



**Validation report form for post-registration changes for
CDM project activities
(Version 03.0)**


Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION

Title and UNFCCC reference number of the project activity	Grid connected electricity generation plant using natural gas at Jurong Island in Singapore (UNFCCC reference number: 9687 ¹)
Process track	<input checked="" type="checkbox"/> Prior approval <input type="checkbox"/> Issuance <input type="checkbox"/> Renewal of crediting period
Version number of the validation report	01
Completion date of the validation report	17/02/2020
Type(s) of PRCs	<input type="checkbox"/> Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents ² <input checked="" type="checkbox"/> Corrections <input type="checkbox"/> Changes to the start date of the crediting period <input type="checkbox"/> Inclusion of a monitoring plan <input checked="" type="checkbox"/> Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents <input type="checkbox"/> Changes to the project design <input type="checkbox"/> Changes specific to afforestation and reforestation project activities
Version number of PDD to which this report applies	06
Project participants	PacificLight Power Pte. Ltd.
Host Party	Singapore
Applied methodologies and standardized baselines	Selected Methodology: AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" (Version 03, EB 39)
Mandatory sectoral scopes	01
Conditional sectoral scopes, if applicable	NA
Name and UNFCCC reference number of	LGAI Technological Center, S.A. (Applus+ Certification).

¹ <https://cdm.unfccc.int/Projects/DB/BVQI1373973780.44/view>

² Other standards, methodologies, methodological tools and guidelines (to be) applied in accordance with the applied(selected) methodologies are collectively referred to as the other (applied) methodological regulatory documents).

the DOE	UNFCCC reference number: E-0032
Name, position and signature of the approver of the validation report	Juan Sendin Caballero, BU Managing Director (Applus+ Certification) 

SECTION A. Executive summary

The purpose of the project activity is construction and operation of a new 800 MW natural gas based power plant. The electricity generated will be exported to the Singapore national grid. At the site ambient conditions and a frequency of 50 Hz, the rated capacity of plant will be 800 MW $\pm 10\%$ (two units)³. 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 would be recovered in individual heat recovery steam generators. The steam generated would then be expanded in a condensing type steam turbine driving an electric generator.

During the onsite visit assessment team checked the rated capacity of the project is same as mentioned in the registered PDD version 05.1 dated 16/03/2014 and thus conclude that there is not design change applicable for present post registration changes. The project activity is a new, independent natural gas based power plant and thus no power generating equipment existed in the project site before the project activity plant. Thus, the pre project scenario is continuation of existing carbon intensive fuel mix in the grid to generate power.

Validation Scope: The scope is defined as an independent and objective review of the project design document (PDD). The PDD 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, including the approved baseline and monitoring methodology AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" (Version 03, EB 39). The validation was based on the requirements in the Validation and Verification Standard (VVS version 02 for the project activity)

The validation 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 project design document.

Validation Process: The project assessment is based on the "Clean Development Mechanism Validation and Verification Standard version 2.0 for the project activity 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 CDM project activity are appointed.

Once the project is made available for the global stakeholder consultation process, the members of the assessment team carried out:

- I A desk review of the project design documentation;
- II Follow-up interviews with project stakeholders;
- III The resolution of outstanding issues and the issuance of the final validation report and opinion.

The prepared validation report and other supporting documents then undergo an internal quality control at the HQ (Accredited office) before being submitted to the CDM-EB.

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, LGAI Technological Center, S.A. (Applus+ Certification) has composed a project assessment team in accordance with the appointment rules in the internal Quality Management System of LGAI Technological Center, S.A. (Applus+ Certification).

The composition of audit team shall be approved by the LGAI Technological Center, S.A. (Applus+ Certification) ensuring that the required skills are covered by the team.

³ As per technical specifications of the EPC contract with Siemens

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. Sukanta Das	LA/TE	YES	YES	YES	YES
Mr. Simon Shen	TR	YES	YES	NA	NA

Document review

The Project Design Document submitted by the Client was reviewed against the approved methodology and other relevant criteria to verify the correctness, credibility, and interpretation of the presented information. Furthermore, a cross-check between information provided and information from other sources has been done. Please refer Appendix 3 of this report.

Follow-up interviews

A site visit is conducted by Applus+ Certification that performed interviews, telephone conferences, and physical site inspection with project stakeholders to confirm selected information and to resolve issues identified in the document review.

Resolution of Clarification and Corrective Action Request

The objective of this phase of the validation was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for Applus+ Certification's positive conclusion on the project design document. 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 validation process, the concerns raised and responses given are summarized in Appendix 4 below.

The final revised PDD version 06 dated 06/02/2020 submitted by PP serves as the basis for the final assessment presented. Additional changes to the project during the validation process are not considered to be significant with respect to the main CDM objectives. The two CDM 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 validation of the final documentation including the validation 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 validation opinion and relevant documents are submitted to the EB through the UNFCCC web-platform.

Conclusion

Applus+ Certification has performed a validation of the "Grid connected electricity generation plant using natural gas at Jurong Island in Singapore". The validation was performed on the basis of UNFCCC criteria and host country criteria, as well as criteria, e.g. AM0029 "Baseline Methodology for Grid Connected

Electricity Generation Plants using Natural Gas” (Version 03, EB 39) given to provide for consistent project operations, monitoring and reporting.

The review of the project design documentation and the subsequent follow-up interviews have provided Applus+ Certification with sufficient evidence to determine the fulfilment of stated criteria. In our opinion, the project meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria. The project will hence be recommended by Applus+ Certification for registration with the UNFCCC.

The permanent change in Monitoring plan is in compliance with relevant requirements in the “CDM project standard for project activities”. Assessment team also confirm that corrected parameters reflect the application of the applied methodologies, the registered monitoring plan, the applied standardized baselines and the other applied methodological regulatory documents.

The validation has been performed following the requirements of the latest version of the CDM VVS version 2.0 for the project activity and on the basis of the contractual agreement. The single purpose of this report is its use during the post-registration process as part of the CDM/UNFCCC project cycle.

SECTION B. Validation team, technical reviewer and approver

B.1. Validation 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/document review	On-site inspection	Interviews	Validation findings
1.	Lead Auditor /Technical Expert	O R	Das	Sukanta	True Quality Certifications private Limited- Outsourced entity	Yes	Yes	Yes	Yes

B.2. Technical reviewer and approver of the validation report on PRCs

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	EI	Shen	Simon	Applus+ Certification
2.	Approver	IR	Sendin Caballero	Juan	Applus+ Certification

SECTION C. Means of validation

C.1. Desk/document review

The details of the document observed during the validation process are listed below in Appendix 3 of this report.

C.2. On-site inspection

Duration of on-site inspection: 08/02/2018 to 09/02/2018

No.	Activity performed on-site	Site location	Date	Team member
1.	Discussion on project design, Monitoring, Emission reduction calculation, Corrections in the PDD and onsite visit to the complete power plant	The project site is located at 47 Jurong Island Highway, Singapore 627626	08/02/2018 to 09/02/2018	Mr. Sukanta Das

C.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Ravi Kumar	PVS	PP representative	08/02/2018 to 09/02/2018	As mentioned in section C.2 above	Mr. Sukanta Das
2.	Savereux	Clare	PP representative	08/02/2018 to 09/02/2018	As mentioned in section C.2 above	Mr. Sukanta Das

C.4. Sampling approach

Not Applicable.

C.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Areas of validation findings	No. of CL	No. of CAR	No. of FAR
Compliance with PDD form	00	00	00
Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents	00	00	00
Corrections	00	01	00
Changes to the start date of the crediting period	00	00	00
Inclusion of a monitoring plan	00	00	00
Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents	00	01	00
Changes to the project design	00	00	00
Changes specific to afforestation and reforestation project activities	00	00	00
Others (please specify)	00	00	00
Total	00	02	00

SECTION D. Validation findings

D.1. Compliance with PDD form

Means of validation	The guideline for completing CDM form version 11.0 for project activity is checked by the assessment team.
Findings	No findings raised for this compliance
Conclusion	The latest version 11.0 available in the UNFCCC site is used for the revision of PDD. The project activity description is in accordance to the PDD form and thus the same is acceptable to the assessment team.

D.2. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

Means of validation	The post registration changes do not fall under this category.
Findings	The post registration changes do not fall under this category.
Conclusion	The post registration changes do not fall under this category.

D.3. Corrections

Means of validation	Assessment team checked the registered PDD version 05.1 dated 16/03/2014
Findings	CAR 01 raised and closed successfully during the validation process. Please refer Appendix 4 for the detail closure of the CAR.
Conclusion	<p>Following corrections were carried out in the revised PDD version 06 dated 06/02/2020:</p> <ol style="list-style-type: none"> 1. Section A.2 of the revised PDD now clearly mentions the address of the project site. Assessment team confirm the same during the onsite visit and thus the correction in the revised PDD is deemed correct 2. Due to new template format of the PDD version 11.0 of UNFCCC following text are added : <p>Cover page: Assessment team confirms that Completion of additional fields namely Project participant(s), Host Party, Sectoral scope and selected methodology(ies), mandatory and conditional sectoral scope and Estimated amount of annual average GHG emission reductions is in line with new PDD template. Also section F as per the new PDD template is now included which mentions the details of the Host country approval. PP has received the letter of approval from the Host Country DNA on 24th April 2013. The same is checked from the UN home page as well (https://cdm.unfccc.int/Projects/DB/BVQI1373973780.44/view) and found correct.</p> <p>Section A.6 has been updated as per the latest PDD template. Assessment team confirms that the proposed CDM project activity is registered as a CDM project activity with UN reference number as UN:9687. This project activity is not included as a component project activity (CPA) in a registered CDM programme of activities (PoA). The proposed CDM project activity was not a CPA that has not been excluded from a registered CDM PoA. This is a registered CDM project activity whose first crediting period is ongoing and project exists in the same geographical location as the proposed registered CDM project activity.</p> <p>Section A.7 has been updated as per the latest PDD template: The capacity of the project activity being 800 MW which is more than 15 MW type 1 limit and thus it qualifies as large scale project activity. Therefore section A.7 i.e. De-bundling criteria is not applicable for the present project activity.</p> <p>For the ex-ante Parameter $EF_{OM,y}$, the Description of the data is now corrected. In the revised PDD the description is corrected with mention of Singapore national grid. The typo error from the registered PDD as Southern grid is now corrected as Singapore national grid. As the error is typo the same is acceptable to the assessment team.</p> <p>The contact information of Project participant is updated in Appendix 1. The MoC for the project is also changed and the mail sent to UN regarding MOC updation is checked and found correct by the assessment team. The change in PP information as mentioned in the revised PDD is in line with revise MoC and thus the correction is acceptable to the assessment team</p> <p>Leakage (LE_y) of the project activity has been calculated from two emission sources i.e. $LE_{CH_4,y}$ & $LE_{LNG,CO_2,y}$ as per applied methodology AM0029. The value of $LE_{CH_4,y}$ is -47,466 tCO₂ but same was considered zero in the earlier registered PDD. As per the registered methodology this is a negative number and means that upstream emissions of fuel used in the country are higher than that of NG required for the project activity. As per AM0029, pg. 10 'Where total net leakage effects are negative (LE_y < 0), project participants should assume LE_y = 0. Now since LE_y is positive</p>

	<p>and more than zero LE_y is part of emission reduction calculation as per the formula mentioned in the registered PDD. Therefore the leakage calculation is corrected and actual value of LE_{CH4} has been considered in the leakage calculation. Due to the correction, the leakage emission amount has been changed from 187,483 tCO₂ (estimated in the registered PDD) to 140,017 tCO₂ in the revised PDD and accordingly ER amount has been increased from 286,755 tCO₂ per annum (estimated in the registered PDD) to 334,221 tCO₂ per annum in the project activity. The baseline emission, project emission and leakage emission calculation is checked and found correct by the assessment team. Assessment team would like to convey that there is no change in baseline emission and project emission value from the registered PDD. The only difference is actual negative value of Leakage for CH₄ emission is now considered which was considered zero in the earlier registered PDD.</p> <p>Source of data for the parameter EF_{BL,CO2,y} is corrected to latest from published 20/04/2012 NEA data 'Information on emission factors (for CDM projects in Singapore)' from earlier</p>
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D.4. Changes to the start date of the crediting period

Means of validation	The post registration changes do not fall under this category.
Findings	The post registration changes do not fall under this category.
Conclusion	The post registration changes do not fall under this category.

D.5. Inclusion of a monitoring plan

Means of validation	The post registration changes do not fall under this category.
Findings	The post registration changes do not fall under this category.
Conclusion	The post registration changes do not fall under this category.

D.6. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents

Means of validation	Assessment team checked the revised PDD version 06 dated 06/02/2020										
Findings	CAR 02 was raised during the validation process and closed successfully. Please refer Appendix 4 of this report for the detail closure of the CAR										
Conclusion	Following are the observation of the DOE. Assessment team also concludes that the changed Monitoring plan is as per the National Law of the host party Singapore and also in compliance with the applied methodology. Accuracy class is in line with gas metering code as it is regulatory requirement of Singapore and hence Assessment team confirm that the level of accuracy for the metering equipment changed for the monitoring period do not reduce the level of accuracy. The detail for each parameter change is provided below in the table:										
	<table><tr><th>Sl. No</th><th>Detail as per Old PDD version 5.1 dated 16/03/2014</th><th>Detail as per New PDD version 6.0 dated 06/02/2020</th><th>Reason for change</th></tr><tr><td>1.</td><td>For the parameter FC_{NG,y}: As per the registered PDD fuel consumption will be monitored at both PP end and supplier end. Calibration</td><td>The total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises and measured in mmbtu in accordance with Gas Supply Agreement and also in line with national regulations of</td><td>As per the onsite practice the total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises and measured in mmbtu in accordance with Gas Supply Agreement.</td></tr></table>				Sl. No	Detail as per Old PDD version 5.1 dated 16/03/2014	Detail as per New PDD version 6.0 dated 06/02/2020	Reason for change	1.	For the parameter FC_{NG,y} : As per the registered PDD fuel consumption will be monitored at both PP end and supplier end. Calibration	The total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises and measured in mmbtu in accordance with Gas Supply Agreement and also in line with national regulations of
Sl. No	Detail as per Old PDD version 5.1 dated 16/03/2014	Detail as per New PDD version 6.0 dated 06/02/2020	Reason for change								
1.	For the parameter FC_{NG,y} : As per the registered PDD fuel consumption will be monitored at both PP end and supplier end. Calibration	The total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises and measured in mmbtu in accordance with Gas Supply Agreement and also in line with national regulations of	As per the onsite practice the total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises and measured in mmbtu in accordance with Gas Supply Agreement.								

	frequency of Gas flow meter: Once in a six month	Singapore.	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. This is as per national regulations of Singapore. Due to commercial value, both PP and gas supplier ensures that gas quantity data is measured accurately.
	Calibration frequency of pressure and temperature transmitter is not mentioned in the PDD.	The pressure and temperature transmitter will follow six months calibration frequency as per gas metering code of Singapore	
	Accuracy: $\pm 0.1\%$ of MV (linearity)	Accuracy: $\pm 1\%$ as per Gas Metering code)	
	The fuel consumption will be cross checked at project end (PP's gas flow meter at the gas skid/ receiving station) for cross verification.	The fuel consumption will be cross checked through invoices of supplier.	The supplier gives the gas consumption data in mmbtu ⁴ and the same is converted into SM ³ by using conversion factor of 25.2 (1mmbtu=25.2 SM ³). The same is confirmed from Petroleum Planning & Analysis Cell (PPAC) ⁵ Literature and thus found acceptable.
	The parameter is used for Project emission.	The parameter is used for project and leakage emission	<p>Calibration frequency:</p> <p>The Calibration of the Gas flow meter will be Annual as per gas metering code of Singapore. The frequency is as per the national grid law and thus acceptable to the assessment team.</p> <p>Moreover, The pressure and</p>

⁴ Gas flow rate measurement is made in Normal cubic meter (Nm³/hr) by USM and sent to flow computer for integration & pressure/temperature compensation. Flow computer then convert and integrate gas consumption in terms of heat value (mmBTU) and standard cubic feet (SCF).

⁵ http://ppac.org.in/WriteReadData/userfiles/file/conversion_factor.xls

				<p>temperature transmitter will follow six months calibration frequency as per gas metering code of Singapore. The same is thus acceptable to the assessment team.</p> <p>The Accuracy of the Ultrasonic gas flow meter : $\pm 1\%$ as per Gas Metering code and thus the same is acceptable to the assessment team).</p> <p>Gas bill generated by supplier at the month end is finally cross checked by both parties before settlement. This is as per national regulations of Singapore. Hence cross check mechanism is acceptable to the assessment team.</p> <p>The typo error is now corrected and leakage emission is also added as the parameter is used for leakage calculation.</p>
	2	<p>For the parameter EG_{Export,y}:</p> <p>Calibration frequency: Annual</p> <p>The parameter is used for baseline, Project emission.</p>	<p>Calibration frequency: Once in a 2 year</p> <p>The parameter is used for baseline, Project and Leakage emission.</p>	<p>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.</p> <p>The change in frequency is thus acceptable to the assessment team as the same is in line with National meter testing guideline.</p> <p>The typo error is now corrected and leakage emission is also added as the parameter is used for leakage calculation.</p>

	3	<p>For the parameter NCV_{NG,y}:</p> <p>The source of data for the parameter is: Invoice from the gas supplier</p> <p>Calibration frequency was missing.</p>	<p>The parameter is also measured via onsite Gas Chromatograph for GCV of gas and GCV is converted to NCV.</p> <p>The onsite GC will be calibrated fortnightly</p>	<p>As per the onsite practice the parameter is also measured via onsite Gas Chromatograph (GC) for GCV of gas and GCV is converted to NCV.</p> <p>As per Gas Supply agreement between PP and Supplier with SPPG, entire billing process for consumed gas is per MMBTU (GCV based), Hence PP will convert MMBTU to SM³ and convert GCV from BTU/FT³ to GJ/m³ and use 0.9⁶ factor for GCV to NCV conversion and calculate the GJ/m³ value. (1mmbtu=25.2 SM³ and 1 cubic Feet =0.0283 Cubic Meter). The calculation process is acceptable to the assessment team and hence can be a source of data in case Invoice from the gas supplier do not provide the NCV value.</p> <p>The onsite GC will be calibrated fortnightly as per Gas Metering Code, Energy Market Authority of Singapore</p>
		The parameter is used for Project emission.	The parameter is used for Project and Leakage emission.	The typo error is now corrected and leakage emission is also added as the parameter is used for leakage calculation.
	4	<p>EF_{BL, Upstream,CH4}. This parameter was missing from the registered monitoring plan.</p>	<p>EF_{BL, Upstream,CH4} is added as ex-post monitoring parameter as per the applied methodology.</p>	<p>The parameter "EF_{BL, Upstream,CH4}" is considered as ex post parameter instead of ex-ante. This is consistent with ex-post monitoring</p>

⁶ http://ppac.org.in/WriteReadData/userfiles/file/conversion_factor.xls

				parameter of build margin and in line with the registered methodology
	5	<p>For the parameter FC_{FF,y} : The total fuel consumption will be monitored if used for start-up/ auxiliary via mass flow meter</p> <p>Accuracy class: +/- 1%</p> <p>Monitoring frequency: Continuous monitoring with Monthly recording</p>	<p>The parameter is measured via Radar level Transmitters</p> <p>Accuracy class: +/-3mm</p> <p>Monitoring frequency: Monthly recording</p>	<p>As per the onsite observation and National law the total auxillary fuel consumption is monitored through Radar Level Transmittor. Radar level transmitter records fuel oil storage tank level at the power generating units before and after oil usage. For records purposes, change in storage tank level is converted into oil consumption by using the tank calibration table and oil density analysis.</p> <p>The Accuracy class of the Radar Level Transmittor is checked by the assessment team during onsite visit and found correct.</p> <p>Fossil fuel metering to the project will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. This will also be cross checked with the purchase invoice/ receipts. Further, fuel oil tanks are calibrated in accordance with the recalibration guidelines of chapter 6.3 of API manual Sec 2.2A. Since tank is not used for custody transfer so tank is required recalibration at 15 years interval according to the manual. Further, whenever</p>

				<p>fuel storage tanks are reloaded, sample oil are collected and analysed for density through an independent external laboratory. Oil density results as verified by the independent laboratory will be used for volume to mass conversion, for reference until the next round of fuel oil replenishment of storage tanks.</p> <p>Moreover, IPCC Default value as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories will be used in the emission factor for diesel in tonnes of carbon dioxide per Tera Joule</p> <p>Accuracy class of Radar level transmitter is correct as per onsite observation.</p> <p>As per onsite observation PP has installed 04 number of Storage tanks of capacity 25000 m3 each at site to store back up fuel i.e. Diesel. The diesel fuel storage is provision to meet regulatory requirement of 'Electricity License for Generation Licensee' from EMA to the project activity. As per, pg. 10, para. 10, PP is requirement to maintain 90 days of fuel reserve 'on site'. This is in line with the energy security concerns of the country and to be used only in case of emergencies.</p>
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				<p>With effect from 21-Jul-16, the Energy Market Authority (EMA) has amended the back-up fuel requirement. Notably, PP should have exclusive right of use of storage tank capacity on site to last at least 60 days and the same is acceptable to the assessment team.</p> <p>The recording for the parameter is monthly only and the same is as per the onsite practice and Energy Market Authority (EMA) guideline. Hence the monitoring frequency is acceptable to the assessment team.</p>
	6.	<p>For the Parameter: NCV_{FF,y}</p> <p>The source of data is Invoice from the fossil fuel supplier</p>	<p>For the Parameter: NCV_{FF,y}</p> <p>The source of data is considered from IPCC Default value as provided in table 1.2 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</p>	<p>The Net Calorific value for the fossil fuel will be considered from IPCC Default value as provided in table 1.2 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.</p> <p>The invoice from the supplier do not contains the NCV values and hence standard source of data as provided by IPCC for the parameter will be used for emission reduction calculation and thus the same is acceptable to the assessment team.</p>

D.7. Changes to the project design

Means of validation	The post registration changes do not fall under this category.
Findings	The post registration changes do not fall under this category.
Conclusion	The post registration changes do not fall under this category.

D.8. Changes specific to afforestation and reforestation project activities

Means of validation	The post registration changes do not fall under this category.
Findings	The post registration changes do not fall under this category.
Conclusion	The post registration changes do not fall under this category.

SECTION E. Internal quality control

As final step of a validation of the final documentation including the validation 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 validation opinion and relevant documents are submitted to the EB through the UNFCCC web-platform.

SECTION F. Validation opinion

Applus+ Certification has performed a validation of the “Grid connected electricity generation plant using natural gas at Jurong Island in Singapore”. The validation was performed on the basis of UNFCCC criteria and host country criteria, as well as criteria, e.g. AM0029 “Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas” (Version 03, EB 39) given to provide for consistent project operations, monitoring and reporting.

The review of the project design documentation and the subsequent follow-up interviews have provided Applus+ Certification with sufficient evidence to determine the fulfilment of stated criteria. In our opinion, the project meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria. The project will hence be recommended by Applus+ Certification for registration with the UNFCCC.

The permanent change in Monitoring plan is in compliance with relevant requirements in the “CDM project standard for project activities, version 02”. Assessment team also confirm that corrected parameters reflect the application of the applied methodologies, the registered monitoring plan, the applied standardized baselines and the other applied methodological regulatory documents.

The validation has been performed following the requirements of the latest version of the CDM VVS version 2.0 for the project activity and on the basis of the contractual agreement. The single purpose of this report is its use during the post-registration process as part of the CDM/UNFCCC project cycle.

Appendix 1. Abbreviations

Abbreviations	Full texts
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CEA	Central Electricity Authority
CL	Clarification request
CM	Combined Margin
CMS	Central Monitoring system
CO ₂ e	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNA	Designated National Authority
DCS	Distributed control system
DOE	Designated Operational Entity
DR	Document Review
EF	Emission Factor
EMA	Energy Market Authority (EMA)
EIA	Environmental Impact Assessment
ER	Emission Reductions
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming potential
IPCC	The Intergovernmental Panel on Climate Change
MMBTU	One million British Thermal Units
PP	Project Participant
PLF	Plant Load factor

Appendix 2. Competence of team members and technical reviewers

1. Mr. Sukanta DAS, has done M. SC in (Electronics and Photonics) and M. Tech in (Energy technology) from Tezpur Central University/ Indian Institute of technology Bombay in India. He is a certified lead auditor for ISO 14001 EMS LA and ISO 9001 QMS LA from International registry for Certified Auditors (IRCA) and Certified Lean Management practitioner from Quality Council of India (QCI). He has more than 10 years of working experience at TUV NoRD/ Re-consult/CRA/ Applus+ Certification under various categories of projects stating from Renewable to waste to supercritical projects. He was JI/ CDM Lead Assessor in TUV NoRD and was involved in more than 100 CDM validation and verifications activities in Gold Standard, VCS, CDM projects as a team leader/technical reviewer / validator / verifier covering the sectoral scope 1, 13 technical areas

1.2/1.1/13.1. Currently he is associated with True Quality Certifications Private Limited and is empanelled with Applus+ Certification to carry out GHG audit.

2. Meng (Simon) Shen (Master Degree in Thermal Energy Engineering, Bachelor Degree in Environmental Engineering) is a Lead Auditor appointed by Applus+ LGAI for the GHG project assessment. He is based in Shanghai. He has several years of work experience in environmental protection field. Before he joined Applus+ LGAI, he had been worked for TÜV SÜD as a GHG Validator/Assessment team and ISO 9001/14001 Lead Auditor for 3.5 years

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	NA	Calibration record of Radar Level Transmittor	The Calibration record dated 27/08/2019	PP
2	NA	Tank Capacity Table	The Tank Capacity table from Shinnihone Kentei (s) Pte Ltd	PP
3	NA	Energy Market Authority (EMA) of Singapore, Jan 2014 and April 2016, the generation facility should have meter test cycle as once in every two years.	EMA data from the National Guideline	PP
4	NA	Gas Supply Agreement	Gas Supply Agreement between PP and Supplier	PP
5	NA	Tank Re-calibration guideline	Tank Re-calibration guideline as per Americal petroleum institute.	PP

Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. CLs from this validation

CL ID	xx	Section no.	Date: DD/MM/YYYY
Description of CL			
Project participant response			Date: DD/MM/YYYY
Documentation provided by project participant			
DOE assessment			Date: DD/MM/YYYY

Table 2. CARs from this validation

CAR ID	01	Section no.	D.3	Date: 27/02/2018
Description of CAR				
During the onsite visit and desk review it was observed that the address of the power plant is not mentioned				

correctly in the registered PDD. Moreover, section A.6 and A.7 and the cover page of the PDD is not in compliance with PDD template. The Leakage emission is not correctly calculated in the registered PDD. The source of data for the parameter $EF_{BL,CO_2,y}$ is not correct.

Corrective action is sought for the same.

Project participant response

Date: 06/02/2020

The necessary correction is now carried out in the revised PDD.

Documentation provided by project participant

Revised PDD version 06

DOE assessment

Date: 17/02/2020

Following corrections were carried out in the revised PDD version 06 dated 06/02/2020:

1. Section A.2 of the revised PDD now clearly mentions the address of the project site. Assessment team confirm the same during the onsite visit and thus the correction in the revised PDD is deemed correct
2. Due to new template format of the PDD version 11.0 of UNFCCC following text are added :

Cover page: Assessment team confirms that Completion of additional fields namely Project participant(s), Host Party, Sectoral scope and selected methodology(ies), mandatory and conditional sectoral scope and Estimated amount of annual average GHG emission reductions is in line with new PDD template. Also section F as per the new PDD template is now included which mentions the details of the Host country approval. PP has received the letter of approval from the Host Country DNA on 24th April 2013. The same is checked from the UN home page as well (<https://cdm.unfccc.int/Projects/DB/BVQI1373973780.44/view>) and found correct.

Section A.6 has been updated as per the latest PDD template. Assessment team confirms that the proposed CDM project activity is registered as a CDM project activity with UN reference number as UN:9687. This project activity is not included as a component project activity (CPA) in a registered CDM programme of activities (PoA). The proposed CDM project activity was not a CPA that has not been excluded from a registered CDM PoA. This is a registered CDM project activity whose first crediting period is ongoing and project exists in the same geographical location as the proposed registered CDM project activity.

Section A.7 has been updated as per the latest PDD template: The capacity of the project activity being 800 MW which is more than 15 MW type 1 limit and thus it qualifies as large scale project activity. Therefore section A.7 i.e. De-bundling criteria is not applicable for the present project activity.

For the ex-ante Parameter $EF_{OM,y}$, the Description of the data is now corrected. In the revised PDD the description is corrected with mention of Singapore national grid. The typo error from the registered PDD as Southern grid is now corrected as Singapore national grid. As the error is typo the same is acceptable to the assessment team.

The contact information of Project participant is updated in Appendix 1. The MoC for the project is also changed and the mail sent to UN regarding MOC updation is checked and found correct by the assessment team. The change in PP information as mentioned in the revised PDD is in line with revised MoC and this the correction is acceptable to the assessment team

Leakage (LE_y) of the project activity has been calculated from two emission sources i.e. $LE_{CH_4,y}$ & $LE_{LNG,CO_2,y}$ as per applied methodology AM0029. The value of $LE_{CH_4,y}$ is -47,466 tCO₂ but same was considered zero in the earlier registered PDD. As per the registered methodology this is a negative number and means that upstream emissions of fuel used in the country are higher than that of NG required for the project activity. As per AM0029, pg. 10 'Where total net leakage effects are negative ($LE_y < 0$), project participants should assume $LE_y = 0$. Now since LE_y is positive and more than zero LE_y is part of emission reduction calculation as per the formula mentioned in the registered PDD. Therefore the leakage calculation is corrected and actual value of LE_{CH_4} has been considered in the leakage calculation. Due to the correction, the leakage emission amount has been changed from 187,483 tCO₂ (estimated in the registered PDD) to 140,017 tCO₂ in the revised PDD and accordingly ER amount has been increased from 286,755 tCO₂ per annum (estimated in the registered PDD) to 334,221 tCO₂ per annum in the project activity. The baseline emission, project emission and leakage emission calculation is checked and found correct by the assessment team. Assessment team would like to convey that there is no change in baseline emission and project emission value from the

registered PDD. The only difference is actual negative value of Leakage for CH₄ emission is now considered which was considered zero in the earlier registered PDD.

Source of data for the parameter $EF_{BL,CO_2,y}$ is corrected to **latest from published 20/04/2012 NEA data** 'Information on emission factors (for CDM projects in Singapore)' from earlier

CAR is thus closed.

CAR ID	02	Section no.	D.6	Date: 27/02/2018
Description of CAR				
During the site visit following observation is made by the DOE regarding monitoring practice:				
<ol style="list-style-type: none"> 1. The accuracy class and calibration frequency of the Gas flow meter is not as per the detail mentioned in the registered PDD. Moreover, as per the requirement of ACM0029 the supplier side meters details are also not provided to assessment team. Corrective action is sought for the same 2. The unit of NCV is wrong in registered PDD. Moreover, the calibration frequency/accuracy class of the chromatograph is also not clear in registered PDD. 3. The quantity of fossil fuel i.e. diesel is measured by Dip stick method/ level transmitter however registered PDD mentions mass flow meter. The same is contradictory and thus corrective action is sought for the same. 				
Project participant response				Date: 06/02/2020
<ol style="list-style-type: none"> 1. The Post registration changes (PRC) are requested during current monitoring plan for accuracy class and calibration frequency of gas flow meter. Also location and number of gas flow meters are updated. This is as per national regulations of Singapore and gas supply agreement. The total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises. 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. 2. The unit of NCV mentioned in registered PDD is GJ/m³ and it is as per methodology. The PRC is requested as supplier gives the GCV of gas in BTU/FT³ and PP will convert the same into GJ/m³ by using 0.9 factor for GCV to NCV conversion. Since the PP is getting directly GCV from supplier and Gas chromatograph calibration is not in control of PP, the information of gas chromatograph and it's calibration is not mentioned in PDD. 3. The PRC is requested for fossil fuel consumption parameter and mass flow meter is removed from PDD. The project activity involves radar level transmitters and calibration frequency is once in a six month 				
Documentation provided by project participant				
Revised PDD version 06				
DOE assessment				Date: 17/02/2020
Following are the observation of the DOE:				
<ol style="list-style-type: none"> 1. The total fuel consumption will be monitored through gas metering equipment installed at consumer end (PP side) only and within the project activity premises. 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. PRC changes is thus acceptable to the assessment team. CAR is thus closed. 2. The supplier provides the GCV value and PP will convert the same into GJ/m³ by using 0.9 factor for GCV to NCV conversion. The requested PRC is acceptable to the assessment team. CAR is thus closed. 3. As per the onsite practice the fossil fuel consumption is monitored through Radar level transmitter and not mass flow meter. Radar level transmitter records fuel oil storage tank level at the power generating units before and after oil usage. For records purposes, change in storage tank level is converted into oil consumption by using the tank calibration table and oil density analysis. The Accuracy class of the Radar Level Transmitter is checked by the assessment team during onsite visit and found correct. Fossil fuel metering to the project will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. This will also be cross checked with the purchase invoice/ receipts. Further, fuel oil tanks are calibrated in accordance 				

with the recalibration guidelines of chapter 6.3 of API manual Sec 2.2A. Since tank is not used for custody transfer so tank is required recalibration at 15 years interval according to the manual. Further, whenever fuel storage tanks are reloaded, sample oil are collected and analysed for density through an independent external laboratory. Oil density results as verified by the independent laboratory will be used for volume to mass conversion, for reference until the next round of fuel oil replenishment of storage tanks. The PRC request is thus accepted and hence CAR is closed.

Table 3. FARs from this validation

FAR ID	xx	Section no.	Date: DD/MM/YYYY
Description of FAR			
Project participant response			Date: DD/MM/YYYY
Documentation provided by project participant			
DOE assessment			Date: DD/MM/YYYY

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	31 May 2019	Revision to: <ul style="list-style-type: none">• Ensure consistency with version 02.0 of the “CDM validation and verification standard for project activities” (CDM-EB93-A05-STAN);• Make editorial improvements.
02.0	31 October 2017	Revision to align with the requirements in the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Registration Keywords: post-registration change, project activities, validation report		