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	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia (UNFCCC reference number 2467)
Process track	☒ Prior approval ☐ Issuance ☐ Renewal of crediting period
Version number of the validation report	1.2
Completion date of the validation report	29/01/2020
Type(s) of PRCs	☐ Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents[1] ☐ Corrections ☐ Changes to the start date of the crediting period ☐ Inclusion of a monitoring plan ☒ Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents ☒ Changes to the project design ☐ Changes specific to afforestation and reforestation project activities
Version number of PDD to which this report applies	21.3
Project participants	KUB-Berjaya Enviro Sdn. Bhd. (KBE)
Host Party	Malaysia
Applied methodologies and standardized baselines	Selected methodology: ACM0001 “Flaring or use of landfill gas” – Version 18.0 Selected standardized baseline(s): Not applicable
Mandatory sectoral scopes	Sectoral scope 13 - Waste handling and disposal
Conditional sectoral scopes, if applicable	Sectoral scope 1 - Energy industries (renewable - / non-renewable sources)

[1] 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).

Name and UNFCCC reference number of the DOE	LGAI Technological Center, S.A. (Applus+ Certification) UNFCCC Ref. No.: E-0032
Name, position and signature of the approver of the validation report	Mr. Juan Sendín Caballero *Applus+ Certification Business Unit Managing Director* Signature: 

SECTION A. Executive summary

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LGAI Technological Center, S.A. (hereafter referred to as Applus+ LGAI) has been commissioned by KUB-Berjaya Enviro Sdn. Bhd. (KBE) to perform a validation of the post registration change regarding to the addition of 2 sets of 2 MW biogas engines as well as relavent changes to the registered monitoring plan. The scope of the validation of the post registration change is defined as an independent and objective review of the post-registration changes occurred in the project activity according to the CDM VVS for project activities version 02.0. The validation opinion is finalized based on the assessment of the project design document through applying standard auditing techniques including but not limited to document reviews, follow up actions (e.g. telephone or e-mail interviews) and also the review of the applicable approved methodology and underlying formulae and calculations.

Before finalizing the validation report of the post registration change, the project activity has encountered several times of post registration change. Here is the history of the changes:

No.	Type of change	Change content	Date of approval by EB
1	Revision of monitoring plan	The revision is related to alternative measurement and handling of data during emergency conditions for methane content, flow meters and electricity meter.	09/05/2012
	Correction	The change is related to the internal use of power generated for the landfill operation was not successful and was not approved by the relevant authorities and the grid operator. This was due to technical constraints and deleted the onsite utilization from the PDD.	09/05/2012
2	Permanent changes from the monitoring plan or the monitoring methodology Changes to the project or programme design	PRC-2467-001. The change is related to the following: - Increase of power generation approximately 3MW and upload to the grid by year 2013 - Installation of an additional pipeline and flare system equipped with skid mounted LFG gas blower to handle any excess LFG captured which is expected to be commissioned at the beginning of year 2014	09/09/2013
3	Temporary deviation from the monitoring plan or the monitoring methodology	PRC-2467-002. The deviation is related to the usage of grid electricity by the gas engines 2 & 3 auxiliaries and gas supply system (GSS) are calculated since meter EL6 is not connected to capture the data.	11/09/2015
4	Permanent changes from the monitoring plan or the monitoring methodology Changes to the project or programme design	PRC-2467-003. The change is on non-implementation of Flare No.3.	12/11/2015
5	Permanent changes from the monitoring plan or the monitoring methodology	PRC-2467-004. The change is related to the following: - Increase of power generation approximately 2MW and upload to the	15/11/2016

	Changes to the project or programme design	grid by year 2015; and - Included diesel generator as backup for project activities during the power failure of the grid.	
6	Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools	PRC-2467-005. The change is related to the following: - The Flaring system No.1 was stopped. A Gas Supply System F1 (GSS F1) was built instead of the original Flaring No.1. Gas engine No. 1 which was attached to Flare 2 previously has been converted to GSS F1.	21/06/2018

In this request for post registration change, permanent changes to the registered monitoring plan as well as design change with addition of 2 sets of 2 MW gas engines are applicable.

The permanent changes to the registered monitoring plan occurs in following aspects:

1. Change in the monitoring of Amount of electricity generated using LFG by the project activity in year y ($EG_{PJ,y}$);
2. Change in the monitoring of Volumetric flow of the gaseous stream in time interval *t* on a wet basis ($v_{t,wb}$);
3. Addition of alternative value of Temperature of the gaseous stream in time interval t (T_t) in temporary situation;
4. Addition of alternative value of Pressure of the gaseous stream in time interval t (P_t) in temporary situation;
5. Monitoring diagram change.

The changes to the project designs occurred in below aspects:

1. 2 sets of gas engines with installed capacity of 2 MW each has been newly built as an addition of the electricity generation capacity. Due to the capacity addition, the total capacity has been increased from 6.4 MW to 10.4 MW. The baseline and additionality of the project activity needs to be re-evaluated.
2. The wastes received by Bukit Tagar Sanitary Landfill for year 2017- 2018 estimated in the PDD version 20.5 has been updated according to actual data in the revised PDD. And the annual waste received and landfilled from year 2017 to year 2023 has been updated.

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.

The report and the annexed validation checklist describe a total of 3 findings which include:

- 2 Corrective Action Requests (CARs);
- 1 Clarification Requests (CLs);
- 0 Forward Action Requests (FARs).

During the review by EB, clarification requests have been issued by EB reviewer dated 30/12/2019. the concerns are listed as below.

1. The paragraph 304 (a) of VVS for PA version 2 states that “If investment analysis was used to demonstrate additionality, the project participants have only modified the key parameters in the original spreadsheet calculations affected by the proposed or actual changes to the project activity.” The DOE is required to provide further information how it validates the change of input

values which are not relevant to the change to the project design as per paragraph 304 (a) of VVS for PA considering that "Input" sheet of Appendix 2 (FA1 - BTSL KBE Financial additional 4MW_170919_rev) shows that:
a. Annual electricity generation by the existing 2 MW from 2019 to 2028 has been revised; b. Average tariff sold to grid for the existing 2 MW has been revised from 0.4669 RM/kWh to 0.447 RM/kWh from 2019 to 2028.

2. The DOE has validated the inputs values for new 2 sets of 2 MW gas engine which are used to calculate the project IRR by checking the sources. The DOE is required to provide further information how it crosschecked between the information provided in the revised PDD including input values and information from sources other than those used as per para 275 and 29 (a)(ii) of VVS for PA version 2.

3. The revised monitoring plan of the updated PDD (p 79) includes that "An additional 10% will be deducted to the lower bound of the interval boundaries calculated to account for transmission and distribution losses, according to paragraph 232 b)(ii) of "CDM Project Standard for CDM project activities" (Version 01.0)" while the version 01.0 is not valid.

4. Regarding, addition of alternative value of pressure and temperature of the gaseous stream, the DOE states that it is conservative that the temperature and pressure of the gaseous stream will use the daily manual log-sheet to calculate the lower bound of 95% confidence interval in the case of temporary situation where Tt and/or Pt malfunctions leading to no readings captured. The DOE is required to provide further information on how it considered that it is conservative as it is not clear how the daily manual log-sheet is captured reading as no readings captured due to the malfunctions.

Applus+ Certification has conducted a further assessment on the concerned issues and provided responses as below:

1. The changed annual electricity generation of existing 2 MW GE and electricity tariff have been considered as a part of the change of project design. The assessment team actually has validated the same change in section D.7 of the report. As validated, when installing the 2 sets of 2 MW GE (5&6), the Sustainable Energy Development Authority Malaysia issued a "Feed-in Approval" /6/ requiring that the annual electricity generation of GE 4, 5 and 6 is capped at 42,048,000 kWh (equal to 6 MW * 8760 h * 0.8) per year. The "Feed-in Approval" also requires that the feed-in tariff of GE 4, 5 and 6 to be RM 0.447 /kWh from 2019 onwards. The reason why GE 4 is grouped with GE 5&6 for the new FIT tariff (considered a new application, thus new tariff rate) is also due to the request of TNB (power utility) to divert the upload of the electricity generated from GE4 (together with GE5&6) to the larger substation located 20 km away to prevent the over current issue due to low power demand in the landfill surrounding area. It is a must that the electricity generation and the tariff follows the requirement in the "Feed-in Approval". When updating the demonstration of additionality, the PP has considered the affected annual electricity generation and tariff of existing 2 MW (GE 4) as well. The assessment team confirmed that the change of annual electricity generation and feed-in tariff of existing 2 MW (GE 4) is a part of the project design and confirmed that the PP has re-evaluated the additionality as per VVS version 02.0.

2. Each input value changed along with the project design change has been validated and crosschecked in the report. Please. see below table for detail:

Affected input paramters	Data source in revised PDD	Crosscheck reference
Sales of electricity to grid 2019-2028	Feed-in Approval /6/	As per the Feed-in Approval /6/, the annual electricity generation by the newly installed 2 sets of 2 MW (GE 5 and GE 6) and the existing 2 MW (GE4) will be capped. The expected electricity that will be sold to grid as from 2019 is calculated based on 6 MW at 8,760 h/y with 80% availability

<table>
<tr><td></td><td></td><td>factor.

The availability factor of 80% is based on operating hour of GE1 1MW, GE2 & 3, 3.2MW and GE4 2MW gas engines for the period from Aug 2016 to Dec 2017.

The actual operating hour for GE1, 1MW gas engine was 93%, GE2 & GE3 3.2MW was 79% and GE4 2MW was 71% respectively. The average availability factor for the 3 GEs is 80%. The operation logsheet was verified to confirm the actual availability factor.

A 10% increase in the electricity generation sensitivity analysis has been conducted. The project IRR of the result is -11.9% for 10 years analysis and 13.1% for 21 years analysis. In order to meet the benchmark, the electricity generation is required to be increased by 5.6%.

However, it is unlikely the generation capacity exceeds the approved capacity stated in the feed-in tariff approval. In addition, it is also not possible for the gas engine to operation at 100% in one year without stoppage for maintenance. There are fixed scheduled maintenance of the GE which will require shut down. In addition, there are also instances where the engine will be shut down due to request from the grid operator for upgrading or maintenance of the cables or substations.

It can be concluded the expected amount of electricity for sale to the grid is determine in a plausible approach.</td></tr>
<tr><td>Total capital outlay up to year 2028</td><td>Source /5/:
- CP4
- CP4 a
- CP4 b
- CP4 c
- CP1
- CP1 a
- CP1 b
- CP5
- CP2
- CP6
- CP6 a
- CP7
- CP8</td><td>The total capital outlay has increased by RM 30,512,182 (= RM 99,456,936 - RM 68,944,754) due to the newly built 2 sets of 2MW gas engines as well as electrical works for grid connections. The increased capital includes:

<table>
<tr><th>Capitals</th><th>Value (RM)</th><th>sources /5/</th></tr>
<tr><td>Electrical & Inter-Connection</td><td>14,257,000</td><td>CP4</td></tr>
<tr><td>VO</td><td>627,044</td><td>CP4 a</td></tr>
<tr><td>SST claimed</td><td>217,065</td><td>CP4 b</td></tr>
<tr><td>Service of existing 33kV Step-up Transformer</td><td>35,360</td><td>CP4 c</td></tr>
<tr><td>LFG Gas Engine Generator 2 x 2MW</td><td>8,861,885</td><td>CP1</td></tr>
<tr><td>SST of imported components</td><td>442,915</td><td>CP1 a</td></tr>
<tr><td>SST of local components</td><td>33,510</td><td>CP1 b</td></tr>
<tr><td>Gas Supply System - 2 x 2MW</td><td>1,316,531</td><td>CP5</td></tr>
<tr><td>Phase 1 & Phase 2B Gas Extraction</td><td>1,465,391</td><td>CP2</td></tr>
<tr><td>Building Extension Works</td><td>587,793</td><td>CP6</td></tr>
<tr><td>VO</td><td>38,516</td><td>CP6 a</td></tr>
<tr><td>Platform construction</td><td>188,060</td><td>CP7</td></tr>
<tr><td>Fire Hydrant</td><td>988,151</td><td>CP8</td></tr>
<tr><td>Contingencies (5%)</td><td>1,452,961</td><td>/</td></tr>
<tr><td>Total</td><td>30,512,182</td><td>/</td></tr>
</table>

All the costs in the above table were reviewed and cross checked against with the Letter of Acceptance and original proposal received by the PP to confirm the values applied in the financial analysis are based on the Letter of Acceptance.</td></tr>
</table>

		Based on the revised financial analysis including consideration of updated investment and revenue, the project IRR remains below the benchmark of 12%. The project IRR without finance costs, for 10 years is negative at - 15.7% and for 21 years is +10.6% without CDM revenue. The cost for electrical equipment and installation to grid connection applied is derived from the Letter of Acceptance issued by PP to Chen Guan. The letter of acceptance was reviewed to confirm the cost applied in the financial analysis amounting to RM 15,136,469 is correct. It can concludes that the cost applied is appropriate since it is based on the letter of acceptance. The cost for 4MW gas engines with the relevant works was derived from the Letter of Acceptance to SP Energy Sdn Bhd dated 12/02/2018. The cost applied was cross-checked with other proposals from WZS PowerGen SB dated 29/12/2018 amounting RM 16,665,664.00, and Spektra Voltik SB dated 29/12/2018 amounting RM 13,445,530.00. The cost applied is considered appropriate since it is lower when compared with the original proposals received from both suppliers The cost for Gas Supply System - 2 x 2MW applied is based on the letter of approval of RM 1,316,531 awarded to Interlinx Automation. It can concludes that the cost applied is appropriate since it is based on the letter of acceptance. The letter of acceptance was reviewed to confirm the cost for Phase 1 & Phase 2B Gas Extraction applied in the financial analysis amounting to RM 1,465,391 is correct. Since the cost is derived from the letter of acceptance, it can be concluded the cost applied is plausible. The cost for Building Extension Works applied is based on the letter of approval of RM 626,308 awarded to Melbourne Sunrise. It can concludes that the cost applied is appropriate since it is based on the letter of acceptance. The cost for Platform construction applied is based on the letter of approval of RM 188,060 awarded to AAY Construction. It can concludes that the cost applied is appropriate since it is based on the letter of acceptance. The cost for Fire Hydrant applied is based on the letter of approval of RM 988,151 awarded to Tai Hoe. It can concludes that the cost applied is appropriate since it is based on the letter of acceptance. The contingencies is 5% of above cost. The ratio is also applied in the project original design. The same ratio has been validated by TUV NORD in previous validation opinion of post registration change dated 05/09/2016. It can be concluded that the increase in investment cost is considered reasonable.
Average	Feed-in	The tariff rate applied for GE4, GE5 and GE6 was based on

electricity tariff of GE 4, 5 & 6 from 2019-2028	Approval /6/	the approval by Sustainable Energy Development Authority Malaysia effective from 20/06/2019 for a period of 16 years. In the approval it states the net export capacity is 6MW. The feed-in approval was reviewed to confirm the tariff and export capacity applied for GE4, GE5 and GE6 is correct in the financial analysis. The feed-in-tariff of electricity generated by GE4, GE5 and GE6 after the design change applies RM 0.447/kWh, which is different with the feed-in-tariff (RM 0.4669/kWh of electricity generated by GE4), this is due to the grid operator requested to reconnect the GE4 together with GE5 and GE6 to TNB substation at SIME DARBY Bestari Jaya. The sub-station is more stable in power connection as it can handle bigger power capacity. It is confirmed that PP is forced to reconnect GE4 together with GE5 and GE6. A 10% increase in the tariff sensitivity analysis has been conducted. The project IRR of the result is -11.9% for 10 years analysis and 13.1% for 21 years analysis. In order to meet the benchmark, the tariff is required to be increased by 5.6%. However, such incremental is unlikely since the tariff is stated clearly in the approval and power purchase agreement and fixed over the agreement period. Assessement has been done to compare the current and historical approved tariff for biogas by Sustainable Energy Development Authority Malaysis (SEDA) through the e-bidding system. It has been validated against SEDA website (http://www3.seda.gov.my/iframe/) by the assessment team that since November 2018, SEDA has changed the method to determine the FiT from fixed rate (fixed at 0.3184/kWh during 2013-2018) into variable rate through bidding system. The FiT was fluctuant from RM 0.2210/kWh to RM 0.2814/kWh since then. The basic FiT rate is lower than the tariff of GE5 and GE6. As a result, it could be concluded that the trend of FiT rate is only going downwards (degressing). Furthermore, the tariff is stated clearly in the Feed-in approval /6/ and the effective period was fixed for 16 years, thus, the tariff increase or decrease is impossible as it is already fixed under the approval. The assessment team concluded that the tariff applied by the project participant is appropriate.
Average operations and maintenance costs	Source /5/: - CP 1 - CP 1c - CP 3 - CP 9 - CP 10	The O&M cost is derived from the proposal submitted by SP energy based on the interval of operating hours for each year starting from year 3 of operation. The initial year 1 and year 2 costs are derived from the gas engine supply contract. Therefore, this cost is not included in the analysis. The year 1 & 2 cost was cross-checked with the engine supply contract and confirmed is correct. The O&M cost from year 3 onwards is cross-checked with maintenance summary provided by the gas engine supplier.

		The costs from year 2025 to 2028 is based on the year 2024 cost and add the annual 3%. The inflation rate is considered conservative since it is lower than the average inflation of the host country as at 2017 (https://www.indexmundi.com/malaysia/inflation_rate_(consumer_prices).html). A 10% decrease in the cost has been conducted. The project IRR of the result remains below the benchmark at 10% for 21 years. In order to meet the benchmark the cost need to reduce by 28% which is practically not possible. It can be concluded, the O&M cost applied is plausible and considered conservative.

3. PP has revised the PDD with updating the version number of quoted Project Standard for CDM Project Activity from 01.0 to 02.0. The assessment team confirmed correct version of Project Standard is applied.

4. The PP has updated the relevant part of PDD. For the temperature, in the case of temporary situation where T_t or P_t malfunctions leading to no readings captured, conservative method will be applied to count the figure as per the appendix, “Additional data handling and monitoring guidance for determining the mass flow of methane in biogas” of the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” to determine the mass flow of a greenhouse gas in a gaseous stream. The added information provides a conservative manner of applying the value of the parameter. Therefore, the change does not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan, and does not lead to a reduction in the accuracy of the calculation of GHG emission reductions.

The assessment team considered that the alternative approach in case of T_t and P_t malfunctions reflects good practice of conservative consideration of emission reductions. Clear method has been described in the PDD which provides readers a clear understanding how to treat the figures during malfunctions.

In summary, it is Applus+ LGAI’s opinion that the project activity “Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia” (Ref. No. 2467) in Malaysia, as described in the PDD, version 21.3 dated 29/01/2020, meets all relevant UNFCCC requirements for the post registration change. Hence Applus+ LGAI submitted the request for post registration change of the project activity together with the request for renewal of crediting period to UNFCCC.

SECTION B. Validation team, technical reviewer and approver

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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.	Team Leader / Technical expert	EI	Shen	Meng (Simon)	Applus+ LGAI Shanghai	x	x	x	x

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	Cortés	Miguel	Applus+ LGAI
2.	Approver	IR	Sendín Caballero	Juan	Applus+ LGAI

SECTION C. Means of validation

C.1. Desk/document review

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The PDD version 21.0 dated 26/08/2019 was submitted by the Client to Applus+ LGAI for the document review. This version of PDD has updated from version 20.5 which was submitted for renewal of crediting period. with including the changed project design and the change of monitoring plan.

During the desk review, the relevant documents, including the registered PDD, the updated PDD, the previous monitoring reports and corresponding verification reports for the 1st and 2nd crediting period, the latest MoC, financial analysis spreadsheet, technical specifications of equipments and other relevant background documents were provided and assessed. A complete list of all documents and evidences reviewed is included in Appendix 3 to this report. The validation team could confirm the status of the project design, construction, operation and monitoring plan etc. And the affect of the post registration changes to the additnality, project scale, the applibility and application of the methodology etc. also can be confirmed as it was defined by the applied methodology ACM0001 version 18.0.

C.2. On-site inspection

Duration of on-site inspection: 13/09/2019				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	- Implementation status of the project activity; - Change of project design; - Permanent change from the registered monitoring plan occurred during this monitoring period; - The compliance with revised PDD.	Bukit Tagar, Mukim Sg. Tinggi, Hulu Selangor District in the State of Selangor, Malaysia	13/09/2019	Meng (Simon) Shen

C.3. Interviews

No.	**Interviewee**			**Date**	**Subject**	**Team member**
	Last name	**First name**	**Affiliation**			
1.	Mohd Zain	Zainal Fikry	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	13/09/2019	- Implementation status of the project activity; - Change of project design; - Permanent change from the registered monitoring plan occurred during this monitoring period; - The compliance with revised PDD.	Meng (Simon) Shen
2.	Bin Azmi	Khairul Ammeer	Eco-Ideal Consulting Sdn Bhd	13/09/2019		Meng (Simon) Shen
3.	Chen	Saw Ling	Eco-Ideal Consulting Sdn Bhd	13/09/2019		Meng (Simon) Shen
4.	Abd Aziz	Mustaffa Kamal	Eco-Ideal Consulting Sdn Bhd	13/09/2019		Meng (Simon) Shen

C.4. Sampling approach

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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	0	0	0
Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other	0	0	0

methodological regulatory documents			
Corrections	0	0	0
Changes to the start date of the crediting period	0	0	0
Inclusion of a monitoring plan	0	0	0
Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents	0	0	0
Changes to the project design	1	2	0
Changes specific to afforestation and reforestation project activities	0	0	0
Others (please specify)	0	0	0
Total	1	2	0

SECTION D. Validation findings

D.1. Compliance with PDD form

Means of validation	The assessment team has verified the format against the "PDD form" template to confirm whether the correct format of PDD form is used. The assessment team also confirmed the information transferred to the updated PDD against the original registered PDD to confirm whether the information transferred is materially the same. The latest version of Project Design Document form version 11.0 was applied in the final PDD as per CDM PS for project activities version 02.0. The assessment team confirmed the PDD template format is correctly applied.
Findings	No CAR/CL/FAR is issued.
Conclusion	In accordance with paragraph 278-280 of the CDM VVS for project activities version 02.0, the assessment team confirmed that the updated PDD complies with the applicable PDD form with the lastest version 11.0 and instructions therein for filling out the PDD. Information transferred to the later valid version of the PDD form is materially the same as that in the registered PDD。

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	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.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	The assessment team has validated the permanent changes from the registered monitoring plan applying standard auditing techniques in compliance with paragraph 296-299 of CDM VVS for project activities version 02.0. The assessment team has confirmed that there are permanent changes to the registered monitoring plan. However, no permanent deviation of monitoring from the applied methodologies or other methodological regulatory documents is available. And standardized baseline is not applicable in the project activity. Paragraph 296: it has been determined that there are permanent changes applicable to the registered monitoring plan. It has been validated by the assessment team in below cell that the permanent changes comply with the relevant requirements in the "CDM project standard for project activities".

Paragraph 297:
The assessment team has confirmed in below cell that the permanent changes to the registered monitoring plan has been clearly described in the revised PDD, and the changes are in compliance with the applied methodologies ACM0001 version 18.0, and do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.

Paragraph 298:
The assessment team has confirmed in below cell that the permanent changes to the registered monitoring plan are unlikely to lead to a reduction in the accuracy of the calculation of GHG emission reductions.

Paragraph 299:
The assessment team has stated the opinion in below cells that the permanent changes comply with the relevant requirements in the "CDM project standard for project activities".

The permanent changes to the registered monitoring plan occurs in following aspects:

1. Change in the monitoring of Amount of electricity generated using LFG by the project activity in year y ($EG_{PJ,y}$);
2. Change in the monitoring of Volumetric flow of the gaseous stream in time interval *t* on a wet basis ($v_{t,wb}$);
3. Addition of alternative value of Temperature of the gaseous stream in time interval t (T_t) in temporary situation;
4. Addition of alternative value of Pressure of the gaseous stream in time interval t (P_t) in temporary situation;
5. Monitoring diagram change.

The assessment team has validated each change as below:

1. Change in the monitoring of Amount of electricity generated using LFG by the project activity in year y ($EG_{PJ,y}$)

2 sets of 2 MW biogas engines were newly installed. The monitoring of the electricity generation of the project activity has been changed accordingly.

Before the change:

The amount of electricity actually uploaded to grid is measured by electricity meters (EL5 for GE1, EL11 for GE2/3 and EL13 for GE4) and compared with the net amount (EL4 for GE1, EL9 for GE2, EL10 for GE3, EL12 for GE4) derived from above. Lower value of the amount will be taken as the net amount for emission reductions calculations. The comparison is tabulated as below:

Electricity Meter	
Installed on-site	**Owned by Grid Operator**
EL4	EL5
EL9 and EL10	EL11
EL12	EL13

Electricity meters (except the meter owned by the grid operator, i.e. EL5, EL11 and EL13) will be checked and calibrated regularly according to manufacturer's recommendations.

After the change:

The amount of electricity actually uploaded to grid is measured by electricity meters (EL5 for GE1, EL11 for GE2/3 and EL16 for GE4/5/6) and compared with the net

amount (EL4 for GE1, EL9 for GE2, EL10 for GE3, EL12 for GE4, EL14 for GE5, EL15 for GE6) derived from above. Lower value of the amount will be taken as the net amount for emission reductions calculations. EL13 (Amount of electricity uploaded to grid from Gas Engine No. 4) no longer in used as the amount of electricity actually uploaded to grid for Gas Engine No.4, Gas Engine No.5 and Gas Engine No.6 will be monitored by EL16. The comparison is tabulated as below:

Electricity Meter	
Installed on-site	**Owned by Grid Operator**
EL4	EL5
EL9 and EL10	EL11
EL12, EL14 and EL15	EL16

In the case of temporary situation where EL16 malfunctions leading to no readings captured, the power generated and uploaded to grid for Gas Engine No.4, Gas Engine No.5 and Gas Engine No.6 will use the reading captured by EL12, EL14 and EL15. The recorded reading shall be derived based on 95% confidence interval principles (source: "IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", page 6.6). The lower bound of 95% confidence interval with reference to the above-mentioned guideline will be applied. An additional 10% will be deducted to the lower bound of the interval boundaries calculated to account for transmission and distribution losses, according to paragraph 231 b)(ii) of "CDM Project Standard for CDM project activities" (Version 02.0).

Electricity meters (except the meter owned by the grid operator, i.e. EL5, EL11 and EL16) will be checked and calibrated regularly according to manufacturer's recommendations.

Valiation opinion:

It has been confirmed via site visit that the meter EL13 has been disconnected from using and has been replaced by EL16. The installation location of the newly added electricity meters EL14, EL15, EL16 have been verified via site visit as consistent with the decription in revised PDD. The information such as the type, serial numbers and the accuracy level etc. of the meters has been verified against the nameplates of the electricity meters /8/ and the monitoring diagram /9/ by the assessment team. After the change, the electricity exported to the grid will be monitored by meter EL5, EL11 and EL16 and crosschecked with the individual meters of each gas engine (EL4 for GE1, EL9 for GE2, EL10 for GE3, EL12 for GE4, EL14 for GE5, EL15 for GE6). It could confirm that the changed monitoring system is in compliance with monitoring methodology and applicable installation and calibration requirements. It has been confirmed against the nameplates of the meters that the accuracy level of the newly installed meters are of the same level 0.5s comparing to exising situation, thereby it could concluded that the changes do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.

The amount of electricity exported to grid will be measured by separate electricity meters EL5, EL11 and EL16 and compared with the amount of generated electricity measured by meters EL4, EL9, EL10, EL12, EL14, EL15. In the case of temporary situation where EL16 malfunctions leading to no readings captured, the power generated and uploaded to grid for Gas Engine No.4, Gas Engine No.5 and Gas Engine No.6 will use the reading captured by EL12, EL14 and EL15. The recorded reading shall be derived based on 95% confidence interval principles (source: "IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", page 6.6). The lower bound of 95% confidence interval with reference to the above-mentioned guideline will be applied. An additional 10% will be deducted to the lower bound of the interval boundaries calculated to account for transmission and distribution losses. Therefore, this is the most conservative approach as per paragraph 231 b)(ii) of "CDM Project Standard

for CDM project activities" (Version 02.0), which ensures ERs will not be overestimated. The assessment team confirmed that the convservative method is technical feasible and reflects current good practice, and is in line with CDM project standard version 2.0. It is Applus+ LGAI's opinion that the change does not lead to a reduction in the accuracy of the calculation of GHG emission reductions.

2. Change in the monitoring of Volumetric flow of the gaseous stream in time interval *t* on a wet basis ($v_{t,wb}$)

Before the change:

The Volumetric flow of the gaseous stream in time interval t on a wet basis ($v_{t,wb}$) is sourced from the onsite records of the flow meters. There is an independent flow meter to measure the gas sent to GSS1 (FT3GSS1), GSS2 (FT3GSS2), and GSS F1 (FT3GSSF1).

There are two (2) sets of flow meter (FT1F2 & FT2F2) to measure the gas sent to Flare 2. Flow obtained from FT2F2 will be used for the calculation. During temporary malfunctioning of FT2F2 or data logging system resulting in unrepresentative data, the value of FT1F2 will be used for the calculation.

After the change:

The Volumetric flow of the gaseous stream in time interval t on a wet basis ($v_{t,wb}$) is sourced from the onsite records of the flow meters. There is an independent flow meter to measure the gas sent to Flare 2 (FT1F2 & FT2F2), GSS1 (FT3GSS1), GSS2 (FT3GSS2), GSS3 (FT3GSS3) and GSS F1 (FT3GSSF1).

There are two (2) sets of flow meter to measure the gas sent to Gas Engine No.4, Gas Engine No.5 and Gas Engine No. 6. The 1st set of meter will measure the total amount of gas sent to GSS2 (FT3GSS2) and GSS3 (FT3GSS3) before sent to respective gas engines. Another set of the meter will measure the total amount of gas sent to specific gas engine No. 4 (FT7), gas engine No. 5 (FT8) and gas engine No. 6 (FT9). In the case of temporary situation where FT3GSS2 or FT3GSS3 malfunctions leading to no readings captured, the flow of gas sent to gas engines will use the reading captured by respective flow meter (FT7, FT8 and FT9). The recorded reading shall be derived based on 95% confidence interval principles (source: "IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", page 6.6). The lower bound of 95% confidence interval with reference to the above-mentioned guideline will be applied. Alternately, the record from the daily manual log-sheet will be used to calculate the lower bound of 95% confidence interval. The lower bound of the interval boundaries calculated will be applied to the period for the constant data as a conservative approach.

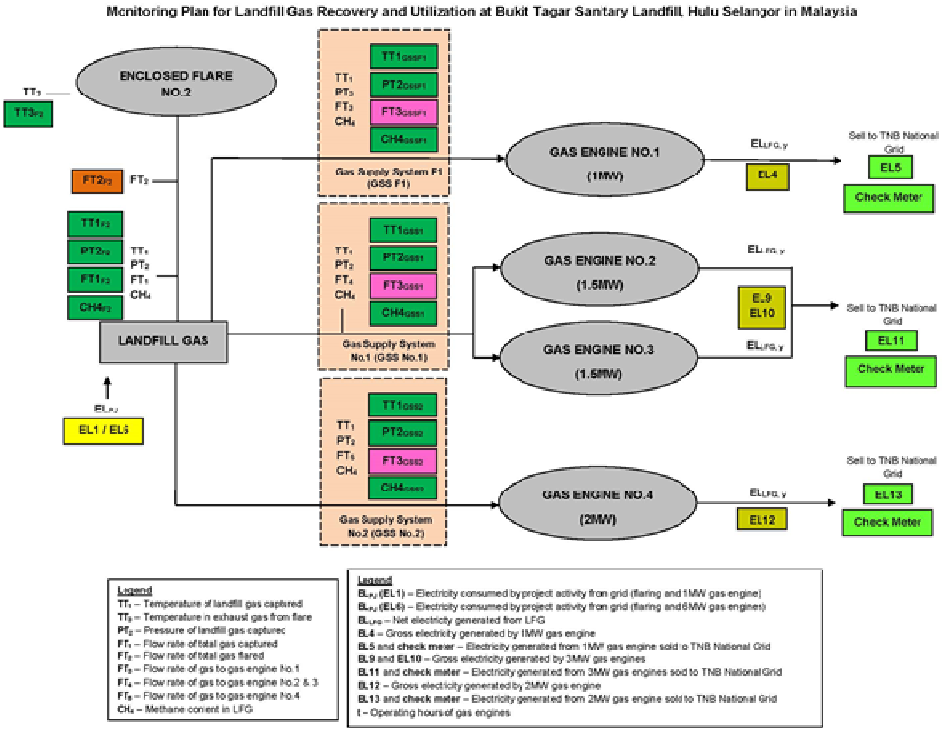
There are two (2) sets of flow meter (FT1F2 & FT2F2) to measure the gas sent to Flare 2. Flow obtained from FT2F2 will be used for the calculation. During temporary malfunctioning of FT2F2 or data logging system resulting in unrepresentative data, the value of FT1F2 will be used for the calculation.

According to CDM Project Standard for Project Activities, version 2.0, Section 8.3.5, Paragraph 241 (a) (i) (a), the CERs estimated (2019 - 2023) above for the increase capacity of 4MW gas engines is only claimed up to 20% (additional 1.1 MW) of the upload capacity stated in original registered PDD (5.5MW). In the case of the total actual electricity uploaded to grid is more than 6.6MW, the additional flow will be deducted from the calculation. The additional flow (from any of the flow meters) will be calculated based on the MWh calculated in $EG_{PJ,y}$ by using the estimated unit amount of m^3 to produce the additional electricity generation.

Validation opinion:

The assessment team has verified the changes. The flow meters to measure gas sent to GSS3 (FT3GSSS3) have been added in the monitoring system. An independent flow meters FT7, FT8 and FT9 have also been added as backup

	meters. The installation location of the newly added meters have been visited by the assessment team and also been confirmed by the assessment team against the monitoring diagram /9/ as consistent with the decription in the revised PDD. The information of the flow meters (FT3GSSS3, FT7, FT8 and FT9), such as the accuracy level, calibration requirement etc. has been verified by the assessment team against the specification of flow meters /7/, which is in compliance with monitoring methodology and applicable calibration requirements. In the case of temporary situation where FT3GSS2 or FT3GSS3 malfunctions leading to no readings captured, the flow of gas sent to gas engines will use the reading captured by respective flow meter (FT7, FT8 and FT9). A conservative manner of taking lower bound of recorded value based on 95% confidence interval principle has been applied. It is Applus+ LGAI's opinion that the change does not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan, and does not lead to a reduction in the accuracy of the calculation of GHG emission reductions. **3. Addition of alternative value of Temperature of the gaseous stream in time interval t (T_t) in temporary situation** A paragraph has been added in the row "source of data" of the monitoring table of the parameter: In the case of temporary situation where T_t malfunctions leading to no readings captured, a conservative method will be applied to count the figure as per the appendix, "Additional data handling and monitoring guidance for determining the mass flow of methane in biogas" of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" to determine the mass flow of a greenhouse gas in a gaseous stream. The added information provides a conservative manner of applying the value of the parameter. Therefore, the change does not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan, and does not lead to a reduction in the accuracy of the calculation of GHG emission reductions. **4. Addition of alternative value of Pressure of the gaseous stream in time interval t (P_t) in temporary situation** A paragraph has been added in the row "source of data" of the monitoring table of the parameter: In the case of temporary situation where P_t malfunctions leading to no readings captured, a conservative method will be applied to count the figure as per the appendix, "Additional data handling and monitoring guidance for determining the mass flow of methane in biogas" of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" to determine the mass flow of a greenhouse gas in a gaseous stream. The added information provides a conservative manner of applying the value of the parameter. Therefore, the change does not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan, and does not lead to a reduction in the accuracy of the calculation of GHG emission reductions. **5. Monitoring diagram change** Before change:

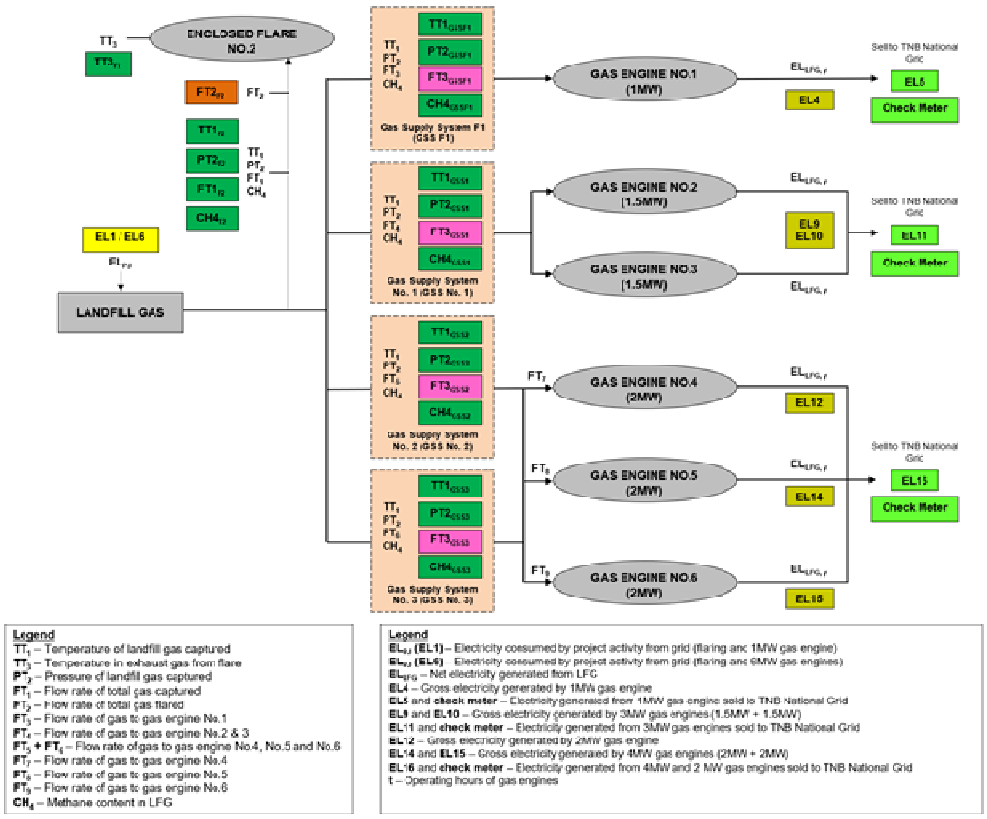


Landfill gas will be capture and send to Enclosed Flare No.2, Gas Supply System F1 (GSS F1), Gas Supply System No.1 (GSS No.1) and Gas Supply System No.2 (GSS No.2). Flow rate of total gas flared by Enclosed Flare No.2 is monitored by FT2 while flow rate of gas to gas engines are monitored by FT3 (GSS F1), FT4 (GSS No.1) and FT5 (GSS No.2) respectively.

The gross electricity generated by each gas engines are monitored using EL4, EL9, EL10 and EL12. The amount will be compared with EL5, EL11 and EL13 which are managed by Tenaga National Berhad to obtain the lower amount so that the result is conservative.

As data will be captured separately in the flaring and power generation system (Flare No.2, Gas Engine No.1 and so forth), a specific subscript will be assigned to the monitoring parameters of the different equipment installed.

After change:



Landfill gas will be capture and send to Enclosed Flare No.2, Gas Supply System F1 (GSS F1), Gas Supply System No.1 (GSS No.1), Gas Supply System No.2 (GSS No.2) and Gas Supply System No.3 (GSS No.3). Flow rate of total gas flared by Enclosed Flare No.2 is monitored by FT2 while flow rate of gas to gas engines are monitored by FT3 (GSS F1), FT4 (GSS No.1) and FT5 (GSS No.2), FT6 (GSS No.3) respectively. Each gas engines also have their own individual meter to record the flow supply from GSS, where FT7 for gas engine no.4, FT8 is for gas engine no.5, FT9 is for gas engine no.6 respectively.

The gross electricity generated by each gas engines are monitored using EL4, EL9, EL10 and EL12, EL14 and EL15. The amount will be compared with EL5, EL11 and EL16 which are managed by Tenaga National Berhad to obtain the lower amount so that the result is conservative.

As data will be captured separately in the flaring and power generation system (Flare No.2, Gas Engine No.1 and so forth), a specific subscript will be assigned to the monitoring parameters of the different equipment installed.

Validation opinion:

The changes of monitoring diagram mainly take place in the monitoring of electricity and gas flow. The changed monitoring system has been verified by the assessment team during site visit. The monitoring system has been confirmed by the assessment team against the monitoring diagram /9/ to be in consistent with actual situation and is operational. The information of the added meters, such as installation place, accuracy, calibration status etc. has been verified by the assessment team against the specifications of monitoring equipments /7//8/ and via site tour, which is in compliance with monitoring methodology and applicable calibration requirements. Therefore, the assessment team could confirm that the changes do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan, and do not lead to a reduction in the accuracy of the calculation of GHG emission reductions.

Findings	No CAR/CL/FAR is issued.
Conclusion	In accordance with paragraph 296-299 of CDM VVS for project activities version 02.0, the assessment team confirmed that:

	- The permanent change to the registered monitoring plan complies with the relevant requirements in the CDM PS for project activities version 02.0. - The permanent change to the registered monitoring plan described in the revised PDD are in compliance with the applied methodology ACM0001 version 18.0, and do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan. - The permanent changes to the registered monitoring plan does not lead to a reduction in the accuracy of the calculation of GHG emission reductions.

D.7. Changes to the project design

Means of validation	The assessment team has validated the changes to the project design applying standard auditing techniques in compliance with paragraph 300-310 of CDM VVS for project activities version 02.0. Paragraph 300: The assessment team has confirmed that there are actual changes to the project design, and has validated the compliance of the change with the relevant requirements in the "CDM project standard for project activities". Please refer to below validation process and conclusion. Paragraph 301: The assessment team has conducted a on-site inspection to validate the change to the project design. The actual situation related to the change has been validated by the assessment team against the revised PDD, to determin whether this description accurately reflects the implementation, operation and monitoring of the modified CDM project activity. Paragraph 302: Based on the on-site inspection, the assessment team has validated the impacts of the actual changes on the monitoring plan, the level of accuracy of the monitoring activity, the applied methodologies, and the other applied methodological regulatory documents. Paragraph 303: The assessment team has reviewed the revised PDD against the applicable additionality and methodological requirements and determined that the changes will not adversely affect the conclusions of the validation report of the registered PDD with regard to: (a) The additionality of the registered CDM project activity; (b) The scale of the registered CDM project activity; (c) The applicability and application of the applied methodologies and the other applied methodological regulatory documents with which the CDM project activity has been registered; (d) The compliance of the monitoring plan with the applied methodologies and the other applied methodological regulatory documents. Paragraph 304: The assessment team has validated the impact on the additionality due to the change in the project design, and confirmed: (a) Investment analysis was used to demonstrate additionality, the project participants have only modified the key parameters in the original spreadsheet calculations affected by the proposed or actual changes to the project activity; (b) Barrier analysis is not considered in the revised PDD which has been removed from the additionality demonstration section in the original PDD. Paragraph 305: No standardized baseline is applied in the registered PDD thereby this paragraph is not applicable. Paragraph 306: The assessment team has validated the compliance with all requirement of the

	applied methodology and the other applied methodological regulatory documents. Paragraph 307: The methodology ACM0001 version 18.0 is applied in the revised PDD. The same version of methodology was applied in the PDD submitted for requesting for renewal of crediting period. It is not mandotary to update the methodology during the request for post registration change as per the CDM project standard version 02.0. Besides, ACM0001 version 18.0 was still in valid at the time of submitting the request of post registration change to UNFCCC. The assessment team has confirmed that the compliance with the requirements of the methodology is not affected since the application and applicability of the methodology is not affected. Paragraph 308: The assessment team has stated the opinion on whether the proposed or actual changes comply with the relevant requirements in the "CDM project standard for project activities" related to changes to the project design of a registered CDM project activity in below conclustion. Paragraph 309: The assessment team has stated the opinion on the issues listed in paragraph 309(a)-(c(vi)) of VVS version 2.0 in the validation report. Please refer to blow cells of the validation opinions. Paragraph 310: The assessment team has validated that the proposed revisions will ensure that the level of accuracy and completeness in the monitoring and verification process is not reduced as a result of the revision. The assessment team has assessed the accuracy and completeness of change of project design based on the evidences listed in below cells. The assessment team has validated that the proposed revisions comply with all requirements of the applied methodologies and the other applied methodological regulatory documents. The assessment team has confirmed that there is no open issue of previous verification and certification reports. In the revised PDD, the description of the actual changes has been included in the revised PDD as compared to the description in the registered PDD. The changes to the project designs occurred in below aspects: 1. 2 sets of gas engines with installed capacity of 2 MW each has been newly built as an addition of the electricity generation capacity. Due to the capacity addition, the total capacity has been increased from 6.4 MW to 10.4 MW. The baseline and additionality of the project activity needs to be re-evaluated. Meanwhile, Annual electricity generation by the existing 2 MW (GE4) from 2019 to 2028 has been revised. Average tariff sold to grid for the existing 2 MW (GE4) has been revised from 0.4669 RM/kWh to 0.447 RM/kWh from 2019 to 2028. 2. The wastes received by Bukit Tagar Sanitary Landfill for year 2017-2018 estimated in the PDD version 20.5 has been updated according to actual data in the revised PDD. And the annual waste received and landfilled from year 2017 to year 2023 has been updated. For the details of the changes, please see below validation process. It is assessed by the assessment team as per the BTSL Power Generation Implementation Scheduled Plan /12/ that the construction of the addition of 2 sets of 2 MW gas engines started dated 05/03/2018, and the newly built gas engines were commissioned dated 10/05/2019 as per the IOD Acceptance Letter /18/. According to the scheduled plan /12/, the project owner started the planning of the addition of capacity since 05/2017. The feasibility of addition of the gas engines was studies based on the estimation of the forcasted LFG available at all cells. According to the Preliminary assessment presentation on 6 MW Power Export /17/

dated 20 October 2016, the LFG was estimated to be 4900 Nm^3/hr as of 01/2017 and to be 6460 Nm^3/hr as of 10/2018, therefore 2 additional gas engines with 2 MW each (GE5 and GE6) were proposed based on existing situation. The existing situation is that 2 MW of gas engine (GE4) has been added in year 2015. The 4 MW of gas engine (GE5 and GE6) was planned to build in year 2019. The decision of adding new gas engines was made after the project first registration at UNFCCC thereby the changes were not known by the project participants prior to the registration of the CDM project activity. The additional of the capacity will have positive impact on the overall operation of the CDM project activity to deliver emission reductions as stated in the PDD. That means the emission reductions due to the change of project design would be increased in the rest period of the 2nd crediting period. The capacity of the landfilled amount of wastes, which is under the mandatory sectoral scope, is not affected due to the change. The addition in capacity of the power generation is under the conditional sectoral scope thereby should take the cap of 20% increase rate in accordance with paragraph 241(a)(i)a of the "CDM project standard for project activities". However, in the PDD version 20.5, the cap of 20% is not considered in the calculation of ERs. The assessment team issued CAR #1 requesting PP's clarification or correction of ER calculation. As the reply, PP has revised the ERs calculation in the PDD with considering the cap of 20% up to the capacity in the original design. The assessment team confirmed that the calculation of ERs is in line with the methodology ACM0001 version 18.0 and the CDM PS version 02.0, thereby closed the CAR.

The validation opinion of above changes are presented as below:

1. Newly installation of 2 sets of gas engines

In the revised PDD, the methodology ACM0001 Version 18.0 has been applied. The applied methodology is the same version with the one used in PDD version 20.5 submitted to request for renewal of crediting period which is approved by EB for the 2nd crediting period. As per paragraph 303 of VVS version 02.0, the revised PDD is reviewed by the assessment team against ACM0001 version 18.0 and relevant tools. The assessment team has validated the mpact to the additionality, scale, applicability and application of methodology and compliance of monitoring plan as below.

1) Impact of additionality

In PDD version 20.5 which is the version submitted for renewing of crediting period, the additionality demonstration part is walved since the renewal of crediting period does not require additionality demonstration. Due to the change of the project design with the addition of 2 sets of gas engines, the additionality need to be reevaluated applying the modified key parameters, thereby the additionality demonstration part is included in the PDD again. Since the previous version of PDD, i.e. PDD version 19.0 contains the complete demonstration of additionality, the PP updated the additionality demonstration part based on PDD version 19.0.

In PDD version 21.0 submitted to the assessment team for validation of post registration change, the re-evaluation of the additionality is not included in the PDD. The assessment team issued CAR #2 requesting PP include the additionality analysis in the PDD. As the response, PP has updated the section B.5 with including the demonstration of additionality via modifying the affected key parameters. The assessment team validated the analysis in PDD and confirmed it correctness. The CAR is thereby closed out.

A). Financial analysis

Since investment analysis was used to demonstrate additionality, the project participant has re-calculated the IRR with modified key parameters in the original calculation spreadsheet as per paragraph 304a) of VVS 02.0. The comparison of the parameters are listed as blow:

Parameters/Assumptions	Value before change	Value after change
Revenues (excluding CER revenues) - Sale of electricity to grid from 2012 (1MW) - Sale of electricity to grid from 2013 -2015 (4MW) - Sale of electricity to grid from 2016 - 2018 (5.5MW) - Sale of electricity to grid from 2019 (9.5MW) - Sale of electricity to grid from 2020 – 2028 (9.5MW)	 RM 1,497,960/yr RM 6,622,560/yr RM 12,144,119/yr / /	 RM 1,497,960/yr RM 6,622,560/yr RM 12,144,119/yr RM 14,454,000/yr RM 25,418,016/yr
Total capital outlay up to year 2028	RM 68,944,754	RM 99,456,936
Interest rate for long term bank loan	8% p.a.	8% p.a.
Average electricity tariff - For sale to the grid from 2011 onwards (1MW) - For sale to the grid from 2013 onwards (4MW) - For sale to the grid from 2016 - 2018 (2MW) - For sale to the grid from 2019 – 2028 (5.5MW)	 RM 0.19/kWh RM 0.21/kWh RM 0.4669/kWh /	 RM 0.19/kWh RM 0.21/kWh RM 0.4669/kWh RM 0.447/kWh
Average operations and maintenance costs	RM 1,844,680/yr	RM 2,754,766/yr
Project lifespan	21 years	21 years
Project payback period (with CERs)	10 years	10 years
Project payback period (without CERs)	>21 years	>21 years
Project NPV at discount rate of 8% for 10 years (without CERs)	(20,847,329)	(20,847,329)
Project NPV at discount rate of 8% for 21 years (without CERs)	(12,998)	9,007,330
Project NPV at discount rate of 8% for 10 years (with CERs)	(3,588,041)	(3,588,041)
Project NPV at discount rate of 8% for 21 years (with CERs)	17,246,290	26,445,307
Project IRR for 10 years (without CERs)	**-15.7%**	**-15.7%**
Project IRR for 21 years (without CERs)	**8.0%**	**10.6%**
Benchmark Project IRR	**12.0%**	**12.0%**
Project IRR for 10 years (with CERs)	**2.2%**	**2.2%**
Project IRR for 21 years (with CERs)	**17.8%**	**18.8%**

The assessment team confirmed that all above parameters which are not changed along with the design change, have been validated in the validation report of original PDD for registration and previous validation opinion of PRC issued by TUV NORD /20/, thereby the assessment team will not conduct any further assessment of these parameters. However, the assessment team will validate the parameters changed during the design change as below.

As confirmed with the technical specifications of the gas engines /7/, the total installed capacity of existing situation is 6.4 MW. According to the Feed-in Approval /6/, the declared annual availability for GE no.1 (installed capacity of 1.2MW) is 7,446MWh per year, for GE No.2&3 (total installed capacity of 3.12MW) is 22,338MWh per year and for GE No.4 (installed capacity of 2MW) is 9,855MWh per

year. Assuming 90% availability of GEs, the delivery capacity rating for the GEs is 5.69MW. In addition, after taking into account of the energy consumed for project activity of 0.09MW, the total amount of energy generated from the GEs is 5.12MW which is less than the amount of 5.5MW used in the financial analysis calculation. Therefore, the value of 5.5MW used is conservative. The original capacity of 5.5 MW is the value that uploaded to the grid which has been validated by TUV NORD the previous validation report of post registration change dated 05/09/2016. During this post registration change, the added installation capacity of 4MW is same as the upload capacity to the grid which is confirmed with the Feed-in Approval /6/. Therefore, the uploaded capacity is inceased from 5.5 MW to 9.5 MW due to the change.

Above figures marked in grey are modified due to the project design change. The changed input figures are verified as below:

a) Sale of electricity to grid from 2019 (9.5MW): RM 14,454,000/yr
b) Sale of electricity to grid from 2020 – 2028 (9.5MW): RM 25,418,016/yr
c) Average electricity tariff for sale to the grid from 2019 - 2028 (5.5MW): RM 0.447/kWh

The sale of electricity to the grid is calculated by electricity sold to the grid multiplied by the electricity tariff. The tariff of electricity generated by GE1, GE2 and GE3 is RM 0.21/kWh, the tariff of electricity generated by GE4 is RM 0.4669/kWh which has been validated by TUV NORD in previous validation report of post registration change dated 05/09/2016. The actual electricity tariff was also been crosschecked with power receipt issued by the grid company /21/, which is exactly RM 0.4669/kWh. Since 2019, the electricity tariff of of GE1, GE2, GE3 does not change however, the electricity tariff of GE4 as well as newly built GE5, GE6 will change. As per the “Feed-in Approval” /6/ issued by Sustainable Energy Development Authority Malaysia, the feed-in-tariff of GE4, GE5 and GE5 is fixed at RM 0.447/kWh for next 16 years since 20/06/2019. The FiT tariff is composed of basic feed-in-tariff rate of RM 0.2985/kWh (4-10 MW), additional for use of gas engine technology with electricity efficiency of above 40% which is RM 0.0199/kWh, additional for use of locally manufactured or assembled gas engine technology which is RM 0.0500/kWh and additional for use of landfill, sewage gas or agricultural waste including animal waste as fuel sources which is RM 0.0786/kWh.

As per the financial analysis spreadsheet, the feed-in-tariff of electricity generated by biogas engine GE4, GE5 and GE6 after the design change applies RM 0.447/kWh, which is different with the feed-in-tariff (RM 0.4669/kWh of electricity generated by GE4. The assessment team issued CL No. 2 requesting project participant clarify the same. The project participant clarified that the feed-in-tariff for GE4 amended from RM 0.4669/kWh to RM 0.447/kWh due to grid operator requested to reconnect the GE4 together with GE5 and GE6 to TNB substation at SIME DARBY Bestari Jaya. The sub-station is more stable in power connection as it can handle bigger power capacity, due to this request, the PP needs to follow the new rate of RM 0.447/kWh for GE4, GE5 and GE6. The assessment team verified the “Feed-in Approval” /6/ issued by Sustainable Energy Development Authority Malaysia (SEDA), and confirmed that in the approval the feed-in-tariff of GE4, GE5 and GE6 is approved together, which is RM 0.447/kWh. Meanwhile, it has been validated against SEDA website (http://www3.seda.gov.my/iframe/) by the assessment team that since November 2018, SEDA has changed the method to determine the FiT from fixed rate (fixed at 0.3184/kWh during 2013-2018) into variable rate through bidding system. The FiT was fluctuant from RM 0.2210/kWh to RM 0.2814/kWh since then. The basic FiT rate is lower than the tariff of GE5 and GE6. As a result, it could be concluded that the trend of FiT rate is going downwards. Furthermore, the tariff is stated clearly in the Feed-in approval /6/ and the effective period was fixed for 16 years, thus, the tariff increase or decrease is impossible as it is already fixed under the approval. Therefore, the assessment team confirmed that the clarification is closed out.

In the “Feed-in Approval” /6/, the electricity sold to the grid by GE 4, 5 & 6 is capped at 22464 MWh for year 2019 and 42048 MWh since year 2020. It is validated

during site visit that G4 was shutdown for maintenance and construction of electrical work of combination with G5/G6 since January 2019, and the Fit certificate scheduled to upload to grid since July 2019, so only 5 months of electricity generation was planned in the financial analysis. Therefore, the electricity generation of G4, G5 and G6 in year 2019 was estimated to be 17,520 MWh (= 2MW*8760h*0.8*5/12 + 4MW*8760h*0.8*5/12). According to the estimated electricity generation and the approved feed-in-tariff, the sales of electricity to the grid in year 2019 equal to:

31,536,00kWh * 0.21RM/kWh + 17,520,000kWh * 0.447RM/kWh = 14,454,000RM

the sales of electricity to the grid from 2020-2028 equal to:

31,536,00kWh * 0.21RM/kWh + 42,048,000kWh * 0.447RM/kWh = 25,418,016RM

The assessment team confirmed electricity uploaded to the grid and the electricity tariff was estimated appropriately thereby the sale of electricity to the grid from 2018 on is properly estimated.

d) Total capital outlay up to year 2028: RM 99,456,936

The total capital outlay has increased by RM 30,512,182 (= RM 99,456,936 - RM 68,944,754) due to the newly built 2 sets of 2MW gas engines. The increased capital includes:

Capitals	Value (RM)	sources /5/
Electrical & Inter-Connection	14,257,000	CP4
VO	627,044	CP4 a
SST claimed	217,065	CP4 b
Service of existing 33kV Step-up Transformer	35,360	CP4 c
LFG Gas Engine Generator 2 x 2MW	8,861,885	CP1
SST of imported components	442,915	CP1 a
SST of local components	33,510	CP1 b
Gas Supply System - 2 x 2MW	1,316,531	CP5
Phase 1 & Phase 2B Gas Extraction	1,465,391	CP2
Building Extension Works	587,793	CP6
VO	38,516	CP6 a
Platform construction	188,060	CP7
Fire Hydrant	988,151	CP8
Contingencies (5%)	1,452,961	/
Total	30,512,182	/

Each of above investment values of each component has been validated by assessment team as per consolidated evidences. It is confirmed that each cost is consistent with relevant contract. Following evidences /5/ have been verified to confirm the consistence:

- CP1: LoA for GE 2MW x2
- CP1 a: GE 2MW x2 SST-Submission-Foreign Portion
- CP1 b: GE 2MW x2 Local SST-Submission
- CP2: LoA for Phase 2B Gas Extraction
- CP4: LoA for Electrical Connection
- CP4 a: Electrical Connection VO
- CP4 b: Electrical Connection SST claimed
- CP4 c: Quotation of Service & maintenance for Electrical inter-connections
- CP5: LoA for GSS
- CP6: LOA for Building Extension Works
- CP6 a: Building Extension VO
- CP7: Platform Construction cost
- CP8: LoA for Fire Hydrant

The contingencies is 5% of above cost. The ratio is also applied in the project

original design. The same ratio has been validated by TUV NORD in previous validation opinion of post registration change dated 05/09/2016.

e) Average operations and maintenance costs: RM 2,754,766/yr

As comparing to the previous situation before the newly building of 2 sets of gas engines, the average operational and maintenance cost has been increased in below aspects:

- Manpower and supervision cost: RM 30,000/yr is increased due to 1 more person is added;
- Service and Maintenance during the 24 months Defect Liability Period - 4MW GE: RM 1,235,917 is added for year 2019 and 2020 respectively;
- Service and Maintenance for 4MW GE: total of RM 16,262,651 during year 2021-2028

Except for above mentioned data, no other operational and maintenance cost are affected by the newly built gas engines. One person will be added as operator of the 2 sets of 2 MW gas engine. The manpower and supervision cost is RM 30,000/yr which is consistent with the project original design. The service and maintenance during 24 months defect liability period is RM 1,235,917/yr which is evidenced by CP1 - LoA for GE 2MW x2. The service and maintenance for 2021-2028is RM 16,262,651 which is evidenced by below evidences:

- CP1 - LoA for GE 2MW x2;
- CP1 c - GE 2MW x2 Service & Maintenace Cost after 5 years.

The assessment team verified the figures and confirmed the consistence.

f) Other cost: RM 1,129,960
- Project management consultancy: RM 530,000;
- Mechanical and Electrical consultancy: RM 413,400;
- Civil and Structural consultancy: RM 186,560.

The project management consultancy cost is RM 530,000 which is evidenced by:

- CP10 - LoA for PMC.

The mechanical and electrical consultancy cost is RM 413,400 which is evidenced by:

- CP3 - LoA for M&E Consultant.

The civil and structural consultancy cost is RM 186,560 which is evidenced by:

- CP9 - LoA for Civil and Structural Consultancy.

All above figures have been verified by the assessment team as consistent with the evidences.

The assessment team has validated the financial analysis process in the financial analysis spreadsheet. All modified parameters affected by the design change has been taken into account at input figures to calculate the IRR. Other parameters not affected are kept the same with project original design. The assessment team confirmed that correct financial analysis method is applied. The recalculated IRR is correctly resulted. As a result, the IRR without CDM support is -15.7% for 10 years of analysis period, and is 10.6% for 21 years of analysis period, which is lower than the benchmark 12.0%. The low project IRR indicates that the project is financially unattractive and not viable without CDM. However, the IRR will be increased to 2.2% and 18.8% with CDM support for 10 years and 21 years analysis period respectively. The assessment team has verified the calculation process of the IRR and confirmed that the calculation is correct.

B). Sensitivity analysis

A sensitivity analysis based on the fluctuation of key input figures are established to examine whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The critical assumptions include:

(1) Changes in electricity tariff (sell to grid), -10% and +10%
(2) Changes in electricity sold to grid , -10% and +10%
(3) Changes in the total investment costs (capital outlay), -10% and +10%
(4) Changes in total operating & maintenance (O&M) costs, -10% and +10%

These parameters were selected as being the most likely to fluctuate over time due to external factors. Financial analyses were performed by altering each of these parameters by 10% (average plausible range) and assessing the impact on the project IRR for each scenario, see table below.

Description		**Project IRR 10 and 21 years (without CDM)**	
		Scenario	
		-10%	**+10%**
Electricity tariff (sell to grid)	10 years	-19.9%	-11.9%
	21 years	7.7%	13.1%

It is unlikely that the electricity tariff for renewable energy will be further decreased 10% due to government's policy to increase RE share in electricity supply. Likely to be increased 10% as the interest of government to increase RE may motivate this move. However, assessement has been done to compare the current and historical approved tariff for biogas by Sustainable Energy Development Authority Malaysis (SEDA) through the e-bidding system. It is evidenced by the Feed-in-Tariff Approval dated 27 May 2017 that the basic FiT rate approved for GE5&6 is fixed at RM 0.2985/kWh, which is below the benchmark basic rate of RM 0.3184/kWh which was fixed from 2013-2018. Meanwhile, since November 2018, SEDA has changed the method to determine the FiT from fixed rate into variable rate through bidding system (source: http://www3.seda.gov.my/iframe/). Hence, the FiT was fluctuant from RM 0.2210/kWh to RM 0.2814/kWh since then. The basic FiT rate is lower than the tariff of the added gas engines. As a result, it could be concluded that the trend of FiT rate is going downwards. Furthermore, the tariff is stated clearly in the FiT approval and the effective period was fixed for 16 years, thus, the tariff increase or decrease is impossible as it is already fixed under the approval.

In case electricity tariff increased by 5.6%, the project IRR will meet the identified project IRR benchmark (12.0%) for 21 years of analysis period. However it is not likely to be increased to this level (+5.6%) as the cost of energy at this price already exceeds the production cost of conventional energy production. The main utility (Tenaga National Berhad) would be resistant to enter into any purchase agreement at this price. There is no obligatory requirement for TNB to purchase electricity from renewable sources.

The assessment team conclude that the tariff applied by the project participant is appropriate, and the decrease/increase of 10% of tariff is not possible to happen.

Electricity sold to grid[2]	10 years	-18.7%	-11.9%
	21 years	8.4%	13.1%

The amount of electricity sold to grid depends on the operating hours of the gas engine. The likelihood of the decrease in electricity sold to grid of another 10% is possible considering the possible breakdown, the needs for regular maintenance and the consistency of gas supply may affect the electricity sold to grid. It is unlikely the generation capacity exceeds the approved capacity stated in the feed-in tariff approval. In addition, it is also not possible for the gas engine to operation at 100% capacity (24 hours, 365 days) in one year without stoppage for maintenance.

In case electricity sold to grid increased by 5.6%, the project IRR will meet the identified project IRR benchmark (12.0%) for 21 years of analysis period. However the amount of electricity sold to the grid was capped by the Feed-in-tariff approval. The financianl analaysis has been made using the maximum electricity amount approved by SEDA. It can be concluded the expected amount of electricity for sale to the grid is unlikely will exceeds the approved capacity stated in the feed-in tariff approval. Therefore, the electricity is not likely to increase by 5.6%.

Total capital outlay	10 years	-12.4%	-18.6%
	21 years	12.4%	9.0%

The capital outlay of the project cannot decrease 10% as the actual prices of the equipment is applied and tabulated in financial analysis. It is likely that the capital outlay of the project might increase 10% in future as prices of some of the equipment for future purchase may increase over time due to inflation as well as increasing demand of equipment.

In case the total capital outley decreased by 7.7%, the project IRR will meet the identified project IRR benchmark (12.0%) for 21 years of analysis period. However, it is very unlikely to decrease to this level (-7.7%) because the prices of some of the equipment and installation have been determined and agreed upon and quotation prices of other equipment and installation have also been obtained. Furthermore, it is very unlikely for the capital outlay to decrease up to -7.7% without any changes in the scope and equipment. The assessment team has verified the contracts available for the addition of 2 gas engines and confirmed that the gross capital outley has is not likely to decrease by 7.7%.

It can be concluded the capital outlay is unlikely to decrease/ increase 10%.

Total O&M costs	10 years	-14.8%	-16.6%
	21 years	11.1%	10.0%

It is likely that the O&M might decrease to this level as the company might be able to optimize the process, proper maintenance and thus reducing the overall

[2] Amended production hour to electricity sold to grid for better representation. The results remain same for increase in production hours or actual electricity sold to grid as it is directly correlated.

O&M cost. It is very likely that the O&M might increase to this level as cost of material and services is likely to increase over time in line with the inflation. Furthermore, raw materials prices are increasing and thus the spare parts and replacement parts of the plant will surely be increased in parallel.

In case the total O&M cost decreased by 28.0%, the project IRR will meet the identified project IRR benchmark (12.0%) for 21 years of analysis period. The assessment team has verified the historical O&M cost rate of the project activity which was RM 0.053/kWh. Based on the estimated electricity sold to the grid which is 73,584 MWh per year, the O&M cost could be RM 3,899,954/yr, which has been higher than the estimated annual O&M cost which is RM 2,754,766/yr. Therefore, it could be concluded that the O&Mcost is not likely to decrease by 28.0%.

As it is shown in the various scenarios above, the project IRR can only achieve the project benchmark of 12% with "unrealistic" scenarios. With the assessment and conclusion explained above, it is further confirms that the project is unlikely to be financially attractive and feasible without CDM financing.

C). Barrier analysis

In original PDD version 20.5 as well as previous version of PDD version 19.0, barrier analysis is applied. However, in the final version of revised PDD (version 21.3), the barrier analysis is not considered in the demonstration of additionality because there are more than one alternative remaining and one of the alternatives is the project without CDM. The proposed CDM project activity is unlikely to be the most financially attractive after the financial analysis. None of the baseline alternatives face barriers apart from what is discussed in the Investment Analysis to the extent that they would prevent the alternatives' implementation. The assessment team confirmed that the waive of barrier analysis does not affect the additionality demonstration.

D). Common practice analysis

In the final PDD, common practice analysis section is updated applying the steps defined in the Combined tool to identify the baseline scenario and demonstrate additionality, version 06.0.

the Project is not the First-of-its-kind and which involves methane destruction (example: landfill gas flaring) and applies the measure that is listed in the definitions section in the tool. Therefore, proceed to Step 4 a, and the followed four steps are applied. The proposed project activity has an installed electricity generation capacity of 10.4MW. The applicable output range of +/-50% yields 5.2MW~15.6MW.

The applicable geographical area is the entire host country, Malaysia. In Malaysia, municipal solid waste is typically handled by the local government under public cleansing activities. Waste are collected and transported to disposal sites. Open dumps and landfills are the most common disposal method for solid waste. As reported by National Solid Waste Management Department (JPSPN), in 2015, there are approximately 297 operating and closed landfills throughout the country of which 162 considered as operating landfills (excluding closed landfills). The landfills which are inactive or not operational are not taken into consideration for this calculation. Most of these landfills are not engineered and do not have gas venting or collection systems. In 2007, a new Solid Waste Management and Public Cleansing Act was gazetted to empower the federal government of Malaysia to take over the solid waste management in Peninsula Malaysia in the coming future. Under the new legislation, there are no obligations for landfill operators to recover and utilize landfill gas. From the above-mentioned 162 sites, a total of 14 projects are being developed under the Clean Development Mechanism, they are either

Registered CDM project activities and/or undergoing validation. Therefore, N_{all} = 162 - 14 = 148.

Apart from several CDM-registered projects, there is only one landfill gas recovery activity (TPS Air Hitam Sanitary Landfill) that is similar to the proposed project activity which was not a CDM project originally. The project was funded and implemented as a demonstration project as a renewable energy demonstration initiative under a "Small Renewable Energy Programme" under the Energy Commission of Malaysia. The project was operated by Jana Landfill Sdn Bhd, a subsidiary of Tenaga Energy Services (a subsidiary of the national utility TNB) under the largest electricity supplier in Malaysia and Worldwide Landfill Sdn Bhd. since November 2003. The project, however, is rejected .As all these projects were already excluded as part of Sub-step 4a (2), then the rest are considered to apply different technologies to the Project. Hence, N_{diff} = 148.

Calculate factor $F=1-N_{diff}/N_{all}$. The proposed project activity is regarded as common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:
(a) The factor F is greater than 0.2; and
(b) Nall-Ndiff is greater than 3.
The factor F is calculated as 1 - (148/148), which is 0. From the above, neither of these two conditions applies to the proposed CDM Project Activity. Hence, the conditions of sub-step4a (4) are met and the project is additional.

As demonstrated, similar activities are not widely observed and commonly carried out in Malaysia, when we discard the other CDM projects, there is no other activities are currently delivering the same output as the proposed project activity, it can be concluded the project is not a common practice in Malaysia.

From the common practice analysis, it is concluded that either no gas management or passive venting method are common practices in landfills in Malaysia. Landfill gas projects that are similar are all implemented with consideration of CDM.

The proposed project activity is not regarded as "common practice". In conclusion, with steps 4a and 4b satisfied, this project activity is additional.

2) Impact of project scale

The scale of the project activity is not affected since methodology for large scale project activity ACM0001 version 18.0 is applied.

3) Impact of applicability and application of methodology

In the PDD version 20.5 submitted for application of renewal of crediting period, methodology ACM0001 version 18.0 is applied. The same version is applied due to the project design change. Thereby the applicability and application of the methodology is not affected.

4) Impact of compliance of monitoring plan

The monitoring plan has been changed due to the project design change. The validation of the change of monitoring plan as well as its compliance, please refer to section D.6 of this report.

2. Changes in the waste received

In the updated PDD version 21.3, the amount of wastes sent to the landfill site has been updated according to the actual data. The amount of wastes from year 2017 to year 2023 before the change is listed as below:

Year	Average Waste Received (tonnes/day)	Total Waste Received (tonnes/yr)	Accumulated Waste (tonnes/yr)
2017	2,834	1,034,548	11,125,313
2018	2,976	1,086,276	12,211,589
2019	3,125	1,140,590	13,352,179
2020	3,281	1,197,619	14,549,798
2021	3,445	1,257,500	15,807,298
2022	3,617	1,320,375	17,127,673
2023	3,798	1,386,394	18,514,067

The amount of wastes from year 2017 to year 2023 based on the actual data is listed as below:

Year	Average Waste Received (tonnes/day)	Total Waste Received (tonnes/yr)	Accumulated Waste (tonnes/yr)
2017	2,638	963,050	11,053,814
2018	2,748	1,003,079	12,056,893
2019	2,886	1,053,232	13,110,125
2020	3,030	1,105,894	14,216,019
2021	3,181	1,161,189	15,377,208
2022	3,340	1,219,248	16,596,456
2023	3,507	1,280,211	17,876,667

The actual amount of wastes sent to the landfill has been verified by the verification body in previous verification report. For the amount of wastes sent to the landfill from 2019 to 2023, A increase rate of 5% by weight annual increase of waste amount received at landfill was considered. The increase rate of 5% has been applied in the original design. Besides, Based on the amount of waste received by Bukit Tagar landfill, the waste amount has been growing up with average of 6% by weight per year since its operation in 2005. Thereby the rate is convincible.

As it compared to the estimated amount of wastes sent to the landfill in the original design, the actual amount is lower than planned. Therefore, it is more conservative to apply the actual data in 2017-2018 and furtherly apply the estimated data based on the actual data since year 2019.

The emission reductions of following crediting period has been updated accordingly due to the change in the electricity generation and the amount of wastes sent to the landfill. Only the affected input figures of calculating emission reductions are changed and the calculation method of the emission reductions is not revised. The assessment team has verified the calculation process and confirmed the calculation of the emission reductions is correct.

Findings	2 CARs and 1 CL is issued. Please refer to appendix 4.
Conclusion	In accordance with paragraph 300-310 of CDM VVS for project activities version 02.0, the assessment team confirmed that: - The assessment team has confirmed there are actual changes to the project design, and has confirmed that the changes are in compliance with the relevant requirements in the "CDM project standard for project activities". - The assessment team has conducted a on-site inspection to validate the change to the project design. The actual situation related to the change has been validated by the assessment team against the revised PDD. The description of the actual changes has been included in the revised PDD as compared to the description in the registered PDD. The assessment team confirmed that the description in revised PDD accurately reflects the implementation, operation and monitoring of the modified CDM project activity. - Based on the on-site inspection, the assessment team confirmed that the actual changes have no material impact on the monitoring plan, the level of accuracy of the monitoring activity, the applied methodologies, and the

	other applied methodological regulatory documents. - The assessment team has reviewed the revised PDD against the applicable additionality and methodological requirements. The assessment team concludes that the actual changes does not adversely affect the conclusions of the validation report of the registered PDD with regard to: (a) The additionality of the registered CDM project activity; (b) The scale of the registered CDM project activity; (c) The applicability and application of the applied methodologies and the other applied methodological regulatory documents with which the CDM project activity has been registered; (d) The compliance of the monitoring plan with the applied methodologies and the other applied methodological regulatory documents. - The assessment team has confirmed that the project participants have only modified the key parameters in the original spreadsheet calculations affected by the actual changes to the project activity, and concluded that the project revenue without CDM even after addition of 2 sets of 2 MW gas engines is still not financial attractive. The barrier analysis is not considered in the revised PDD. - The assessmen team confirmed that there is no standardized baseline is applied in the registered PDD. - The assessment team confirmed the revised PDD is in compliance with all requirement of the applied methodology and the other applied methodological regulatory documents. - The assessment team confirmed that methodology ACM0001 version 18.0 is not updated since last version of PDD which was submitted for requesting for renewal of crediting period. Therefore the compliance with the requirements of the methodology is not affected. - The assessment team confirmed that the contruction of the new gas engines were started dated 05/03/2018 and the commissioning was started on 10/05/2019. The reason of the change is due to that the installed capacity of the power generation is based on the estimation of LFG generation. The decision of addting new gas engines was made after the project first registration at UNFCCC thereby the changes were not known by the project participants prior to the registration of the CDM project activity. The additional capacity will have positive impact on the overall operation of the CDM project activity to deliver emission reductions as stated in the PDD. That means the emission reductions due to the change of project design would be increased in the rest period of the 2nd crediting period. The capacity of the landfilled amount of wastes, which is under the mandatory sectoral scope, is not affected due to the change. The addition in capacity of the power generation under the conditional sectoral scope has been taken into account of the cap of 20% in accordance with paragraph 241(a)(i)a of the “CDM project standard for project activities” version 02.0. - The assesstment team confirmed that the changes to the project design do not adversely affect the conclusion of the validation report of the registered PDD with regard to: (i) The applicability and application of the applied methodologies which is not updated from the registered PDD for renwal of crediting period; (ii) The project boundary and any associated leakages due to the changes; (iii) The compliance of the monitoring plan with the applied methodologies and the other applied methodological regulatory documents; (iv) The level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan; (v) The additionality of the registered CDM project activity; (vi) The scale of the registered CDM project activity. - The assessment team has confirmed that the proposed revisions ensure that the level of accuracy and completeness in the monitoring and verification process is not reduced as a result of the revision. The assessment team has, using objective evidence, confirmed the accuracy and completeness of each proposed revision to the registered monitoring

	plan, including the frequency of measurements, the quality of monitoring equipment (e.g. calibration requirements, the quality assurance and quality control procedures) have not been adversely affected; - The assessment team has confirmed that the proposed revisions comply with all requirements of: (i) The applied methodologies and the other applied methodological regulatory documents; or (ii) The updated/changed method ologies including the standards, methodological tools and guidelines applied in accordance with the updated/changed methodologies, and/or changed to other methodologies; - The assessment team has confirmed that there is no FAR from previous verification and certification reports.

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

Means of validation	Not applicable for the project activity.
Findings	Not applicable for the project activity.
Conclusion	Not applicable for the project activity.

SECTION E. Internal quality control

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As a final step for Validation, the final documentation, including the validation report, has to undergo an internal quality control by the Technical Reviewer(s) to be approved.

Details of the Technical Reviewer(s) are provided within the validation report in Section B.2. and Appendix 2 for further references of knowledge and capability to conduct the quality checking.

After the Technical Review process, the final documentation has to undergo a final quality checking process called Administrative Review, done by the Applus+ Certification Project Activity Manager and/or Technical Support.

For final approval, the final set of documents are prepared by the DOE's Technical Manager or its deputy and signed by the authorized signatory of the DOE.

In case any of the persons performing this final internal quality control approval process has acted as a part of the Assessment Team or Technical Review team, the approval can only be given by DOE's personnel who is not part of those teams.

If the final set of documents has been satisfactorily approved, the Request is submitted to the UNFCCC CDM EB along with the relevant documents.

SECTION F. Validation opinion

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LGAI Technological Center, S.A. (hereafter referred to as Applus+ LGAI) has been commissioned by KUB-Berjaya Enviro Sdn. Bhd. (KBE) to perform a validation of the post registration change regarding to the addition of 2 sets of 2 MW biogas engines as well as relavent changes of monitoring plan.

The review of the project design documentation and the subsequent follow-up interviews have provided Applus+ LGAI with sufficient evidence to determine the fulfilment of stated criteria. As a result of the validation, Applus+ LGAI confirmed that:

For permanent change to the registered monitoring plan:

- The permanent change to the registered monitoring plan complies with the relevant requirements in the CDM PS for project activities version 02.0.
- The permanent change to the registered monitoring plan described in the revised PDD are in compliance with the applied methodology ACM0001 version 18.0.0, and do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.
- The permanent change to the registered monitoring plan does not lead to a reduction in the accuracy of the calculation of GHG emission reductions.
- The permanent changes comply with the relevant requirements related to the permanent changes to the registered monitoring plan.

For changes to the project design:

- The actual changes comply with the relevant requirements in the “CDM project standard for project activities” related to changes to the project design of a registered CDM project activity.
- The description of the actual changes as compared to the description in the registered PDD has been included in the revised PDD.
- The changes to the project design do not adversely affect the conclusion of the validation report of the registered PDD with regard to:
  (i) The applicability and application of the applied methodologies which is not updated from the registered PDD for renwal of crediting period;
  (ii) The project boundary and any associated leakages due to the changes;
  (iii) The compliance of the monitoring plan with the applied methodologies and the other applied methodological regulatory documents;
  (iv) The level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan;
  (v) The additionality of the registered CDM project activity;
  (vi) The scale of the registered CDM project activity.
- The proposed revisions comply with all requirements of:
  (i) The applied methodologies and the other applied methodological regulatory documents; or
  (ii) The updated/changed method ologies including the standards, methodological tools and guidelines applied in accordance with the updated/changed methodologies, and/or changed to other methodologies.

The validation has been performed following the requirements of the latest version of the CDM VVS for project activities version 02.0 and on the basis of the contractual agreement. In our opinion, the project meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria. The request for approval of the post registration change will hence be recommended by Applus+ LGAI to the UNFCCC.

Appendix 1. Abbreviations

Abbreviations	Full texts
ACM	Approved Consolidated Methodology
AM	Approved Methodology
AMS	Approved Methodology Small Scale
Applus+ LGAI	LGAI Technological Center, S.A. (Applus)
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CER	Certified Emission Reduction
CL	Clarification Request
CM	Combined Margin
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
CSPG	China South Power Grid
DNA	Designated National Authority
DOE	Designated Operational Entity
EF	Emission Factor
EIA	Environmental Impact Assessment
ER	Emission Reduction
FAR	Forward Action Request
FSR	Feasibility Study Report
GHG	greenhouse Gas(es)
IPCC	Intergovernmental Panel on Climate Change
IRL	Information Reference List
IRR	Internal Rate of Return
KP	Kyoto Protocol
MP	Monitoring Plan
NDRC	National Development and Reform Commission, the DNA of Malaysia
NGO	Non-Governmental Organization
OM	Operational Margin
PCP	Project Cycle Procedure
PDD	Project Design Document
PP	Project Participant
PS	Project Standard
UNFCCC	United Nations Framework Convention for Climate Change
VVS	Validation and Verification Standard

Appendix 2. Competence of team members and technical reviewers

The curricula vitae of the DOE's validation team members are provided below:

Mr. 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/Verifier and ISO 9001/14001 Lead Auditor for 3.5 years.

Mr. Miguel Cortés holds a Bachelor Science Degree on Civil and Environmental Engineering, being specialized on Hydric Resources. He has worked as CDM and environmental consultant for different industries of multidisciplinary sectors world widely. Miguel counts with several years of CDM experience, working and being qualified as Lead Auditor and Technical Reviewer for different DOE's world widely. Furthermore, he has focused his professional CDM portfolio career within LATAM, developing projects in Argentina, Mexico, Panama, Colombia and Chile among others.

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
/1/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Project Design Document version 20.5 Project Design Document version 21.0 Project Design Document version 21.1 Project Design Document version 21.2 Project Design Document version 21.3	26/03/2018 26/08/2019 26/09/2019 31/12/2019 29/01/2020	PP
/2/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	ER spreadsheet version 1.0	17/07/2019	PP
/3/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Financial analysis spreadsheet version 1.0	17/07/2019	PP
/4/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Power consumption estimation	17/07/2019	PP
/5/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Contracts of project planning and construction: /CP1/ LoA for GE 2MW x2 /CP1a/ GE 2MW x2 SST-Submission-Foreign Portion /CP1b/ GE 2MW x2 Local SST – Submission /CP1c/ GE 2MW x2 Service & Maintenace Cost after 5 years /CP2/ LoA for Phase 2B Gas Extraction /CP3/ LoA for M&E Consultant /CP4/ LoA for Electrical Connection /CP4a/ Electrical Connection VO /CP4b/ Electrical Connection SST claimed /CP4c/ Quotation of Service & maintenance for Electrical inter-connections /CP5/ LoA for GSS /CP6/ LOA for Building Extension Works /CP6a/ Building Extension VO /CP7/ Platform Construction cost /CP8/ LoA for Fire Hydrant /CP9/ LoA for Civil and Structural Consultancy /CP10/ LoA for PMC	/	PP
/6/	Sustainable Energy Development Authority Malaysia	Feed-in Approval	17/05/2017	PP
/7/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Specifications of equipmens • Gas engine specification • Flow Meter Specification • Pressure Transmitter Specification • Temperature Transmitter Specification • Gas Analyser Specification	/	PP
/8/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Nameplates of electricity meters	/	PP
/9/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Monitoring diagram	/	PP
/10/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Decision made to purchase GE No. 4,5,6	28/12/2016	PP
/11/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Sit layout plan	15/12/2017	PP
/12/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Implementation schedule plan	/	PP

/13/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Invitation to tenderer Final Tender Evaluation report	24/11/2017 01/2018	PP
/14/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	MoM for FiT for Additional Power Generation from Bukit Tagar	26/02/2018	PP
/15/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	IOD report_UNITEN_Final Official Report	28/08/2018	PP
/16/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Custom Clearance for Imported Goods	22/10/2018	PP
/17/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Preliminary assessment presentation on 6MW power export	20/10/2016	PP
/18/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	IOD acceptance letter	01/07/2019	PP
/19/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Waste record for 2017 & 2018	/	PP
/20/	TUV NORD	Validation opinion of post registration change	05/09/2016	Others
/21/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)			
/22/	UNFCCC website	CDM validation and verification standard for project activities, version 02.0	29/11/2018	Others
/23/	UNFCCC website	CDM project cycle procedure for project activities, version 02.0	29/11/2018	Others
/24/	UNFCCC website	CDM project standard for project activities, version 02.0	29/11/2018	Others
/25/	UNFCCC website	ACM0001 Flaring or use of landfill gas version 18.0	29/11/2018	Others
/26/	UNFCCC website	Combined tool to identify the baseline scenario and demonstrate additionality, version 06.0	24/07/2015	Others
/27/	UNFCCC website	Tool to calculate the emission factor for an electricity system version 05.0.0	27/11/2015	Others
/28/	UNFCCC website	https://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/CP/XISBPNPJJEBP2GO5DCQHFIN79Q18YK/view	/	Others
/29/	IPCC	2006 IPCC Guidelines for National Greenhouse Gas Inventories	/	Others

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

Table 1. CLs from this validation

CL ID	1	**Section no.**	D.7	**Date:** 13/09/2019
Description of CL				
As per the financial analysis spreadsheet, the feed-in-tariff of electricity generated by biogas engine No. 4,5,6 after the design change applies 0.447 RM/kWh, which is different with the feed-in-tariff (0.4669 RM/kWh of electricity generated by engine No. 4. Please clarify.				
Project participant response				**Date:** 26/09/2019
The feed-in-tariff for gas engine no.4 amended from RM0.4669/kWh to RM0.447/kWh due to grid operator requested to reconnect the gas engine no.4 together with gas engine no.5 and no.6 to TNB substation at SIME DARBY Bestari Jaya. The sub-station is more stable in power connection as it can handle bigger power capacity, due to this request, the PP needs to follow the new rate of RM0.447/kWh for gas engine no.4, 5 and 6.				
Documentation provided by project participant				
Financial sheet dated 17/09/19, FA1 - BTSL KBE Financial additional 4MW_170919, version 21.1				
DOE assessment				**Date:** 27/09/2019
The assessment team has validated the actual feed-in-tariff according to the Feed-in Approval /6/ and confirmed that the tariff for latest 3 sets of gas engines (GE4, 5, 6) is fixed at RM 0.447/kWh. The clarification is accepted by the assessment team thereby the CL is closed out.				

Table 2. CARs from this validation

CAR ID	1	**Section no.**	D.7	**Date:** 13/09/2019
Description of CAR				
According to para. 241a of the CDM Project Standard for Project Activities, version 2.0, in case of i*ncrease in the capacity specified in the registered PDD, the CERs may be claimed up to an amount calculated based on the increased capacity by 20 per cent of the capacity specified in the originally registered PDD, or CERs may be claimed for the full amount calculated based on the increased capacity if the project participants can demonstrate that the reason for the increase is not within the control of the project participants. Please demonstrate how this rule is considered in calculating the CERs in the PDD, or please revise the ERs calculation with considering of 20% cap.*				
Project participant response				**Date:** 26/09/2019
According to CDM Project Standard for Project Activities, version 2.0, Section 8.3.5, Paragraph 241 (a) (i) (a), the CERs estimated (2019 – 2023) above for the increase capacity of 4MW gas engines is only claimed up to 20% (additional 1.1 MW) of the upload capacity stated in original registered PDD (5.5MW).				
Documentation provided by project participant				
PDD, version 21.1				
DOE assessment				**Date:** 27/09/2019
The assessment team has confirmed that the cap of 20% of capacity (5.5 MW) in the original registered PDD, which is additional 1.1 MW has been considered in the ERs calculation for the rest of the crediting period since GE5&6 was commissioned. The assessment team confirmed that the calculation of ERs is correct wich is in line with the formula in methodology ACM0001 version 18.0.				

CAR ID	2	**Section no.**	D.7	**Date:** 13/09/2019
Description of CAR				
The eletricity generation capacity of the project activity has been changed from 5.5 MW to 9.5MW, which cause the additionality of the project activity has been affected. Please demonstrate in the PDD how the additionality has been affected following the latest version of the additionality tool.				
Project participant response				**Date:** 26/09/2019
The additionality of the project activity is demonstrated in the revised PDD version 21.1 at section B.5.				
Documentation provided by project participant				
PDD, version 21.1				

DOE assessment	Date: 27/09/2019
The assessment team has confirmed that the additionality demonstration section has been included in section B.5 of the PDD version 21.1. The affect to the additionality due to the post registration change has been validated by the assessment team. Please see the means of validation in section D.7 of this report. As a result, the CAR is closed out.	

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

Version	*Date*	*Description*
03.0	31 May 2019	Revision to: • 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.

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