text{ TJ}$ $LE_{LNG,CO_2,y} = 192,933.46 \text{ tCO}_2$
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$$LE_{2022} = -73,020.85 + 192,933.46$$

$$LE_{2022} = 119,913 \text{ tCO}_2$$

Therefore, leakage emissions are $LE_y = LE_{2021} + LE_{2022} = 114,696 + 119,913 = 234,609 \text{ tCO}_2$

$$\text{Emissions Reduction} = ER_y = BE_y - PE_y - LE_y$$

Year 2021

$$= 2,145,540 - 1,787,362 - 122,883$$

$$= 235,295 \text{ t CO}_2$$

Year 2022

$$= 2,140,121 - 1,804,413 - 127,737$$

$$= 207,971 \text{ t CO}_2$$

Hence, net GHG reduction and removals

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)
<u>2021 (01-January-2021–31-December-2021)</u>	2,145,540	1,787,362	114,696	243,482
<u>2022 (01-January-2022–31-December-2022)</u>	2,140,121	1,804,515	119,913	215,693
Total	4,285,661	35,91,877	234,609	459,175

VVB confirmed that GHG reductions and removals have been quantified correctly and in line with monitoring procedure in CDM PDD and applied methodology.

The estimated emission reduction achieved from the project activity for the current monitoring period is 609,476 tCO₂e based on the number of days covered during the current monitoring period which comes out to be 730 days. Whereas the actual

	emission reductions achieved during the current monitoring period are 459,175 tCO ₂ e. The actual VCU's are -24.66% lower than the estimated VCU's. This variation is majorly due to the fact that the plant shutdown, and hence there was no production of renewable energy which could lead to emission reductions. Hence, accepted.
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4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

Means of verification	The verification team checked the Calibration details of the monitoring meters with the calibration certificates.
Findings	CAR 6 was raised during the verification process and closed successfully. Please refer Appendix 2 of this report for the detail closure of the CAR.
Conclusion	Assessment team has checked calibration certificates^{11/} and found Energy meters are calibrated as per calibration frequency mentioned in registered CDM PDD. The project activity has two transmission lines and each line has one main (by PP) and one check meter (by grid operator). These meters read both total export and import of electricity. The net export is being calculated from readings of these meters (total export – total import). For the current monitoring period, in case of delay in calibration (annual calibration frequency as per registered PDD), error factor as per CDM guideline is applied. PP has applied correction factor for the delayed duration which verified by VVB through ER sheet and confirmed the calculation as correct. Calibration details of the monitoring meters checked with calibration certificates submitted by PP and found that calibration frequency is complied. (refer Appendix-5). The break down log is checked and it was observed that there is a breakdown during the monitoring period (refer Appendix-6). This is due to the technical issue at the project site and hence there was no production of renewable energy which could lead to emission reductions, which is acceptable to the assessment team and evident from Electrical Generation Reports.No unforced error observed. No sampling procedure applied for monitoring of the data parameter and entire documents were checked by the assessment team to arrive at positive verification conclusions. The monitoring plan is followed at the project site. The monitoring meters were calibrated in line with the registered monitoring plan and in case of delay in calibration (annual calibration frequency as per registered PDD), error factor as per CDM guideline is applied. Thus, assessment team concluded that the evidences are sufficient in quantity, and appropriate for the quality, to determine the GHG reductions and removals. Assessment team confirmed that data/ information used for determining GHG reductions and removals were sufficient in quantity and of appropriate quality. Calibration certificates of meters/ QA/QC procedure checked and found to be appropriate.

4.6 Non-Permanence Risk Analysis

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
NA	NA	NA	NA	NA

5. VERIFICATION OPINION

Applus+ Certification has been engaged^{/02/} by Pacific Light Power Pte. Ltd. to perform the 4th verification 01-January-2021 to 31-December-2022 (inclusive of both dates) of the “Grid connected electricity generation plant using natural gas at Jurong Island in Singapore”.

The project participants are responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project’s monitoring plan in the registered CDM PDD ^{/4/} and the applied methodology AM0029, version 03.

Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Further, the verification has been planned and organized to achieve a Reasonable Level of assurance as per the requirement of VCS. No sampling procedure applied for document verifications. The entire documents checked/Power plant verification conducted to arrive at positive verification conclusions. The verification team can confirm that:

- the project is operated as planned and described in the project document;
- the monitoring plan is as per the applied methodology;
- the monitoring process in Monitoring Report is as per the CDM PDD ^{/4/};
- the development and maintenance of records and reporting procedures are in accordance with the monitoring plan;
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements.
- A Reasonable Level of assurance was achieved as planned, during verification process.

Verification period: 01-January-2021 to 31-December-2022 (inclusive of both dates)

Verified GHG emission reductions and removals in the above verification period, broken down by calendar year:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net emission reductions or removals (tCO ₂ e)	GHG
2021 (01-January-2021–31-December-	2,145,540	1,787,362	114,696	243,482	

<u>2021)</u>				
<u>2022 (01-January-2022–31-December-2022)</u>	2,140,121	1,804,515	119,913	207,971
Total	4,285,661	35,91,877	234,609	459,175

Estimated ex-ante GHG emission reductions and removals and the achieved emission reductions and removals for this monitoring period:

Year	Ex-ante emissions reductions/removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
<u>2021 (01-January-2021–31-December-2021)</u>	304,738	<u>243,482</u>	<u>-20.10%</u>	The actual VCUs are -24.66% lower than the estimated VCUs. This variation is majorly due to the fact that the plant shutdown, and hence there was no production of renewable energy which could lead to emission reductions. Hence accepted.
<u>2022 (01-January-2022–31-December-2022)</u>	304,738	<u>215,693</u>	<u>-29.22 %</u>	
Total	609,476	<u>459,175</u>	-24.66 %	

APPENDIX 1: DOCUMENTS REVIEWED OR REFERENCED

No.	Author	Title	References to the document	Provider
1.	NA	Commissioning certificates	Commissioning of the natural gas fired combined cycle power plant	PP
2.	Applus	Contract of the project participant with the DOE. Ref. No. A+SH_SYST_TQC_VCS_VER_2723	20-February-2023	PP
3.	NA	Technical specifications of Biomass residue-based Power project manufactured	Manufacturer technical specifications	PP
4.	NA	Registered CDM PDD and validation report	https://cdm.unfccc.int/Projects/DB/BVQI1373973780.44/view	PP
5.	NA	Monitoring report Version 01 (Initial) Monitoring report Version 02 Monitoring report Version 03 Monitoring report Version 04 Monitoring report Version 05 (Final)	05-March-2023 20-May-2023 03-July-2023 19-July-2023 12-December-2023	PP
6.	NA	Emission reduction sheet version 01 Emission reduction sheet version 02 Emission reduction sheet version 03 Emission reduction sheet version 04	05-March-2023 20-May-2023 03-July-2023 12-December-2023	PP
7.	NA	Shut down/Break down details of the complete monitoring period	Log Sheet	PP
8.	NA	Tools/ guidelines used in the project activity - VCS Program Definitions, version 4.3 - VCS standard Version 4.4 - VCS Program Guide 4.3 - VCS verification report template version 4.2	VERRA website	VERRA
9.	NA	Energy generation reports and fuel purchase / consumption records for the complete monitoring period	Energy generation reports and fuel purchase / consumption records for the complete monitoring period	PP

No.	Author	Title	References to the document	Provider
10.	PP	Declaration regarding no participation in other GHG program for the concerned monitoring period	08-June-2023	PP
11.	NA	Calibration details of the project activity undergoing verification	Calibration certificates	PP
12.	NA	Grievance Register maintained at site	-	PP
13.	UNFCCC	CDM validation and verification standard for project activities, Version 03.0	-	UNFCCC
14.	PP	Shutdown details for the Project Activity Maintenance log book	-	PP
15.	UNFCCC	CDM methodology AM0029,	Version 3.0	UNFCCC
16.	VERRA	Previous verification reports	https://registry.terra.org/app/projectDetail/VCS/1736	VERRA

APPENDIX 2: CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS (CAR/CL/FAR)

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	Section no.	Date :
Description of FAR		
VVB shall check and assess the status of double counting in the subsequent verification as for the current monitoring period, MR is also hosted on UNFCCC website. Hence, VVB shall check and ensure there was no double counting of emission reductions		
Project participant response		Date :
The undertaking for no double counting and no participation in other GHG program other than VCS shall be submitted along with this submission.		
Documentation provided by project participant		
VVB assessment		Date:
PP has submitted undertaking for no double counting and no participation in other GHG program other than VCS to the assessment team and same is found correct. Thus, accepted. FAR is Closed.		

Table 2. CL from this verification

CL ID	01	Section no.	1.1	Date: 28-April-2023
Description of CL				
The approved baseline methodology applied to this project provided under section 1.8 is inconsistent with the registered PDD and previous verification reports. Kindly Clarify. Moreover, The methodology used in MR is AM0029 whereas this methodology is withdrawn and replaced by methodology ACM0025 in EB 83. Hence, assessment team sought clarification from the PP to not used the current methodology.				
Project participant response				Date: 20-May-2023
The project is VCS Gap Validation where PDD is referred from the registered CDM PDD, and hence VCS Monitoring Report should be in line to the CDM PDD. Due to renewal of Crediting period, the PDD has been revised dated 30/06/2022. Since the approved methodology at the time of registration i.e., AM0029 ver. 3 got replaced with new methodology ACM0025 ver. 2, during RCP the methodology has been revised and approved by the UN now. Monitoring Report is based on the CDM PDD which is renewed for the next CDM Crediting Period.				
Documentation provided by project participant				
https://cdm.unfccc.int/Projects/DB/BVQI1373973780.44/view?cp=2				
DOE assessment				Date: DD-Month-2022
PP has revised approved baseline methodology applied to this project provided under section 1.8 with new methodology ACM0025 ver. 2, Since the approved methodology at the time of registration i.e., AM0029 ver. 3 got replaced with new methodology ACM0025 ver. 2, during RCP the methodology has been revised and approved by the UN now. Thus, accepted. CAR is Closed.				

CL ID	02	Section no.	1.1	Date: 28-April-2023
Description of CL				
Please submit the approval granted for the project activity (consent to operate) from the relevant authority.				
Project participant response				Date: 20-May-2023
<i>The Consent to operate shall be submitted herewith.</i>				
Documentation provided by project participant				
<i>Consent to Operate</i>				
DOE assessment				Date: DD-Month-2022
PP has submitted consent to operate to the assessment team. Thus, CAR is Closed.				

CL ID	03	Section no.	3.3	Date: 28-April-2023
Description of CL				
It is not clear whether the project deviations as described under section 3.2.2 of the MR are taken during the current monitoring period or previous MP and whether the deviations impact the applicability of the methodology, additionality, or the appropriateness of the baseline scenario, please provide an explanation of the outcome. Kindly clarify.				
Project participant response				Date: 20-May-2023
The project deviations as described under section 3.2.2 of the MR are taken during previous monitoring period and the same is mentioned in the first line of the section <i>"The below project description deviations were requested & approved in previous monitoring period."</i>				
<i>However, there is one deviation requested in the current monitoring period as below:</i>				
<i>The seconds (") is 4" instead of 24" in the actual latitude. The approved coordinates are 1°17'24" N and 103°43'30" E, however the actual coordinates of the site location are 1°17'4" N and 103°43'30" E.</i>				
The deviations do not have any impact on the applicability of the methodology, additionality, or the appropriateness of the baseline scenario. These deviations are already approved in the previous Monitoring periods.				
Documentation provided by project participant				
<i>Revised MR</i>				
DOE assessment				Date: DD-Month-2022
PP has described project deviations under section 3.2.2 of the MR are taken during previous monitoring period, The deviations do not have any impact on the applicability of the methodology, additionality, or the appropriateness of the baseline scenario. These deviations are already approved in the previous Monitoring periods. However, there is one deviation requested in the current monitoring period and the revision has been made in the relevant section of the deviation in the revised MR. Thus, accepted. CAR is Closed.				

Table 3. CAR from this verification:

CAR ID	01	Section no.	1.1	Date: 28-April-2023
Description of CAR				

During review of monitoring report following inconsistencies observed:	
1. PP is requested to revise the Report ID in KPI page of the MR. corrective action sought. 2. Date format is not inline with the updated MR version 4.2 template guidelines throughout the MR. Thus, corrective action sought. 3. PP is requested to provide the title of the appendix in the Content page of the MR Version 4.2. corrective action sought. 4. PP is requested to submit copies of technical specification of the EPC contract with Siemens to the assessment team. 5. PP is requested to submit the supportive document of synchronization with grid. Kindly submit. 6. PP is requested to submit the commissioning certificate of both the units mentioned in section 1.5 to the assessment team. 7. Geographical coordinates of the project activity under section 1.7 are not accessible on google map. Thus, corrective action sought.	
Project participant response	Date: 20-May-2023
1. The Report ID in KPI page of the MR is revised now as Not applicable. 2. The date format has been corrected throughout the MR. 3. The title of the appendix in the Content page of the MR Version 4.2. is incorporated now. 4. The technical specification of the EPC contract with Siemens are hereby submitted to the assessment team. 5. The commissioning certificate with the details of the synchronization with grid shall be submitted along with this submission. 6. The commissioning certificate of both the units shall be submitted to the assessment team with this submission. 7. The <i>geographical</i> coordinates of the project activity under section 1.7 have revised. The seconds (") is 4" instead of 24" in the actual latitude. The approved coordinates are 1°17'24" N and 103°43'30" E, however the actual coordinates of the site location are 1°17'4" N and 103°43'30" E. The revision has been included for the deviation	
Documentation provided by project participant	
Revised MR Commissioning Certificates Technical Specification	
DOE assessment	Date: 27-June-2023
1. PP has revised report ID in KPI page of revised MR as not applicable. Thus, CAR is Closed. 2. PP has revised Date format inline with VCS MR Template guidelines V4.2. Thus, CAR is Closed. 3. PP has incorporated the title of the appendix in the content page of the revised MR Version 4.2. Thus, CAR is Closed. 4. PP has submitted technical specification of the EPC contract with Siemens to the assessment team. Thus, CAR is Closed. 5. PP has submitted commissioning certificate with the details of the synchronization with grid to the assessment team. Thus, CAR is Closed. 6. PP has submitted the commissioning certificate of both the units to the assessment team and same is found correct. Thus, accepted. CAR is Closed. 7. PP has revised the geographical coordinates of the project activity under Section 1.7. The approved coordinates are 1°17'24" N and 103°43'30" E, however the actual coordinates of the site location are 1°17'4" N and 103°43'30" E. The revision has been included for the deviation under relevant section of the revised MR. Thus, CAR is Closed.	

CAR ID	02	Section no.	1.9	Date: 28-April-2023
Description of CAR				

PP is requested to submit an undertaking for no double counting for current monitoring period and for project activity is participated in other GHG program other than VCS.	
Project participant response	Date: 20-May-2023
The undertaking for no double counting and no participation in other GHG program other than VCS shall be submitted along with this submission.	
Documentation provided by project participant	
No double counting Declaration	
DOE assessment	Date: 27-June-2023
PP has submitted undertaking for no double counting and no participation in other GHG program other than VCS to the assessment team and same is found correct. Thus, accepted. CAR is Closed.	

CAR ID	03	Section no.	1.11	Date: 28-April-2023
Description of CAR				
PP is requested to provide supporting's for SDG Targets under Table 1 given for Sustainable Development Contributions. Kindly submit.				
Project participant response				Date: 20-May-2023
The below supporting documents for SDG Targets under Table 1 given for Sustainable Development Contributions are submitted for the assessment: 1. Employment Record 2. Attendance sheet				
Documentation provided by project participant				
Employment Record Attendance sheet				
DOE assessment				Date: 27-June-2023
PP has submitted employment record and attendance sheet as supportings documents for SDG Targets under Table 1 given for Sustainable Development Contributions. Thus, CAR is Closed.				

CAR ID	04	Section no.	2.2	Date: 28-April-2023
Description of CAR				
PP requested to submit records for ongoing local stakeholder consultation including grievance register etc. to assessment team.				
Project participant response				Date: 20-May-2023
The PP is maintaining the stakeholder feedback register also at the project site for the comments at any point of time during the project crediting period and the same if found genuine will be addressed immediately. PP has explained this mechanism for on-going communication to the local stakeholders and transparently kept the notice mentioning the grievance register and box at the project site. The accounting of all and any input received during ongoing communication will be taken in consideration to take the appropriate measure to resolve the grievance. No issues and grievance for the project activity has been identified during the current monitoring period.				
Documentation provided by project participant				
Stakeholder Feedback register				
DOE assessment				Date: 27-June-2023
PP has submitted stakeholder feedback register and no issues and grievance for the project activity has been identified during the current monitoring period. Thus, CAR is Closed.				

Accuracy of GHG Emission Reduction and Removal Calculation

CAR ID	05	Section no.	4.1	Date: 28-April-2023
Description of CAR				
1. In section 4.1 Data and Parameters Available at Validation is found inconsistent with the registered PDD and previous verification reports. Thus, Corrective action sought. 2. Data and Parameters Monitored values given under Section 4.2 is found inconsistent. thus, corrective action sought. 3. PP is requested to submit the revised ER sheet as the values are found inconsistent with the values mentioned in the MR. Thus, corrective action sought. 4. Quantification of GHG emission reductions and removals under Section 5 of the monitoring report is found incorrect. Thus, corrective action sought. 5. The value of the Net GHG Emission reduction and removals under section 5.4 is inconsistent with the calculated values. Thus, corrective action sought. 6. PP is requested to provide vintage-wise data for net GHG emission reductions and removals in Section 5.4 of MR. Thus, corrective action sought.				
Project participant response				Date: 20-May-2023
1. The project is VCS Gap Validation where PDD is referred from the registered CDM PDD, and hence VCS Monitoring Report should be in line to the CDM PDD. Due to renewal of Crediting period, the PDD has been revised dated 30/06/2022; Hence this Monitoring Report is based on the CDM PDD which is renewed for the next CDM Crediting Period. 2. Data and Parameters Monitored values given under Section 4.2 is as per the new methodology applied in renewed CDM PDD. 3. Data and Parameters Monitored values given under Section 4.2 has been revised now. 4. Quantification of GHG emission reductions and removals under Section 5 of the monitoring report is corrected now and is consistent with the calculated values in the ER Sheet. 5. The value of the Net GHG Emission reduction and removals under section 5.4 is corrected and are consistent with the calculated values now. 6. Vintage-wise data for net GHG emission reductions and removals are calculated in the ER sheet and incorporated in Section 5.4 of the revised MR.				
Documentation provided by project participant				
DOE assessment				Date: 27-June-2023
1. PP has provided the justification that the project is VCS Gap Validation where PDD is referred from the registered CDM PDD, and hence VCS Monitoring Report is in line to the CDM PDD. Due to renewal of Crediting period, the PDD has been revised dated 30/06/2022; Hence this Monitoring Report is based on the CDM PDD which is renewed for the next CDM Crediting Period. Thus, accepted. CAR is Closed. 2. PP has revised the Data and Parameters Monitored values given under Section 4.2 is as per the new methodology applied in renewed CDM PDD. Thus, CAR is Closed. 3. PP has submitted the revised ER sheet updated as per values mentioned in the revised MR. Thus, CAR is Closed. 4. PP has corrected Quantification of GHG emission reductions and removals under Section 5 of the monitoring report now and is consistent with the calculated values in the ER Sheet. Thus, CAR is Closed. 5. PP has corrected the value of Net GHG Emission reduction and removals under section 5.4 and are consistent with the calculated values now. Thus, accepted. CAR is Closed. 6. PP has updated the Vintage-wise data for net GHG emission reductions and removals in the ER sheet and incorporated in Section 5.4 of the revised MR. Thus, CAR is Closed.				

Quality of Evidence to Determine GHG Emission Reductions and Removals

CAR ID	06	Section no.	4.3	Date: 28-April-2023
Description of CAR				

PP has submitted the calibration certificate to the assessment team. However, the submitted documents are found not inline with the dates given in Appendix 2 of the MR and the calibration frequency of the meters are not clear and found inconsistent throughout the MR. Thus, PP is requested to submit the correct calibration certificate covering the complete monitoring period inline with dates mentioned in MR. Kindly submit.	
Project participant response	Date: 20-May-2023
The dates given in Appendix 2 of the MR have been corrected as per the calibration certificates of all the meters of this monitoring period. The frequency of the calibration have also been cleared in the revised MR version 2.0. All the calibration certificates are hereby submitted for the assessment.	
Documentation provided by project participant	
Calibration Certificates Revised MR	
DOE assessment	Date: 27-June-2023
PP has submitted all the calibration certificate with revised date as per the calibration certificate in Appendix 2 of the revised MR. Thus, CAR is Closed.	

APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk review	On-site inspection	Interview(s)	Verification findings
1.	Lead Auditor/Technical Expert	OR	PANKAJ	KUMAR	TQC-Outsourced entity	Yes	Yes	Yes	Yes

Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer (TR)	EI	Xue	Denny	Applus+ Certification
2.	Approver	IR	Calle de Miguel	Agustin	Applus+ Certification

Short CVs of the Team:

- Mr. Pankaj Kumar** has done M. Sc in Environment Management from Forest Research Institute, Dehradun and B. Sc. (Hons.) in Environment & Water Management from Magadh University, Bihar, India. He has also done Post Graduate Diploma in Environmental Law from NLSIU, Bangalore. He has more than 12 years of working experience in GHG Assessments and has participated during his career in Agencies and DOEs like MITCON, Agrinergy, Carbon Check and is empanelled with Applus+ Certification since 2015 for the performance of CDM/VCS/GS project assessments. He has extensive experience in the Renewable, Waste Management and Energy Demand Scopes of UNFCCC CDM and has done more than 100 Validations and Verifications of PAs and PoAs as Lead Auditor, Technical Expert and Technical Reviewer, mainly in Asia, Africa, USA, Asia Pacific and Americas under CDM, Verified Carbon Standard, Gold Standard & Social Carbon Standard, Brazil. He is an experienced, qualified and result oriented Environment and climate change professional having 16 yrs. of relevant experience in Climate Change (Mitigation & Adaptation), Environmental Due Diligence, Disaster Risk Reduction, Climate finance, adaptation planning, capacity building, validation and verification of GHG project. He can also provide technical support for environmental investigative, remedial projects involving air, water and soil, Waste management, EIA, Environmental Compliance, ISO 14001, OHSAS 18001, GHG accounting (ISO 14064) and Carbon foot printing. Mr. Pankaj Kumar is based in Patna, India. Mr. Pankaj Kumar may participate as part of the Audit Team as Lead Auditor and Technical Expert for the assessment.

2. **Mr. Denny Xue** (Master's Degree in Environmental Engineering, Bachelor's Degree in Thermal Engineering) is an Auditor appointed by Applus+ LGAI for the GHG project assessment, auditing and technical review. He has more than 6 years of work experience in CDM/GS4GG/VCS project assessment and technical review with Applus+. Before he joined Applus+ LGAI, he has been working for Shanghai Chuanji Investment and Management which is a CDM consultancy company as a project manager for CDM project development. Mr. Denny Xue is based in Shanghai, China. Mr. Denny Xue participate in the project's technical review team.

APPENDIX 4: ABBREVIATIONS

Abbreviations	Full texts
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
VER	Verified Emission Reduction(s)
CL	Clarification request
CM	Combined Margin
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNA	Designated National Authority
DOE	Designated Operational Entity
DR	Document Review
EF	Emission Factor
EIA	Environmental Impact Assessment
ER	Emission Reductions
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
PP	Project Participant
PLF	Plant Load Factor
MR	Monitoring Report
VCS	Voluntary Carbon Standard
VVB	Validation and Verification Body

APPENDIX 5: CALIBRATION DETAILS

The Energy meter calibration details are as below

	Line 1 Main Meter	Line 1 Check Meter	Line 2 Main Meter	Line 2 Check Meter
Manufacturer	Landis+Gyr	Landis+Gyr	Landis+Gyr	Landis+Gyr
Serial Number	99654212	99654213	99654214	99654215
Accuracy class	0.2s	0.2s	0.2s	0.2s
Date of Calibration	26-11-2020 12-10-2022	13-11-2020 28-10-2022	26-11-2020 12-10-2022	13-11-2020 28-10-2022

The Gas flow meter and pressure and Temp transmitter calibration details are as below

Gas Flow Meter

Model	EX-I SFC 3000	Flowsic 600	EX-I SFC 3000	Flowsic 600
Serial Number	12359001	12098674/1313835	12359003	12098673
Accuracy class	1%	0.3%	1%	0.3%
Date of Calibration	15-10-2020 13-10-2021 14-10-2021 05-10-2022 06-10-2022	15-10-2020 13-10-2021 05-10-2022 	15-10-2020 13-10-2021 14-10-2021 05-10-2022 06-10-2022	14-10-2020 13-10-2021 06-10-2022

Pressure and Temperature Transmitter

	Pressure transmitter	Temp Transmitter	Pressure	Temp Transmitter
Serial Number	91N402226 317/ 90X719054127*	C2M600274216 /C2N500037317*	91M601973 220	C2M600275 216
Accuracy class	0.50%	0.20%	0.50%	0.20%
Date of Calibration	15-10-2020 14-04-2021 13-10-2021 14-04-2022 05-10-2022	15-10-2020 14-04-2021 13-10-2021 14-04-2022 06-10-2022	14-10-2020 15-04-2021 14-10-2021 13-04-2022 06-10-2022	14-10-2020 15-04-2021 14-10-2021 14-04-2022 05-10-2022

* Pressure transmitter and Temperature transmitters got replaced on 13-10-2021 and 14-10-2021 respectively which is within the calibration frequency of 6 months as per gas metering code.

Gas Chromatograph calibration details

PP has two GC having serial number as 61200687 and 61200688 which are configured for auto calibration once every two weeks. Hence it complies with the Gas Metering Code requirement.

GCs	Encal 3000 Quad 61200687			Encal 3000 Quad 61200688		
	2020	2021	2022	2020	2021	2022
Date of Calibration	06-02-2020	09-03-2021	29-03-2022	10-02-2020	10-03-2021	14-04-2022
	08-06-2020	28-06-2021	21-06-2022	09-06-2020	29-06-2021	22-06-2022
	29-09-2020	22-09-2021	19-09-2022	30-09-2020	23-09-2021	29-09-2022
	21-12-2020	22-12-2021	15-12-2022	22-12-2020	30-12-2021	16-12-2022

APPENDIX 6: MAJOR BREAKDOWN DETAILS

Unit 10

S. No	Total Outage Duration			Reason for Shutdown
	Shutdown Time	Start Time	Outage Duration	
1	04-01-2021 00:27	06-01-2021 06:06	53:39	Shutdown due to low grid demand.
2	17-01-2021 23:26	20-01-2021 08:01	56:35	Shutdown due to low grid demand.
3	01-02-2021 23:56	07-02-2021 18:33	138:37	5th Minor inspection
4	23-02-2021 23:26	26-02-2021 04:32	53:06	Shutdown due to low grid demand.
5	07-03-2021 23:26	10-03-2021 04:32	53:06	Shutdown due to low grid demand.
6	09-03-2021 20:26	12-03-2021 22:32	74:06	Shutdown due to low grid demand.
12	13-03-2021 23:26	16-03-2021 04:32	53:06	Shutdown due to low grid demand.
13	07-04-2021 23:26	10-04-2021 04:32	53:06	Shutdown due to low grid demand.
14	24-06-2021 00:27	26-06-2021 06:02	53:35	IGV actuator connecting rod turn buckle retighting.
15	07-07-2021 23:26	17-07-2021 04:32	221:06	Shutdown due to low grid demand.
16	14-09-2021 23:27	17-09-2021 00:32	49:05	Shutdown due to low grid demand.
17	07-09-2021 23:26	10-09-2021 04:32	53:06	Shutdown due to low grid demand.
18	10-11-2021 14:27	16-11-2021 11:16	140:49	4th Minor inspection
19	30-11-2021 21:56	03-12-2021 05:44	55:48	Shutdown due to low grid demand.
20	21-12-2021 21:27	24-12-2021 14:02	64:35	Premix gas flowmeter leak rectification.
21	30-12-2021 14:58	02-01-2022 07:32	64:34	Shutdown due to low grid demand.
22	13-06-2022 19:56	16-06-2022 08:02	60:06	Shutdown due to low grid demand.
23	20-12-2022 22:56	23-12-2022 06:08	55:12	Shutdown due to low grid demand.

Unit 20

S. No	Total Outage Duration			Reason for Shutdown
	Shutdown Time	Start Time	Outage Duration	
1	02-03-2021 05:27	05-03-2021 06:32	73:05	CW debris filter inspection and cleaning
2	22-03-2021 00:28	12-04-2021 20:40	524:12	1st HGPI
3	28-12-2021 21:59	31-12-2021 07:34	57:35	Shutdown due to low grid demand.

4	25-01-2022 21:57	28-01-2022 05:32	55:35	Unit shutdown for CEC installation works.
5	07-02-2022 21:28	14-02-2022 10:52	157:24	4th Minor inspection + shaft balancing works
6	15-02-2022 21:58	17-02-2022 00:00	26:02	Shaft balancing works
7	06-08-2022 21:56	09-08-2022 07:01	57:05	SCW strainer (20PCB16AT001) isolation valve passing rectification
8	08-12-2022 22:57	13-12-2022 17:33	114:36	5th Minor inspection & Condenser rear water box replacement works
9	21-03-2020 02:27	23-03-2020 08:03	53:36	Shutdown due to low grid demand.
10	19-06-2020 22:29	22-06-2020 04:31	54:02	Shutdown due to low grid demand.