





**Validation report form for renewal of crediting period for  
CDM project activities**

**(Version 02.0)**

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

**BASIC INFORMATION**

<b>Title and UNFCCC reference number of the project activity</b>	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia UNFCCC reference number: 2467
<b>Number and duration of the next crediting period</b>	Renewed Crediting Period (2 <sup>nd</sup> ): 28/08/2016 – 27/08/2023
<b>Version number of the validation report for RCP</b>	02.2
<b>Completion date of the validation report for RCP</b>	26/03/2018
<b>Version number of PDD to which this report applies</b>	version: 20.5 Date of Issuance: 26/03/2018
<b>Project participant(s)</b>	KUB-Berjaya Enviro Sdn. Bhd. (KBE)
<b>Host Party</b>	Malaysia
<b>Applied methodologies and standardized baselines</b>	Applied methodology: ACM0001, Flaring or use of landfill gas, version 18.0 Not applicable for standardized baselines
<b>Mandatory sectoral scopes linked to the applied methodologies</b>	Sectoral scope 13: Waste handling and disposal
<b>Conditional sectoral scopes linked to the applied methodologies</b>	Sectoral scope 1: Energy industries (renewable - / non-renewable sources)
<b>Estimated annual average GHG emission reductions or net anthropogenic GHG removals in the next crediting period</b>	283,788 tCO <sub>2</sub> e
<b>Name and UNFCCC reference number of the DOE</b>	 LGAI Technological Center, S.A. (Applus+ Certification) / E-0032
<b>Name, position and signature of the approver of the validation report for RCP</b>	Applus+ Certification BU Managing Director: Juan Sendín Caballero 

**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) (hereafter referred to as the project owner or KBE) to perform a validation of the renewal of crediting period of “Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia” (Ref. No.2467) (hereinafter referred to as the project activity or the proposed project activity) in Malaysia.

The scope of the validation of the renewal of crediting period is defined as an independent and objective review of the updated sections of the PDD relating to the baseline, estimated emission reductions and the monitoring plan using the most recent version of baseline and monitoring methodology applicable for the project activity. 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. site visit, telephone or e-mail interviews) and also the review of the applicable approved methodology and underlying formulae and calculations.

The assessment was performed in accordance with the CDM VVS for project activities version 01.0 and the CDM PS for project activities version 01.0 including an assessment of:

- a) The impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period of the registered CDM project activity at the time of requesting renewal of crediting period of the project activity;
- b) The correctness of the application of the approved methodology and, where applicable, the approved standardized baseline for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period of the registered CDM project activity.

KUB-Berjaya Enviro Sdn. Bhd. (KBE) was the developer responsible for the construction, operation, management and maintenance of the Bukit Tagar sanitary landfill and its facilities. This sanitary landfill is located at Bukit Tagar, Mukim Sg. Tinggi, Hulu Selangor District in the State of Selangor. KBE has management agreement with the Malaysian Government in 2008 to operate and maintain this landfill for the next 30 years. The Bukit Tagar sanitary landfill occupies a 700 acres footprint and is surrounded by a buffer zone of 1,000 hectares of palm oil plantations. The landfill has been in operation since 1 April 2005 and the waste received is expected to increase yearly from 3,000 t/d up to 6,600 t/d <sup>1</sup> over the 40 years <sup>2</sup> designed lifespan according to the Detailed Environmental Impact Assessment (DEIA) for proposed Bukit Tagar Landfill, Sungai Tinggi, Hulu Selangor, Selangor Darul Ehsan dated June 2004.

To date, the landfill received an average of 2,300 tons of municipal solid waste (MSW) per day from Kuala Lumpur City and the Selayang District in the State of Selangor. The landfill was being developed in phases. The detailed information of the already constructed and/or planned phases is presented as below (from the total 17 phases for which the landfill was initially designed and are expected to be developed):

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<sup>1</sup> Note that the description of waste received is different between the revised PDD and the registered PDD (version 05.3 and version 19.0). In the registered PDD, the PP roughly estimated the landfilling capacity as 3,000 tons per day however along with the project progress, the landfilling capacity is increasing. The real situation is that the waste received is expected to increase yearly from 3,000 t/d up to 6,600 t/d over the 40 years lifespan. To address this issue, the PP requested a correction to the description during the renewal of the crediting period. The assessment team has validated the request for correction in the PRC validation report submitted along with the RCP validation report.

<sup>2</sup> Note that KBE signed 30 years of management agreement with Malaysian Government while the project lifespan was designed to be 40 years.

Cell	Status	Duration of filing	Amount of waste disposed (t)
Advance cell	Closed	Apr 2005 – Nov 2007	1,429,323.47
Phase 1	Closed	Nov 2007 – Dec 2011	3,730,406.57
Phase 2	Operation	Jan 2012 – on-going	4,931,034.44 (Latest Dec 16)
Phase 3	Under Construction	Planned to be in operation started from July 2018 to 2023	-

The assessment team interviewed the project owner of above implementation phases and confirmed the implementation status is in line with the real situation.

EB has raised comments Nr. 2-4 during I&R checking which were listed as below:

*2: VVS for project activities para 297*

*The DOE failed to provide its assessment regarding implementation of necessary phases which will be developed in 2nd crediting period as necessary, its relation to the operation of the project activity and its compliance with the applied methodology.*

*The DOE is requested to provide a detailed assessment of necessary phases which will be developed in 2nd crediting period as necessary, its relation to the operation of the project activity and its compliance with the applied methodology.*

*3: VVS for project activities para 299*

*The DOE failed to provide its assessment regarding implementation of necessary phases which will be developed in 2nd crediting period as necessary, its relation to the operation of the project activity and its compliance with the applied methodology.*

*The DOE is requested to provide a detailed assessment of necessary phases which will be developed in 2nd crediting period as necessary, its relation to the operation of the project activity and its compliance with the applied methodology.*

*4: VVS for project activities paras 272(d), 281 The DOE failed to provide its assessment regarding implementation of necessary phases which will be developed in 2nd crediting period as necessary, its relation to the operation of the project activity and its compliance with the applied methodology.*

*The DOE is requested to provide a detailed assessment of necessary phases which will be developed in 2nd crediting period as necessary, its relation to the operation of the project activity and its compliance with the applied methodology.*

The assessment team provided clarifications as below:

It is stated in the section A1 of the approved revised PDD version 19.0 dated 02/09/2016 and section A2 of the original registered PDD version 05.3 dated 23/08/09 for the 1<sup>st</sup> crediting period:

*“The Bukit Tagar sanitary landfill occupies a 700 acres footprint and is surrounded by a buffer zone of 1000 hectares of palm oil plantations. The landfill has been in operation since 1 April 2005 and is designed to receive up to an average of 3,000 tons of solid waste per day for at least 40 years. To date, the landfill received on average of 2,000 tons of municipal solid waste (MSW) per day from Kuala Lumpur City and the Selayang District in the State of Selangor.”*

*“The landfill is being developed in phases. The first cell involved the operation of the cell known as the advance cell, which commenced in April 2005 and was completed in November 2007. A new cell known as Phase 1 is currently in use and is expected to receive up to 3.7 million tons of MSW over the following 3 to 4 years. Both these phases are included in this project, as well as any future phases to be developed.”*

The original registered PDD version 05.3 as well as the approved revised PDD version 19.0 mentioned that the project boundary covers the Bukit Tagar sanitary landfill which occupies 700 acres footprint, which is designed with a lifespan of at least 40 years. The landfill site consists of multi-phases (landfill cells) for MSW landfilling to cater for the continuous incoming waste received. Development of new phases (cells) (up to 17 phases according to landfill design) is necessary when the current cells have reached its designed capacity. This was confirmed during the site visit conducted on 11/12/2017.

Further assessment of the baseline in the approved revised PDD (1<sup>st</sup> CP) also confirms that the baseline calculations are based on the assumptions that the landfill will continue to receive MSW throughout the lifespan. Thus, any future phase development of the landfill (e.g. Phase 2, Phase 3 as well as future cells) are already part of the original PDD baseline and does not constitute any changes in the RCP.

As a result, the assessment team confirmed that the development of new phases in the project activity is necessary and in compliance with the original project design, which could not be considered as changes or deviations to the registered monitoring plan. The assessment team also confirmed that the development of new phases is in compliance with the applied methodology which has been demonstrated in section D.2 of this report. Therefore, paragraph 297, 299, 272 d) and 281 are not applicable for the development and operation of new phases in the project activity.

In year 2016, two high temperature enclosed flares with maximum capacity of 2,500 Nm<sup>3</sup>/hr each are in operation while the remaining portion of the gas captured was sent to a unit of 1.2MW Gas Engine (Gas Engine No.1), 2 units of 1.56MW Gas Engines (Gas Engine No.2 and No.3) and one unit of 2MW Gas Engine (Gas Engine No.4) to generate electricity. The electricity produced by the gas engines is exported to the grid. However, in year 2017, there is some change occurred. Flaring No. 1 is closed dated 03/01/2017. The biogas that was introduced to Flaring No. 1 will be delivered to Gas Supply System (GSS F1) then to Gas Engine No.1 for electricity generation. Below table listed the status of project activities:

<b>Bukit Tagar Project</b>	<b>Construction Start</b>	<b>Commissioned</b>	<b>Status</b>
First flaring system (Flare No. 1)	17/06/2008	28/08/2009	Stop operation in 03/01/2017
Second flaring system (Flare No. 2)	22/01/2010	07/08/2010	Continued to operate
Gas Engine No.1	03/01/2011 (delivery to site)	01/06/2011	Continued to operate
Gas Engine No.2	06/08/2012 (Signed-off Delivery Order)	06/12/2013	Continued to operate
Gas Engine No.3	06/08/2012 (Signed-off Delivery Order)	06/12/2013	Continued to operate
Gas Engine No.4	26/12/2014 (Signed-off Delivery Order)	26/10/2015	Continued to operate

The above change in 2017 has led to the permanent change of the monitoring plan. The same has been validated by the assessment team in the validation report form of the post registration change (CDM-PRCV-FORM) attached with this validation report of renewal of crediting period.

**During EB's I&R check process, EB has raised below issues dated 13/03/2018:**

1: It is noted that PDD under Appendix 7 provides summary of previous post registration changes approved by the Board, however, the PDD does not provide summary post registration changes submitted for approval along with the request for renewal crediting period.

As per PS for project activities para 230, the project participant under Appendix 7 of the PDD needs to provide summary of post registration changes being proposed as PRC request.

Project participant is requested to provide missing information under Appendix 7 of the PDD.

2: Based on the information provided by the DOE in response to the issues raised earlier at IRC, it is noted that the project will develop up to 17 phases (cells) according to landfill design which are necessary when the current cells have reached its designed capacity. However similar information was missing under section A.1 of the revised PDD submitted in response to IRC issues. The project participant is requested to provide missing information in the PDD.

Further, it is noted from section A.1 of the revised PDD that the landfill is designed to receive up to an average of 3,000 tons of solid waste per day. However, the table (refer page 98 of 113 of the revised PDD) providing amount of waste received and projected at the landfill site up to 2023, mentioned that the average waste that is projected to receive from 2016 to 2023 is more than the designed capacity of the landfill site. Please note that it is projected to receive an average of 3221 ton of waste during 2016 to 2023 which is about 7% more than the designed capacity of the landfill site. Noting this information, as per VVS for project activities para 415 the DOE is requested to provide all its applied approaches, findings and conclusions on information related to project implementation during 2nd crediting period transferred to later valid version of the PDD, its compliance with the applied methodology and its relation to the operation of the project activity. The DOE is requested to provide missing information in its validation report for renewal of crediting period.

**For above issues, Applus+ LGAI replied as below:**

1. The PP has included the description related to the PRC which is attached with the renewal of crediting period in appendix 7 of the revised PDD version 20.5, which states:

*There is a revision of monitoring plan in renewal crediting period. The revision is related to the shutdown of Flare No.1 and converting Flare No.1 to GSSF1. Gas engine No. 1 which was attached to Flare 2 previously has been converted to GSSF1. Flare no. 1 is no longer in operation starting from 03/01/2017 onwards. Flare no. 1 is converted to GSS F1, where Gas Engine No. 1 is attached to Flare No. 1. Gas Engine No. 1 no longer attached to Flare No. 2 starting from 03/01/2017.*

Therefore the assessment team confirmed that the issue has been closed.

2. The requested information has been included in section A.1 of the revised PDD as below:

*These phases are included in this project that is to be developed by year 2023. The landfill site consists of multi-phases (landfill cells) for MSW landfilling to cater for the continuous incoming waste received. Development of new phases (cells) (up to 17 phases according to landfill design) is necessary when the current cells have reached its designed capacity. All other phases will be developed when necessary.*

The assessment team consider the missing information in the PDD has been completed.

Related to the designed landfill capacity, the assessment team has concluded that the indicated information related to 3,000 ton/day was a very rough estimation via communicating with the project owner. Thereby it is considered as a "correction" to the project information which has been validated by the assessment team in the PRC validation report submitted along with the RCP validation report. Further assessment is also included as below:

In section A.1 of the original registered PDD version 05.3 and PDD version 19.0, it is stated that:

*The Bukit Tagar sanitary landfill occupies a 700 acres footprint and is surrounded by a buffer zone of 1000 hectares of palm oil plantations. The landfill has been in operation since 1 April 2005 and is designed to receive up to an average of 3,000 tons of solid waste per day for at least 40 years. To date, the landfill received on average of 2,000 tons of municipal solid waste (MSW) per day from Kuala Lumpur City and the Selayang District in the State of Selangor.*

The above description has been corrected in the updated PDD version 20.5 as below (the underlined phrases have been corrected):

*The Bukit Tagar sanitary landfill occupies a 700 acres footprint and is surrounded by a buffer zone of 1000 hectares of palm oil plantations. The landfill has been in operation since 1 April 2005 and the waste received is expected to increase yearly from 3,000 t/d up to 6,600 t/d over the 40 years designed lifespan. To date, the landfill received on average of 2,300 tons of municipal solid waste (MSW) per day from Kuala Lumpur City and the Selayang District in the State of Selangor.*

Clarification and assessment has been carried out on above correction and it can be confirmed that the average of 3,000 ton/day stated in the PDD version 19.0 in fact refers to the initial rate of waste expected to be received (refer to page 1 of the additional report for EIA). However, the waste received is expected to increase yearly from 3,000 t/d up to 6,600 t/d over the 40 years designed lifespan. The EIA report further noted that the 3,000 t/d is indicative and may increase due to various factors. Further checks on the approved Detailed Environmental Impact Assessment (DEIA) for proposed Bukit Tagar Landfill, Sungai Tinggi, Hulu Selangor, Selangor Darul Ehsan dated June 2004, page 5-9, confirmed that the landfill can tolerate a big range of actual waste to be received, in the range from 2,000 to 10,000 ton/day (refer to Detailed Environmental Impact Assessment (DEIA) for proposed Bukit Tagar Landfill, Sungai Tinggi, Hulu Selangor, Selangor Darul Ehsan dated June 2004). As a result, the assessment team confirmed that the table (refer page 98 of 113 of the revised PDD) providing the amount of waste received and projections at the landfill site up to 2023 with an average of 3,221 t/d is well within the designed capacity of the landfill site.

As communicated with the project owner that the 3,000 ton/day indicated in the PDD version 19.0 was a very rough estimation. For avoiding confusion, in the revised PDD version 20.5, the description related to the MSW landfilling capacity has been corrected in accordance with the approved Detailed Environmental Impact Assessment (DEIA) for proposed Bukit Tagar Landfill, Sungai Tinggi, Hulu Selangor, Selangor Darul Ehsan dated June 2004. As a result. The assessment team confirmed that the correction to the designed capacity during the lifespan of the MSW landfilling is an accurate reflection of the actual project information. Also the assessment team confirmed that the correct project implementation information during 2<sup>nd</sup> crediting period has been transferred to the revised PDD version 20.5. And the correction does not affect to the additionality and the compliance with the applied methodology.

As a result, the assessment team consider the issue has been closed.

Before the implementation of the project activity, biogas containing methane was passively vented to the atmosphere directly. Recognising the potential capturing and utilising of landfill gas, KBE hereby proposed the project activity that entails the collection and utilization of landfill gas for power generation as well as flaring the excess gas. The renewable power generated from the landfill gas will be sold to the grid, leading to further reduction of GHGs emission.

Prior to the start of the implementation of the project activity, there was no destruction of CH<sub>4</sub> neither through LFG combustion nor energy generation. Therefore, the scenario existing prior to the implementation of the project activity was no methane collection or destruction leading to CH<sub>4</sub> release into the atmosphere. The situation before the project implementation coincides with the baseline scenario.

The project activity contributes to sustainable development of the local community, the host country and the world. Apart from reducing CH<sub>4</sub> (as a GHG with a Global Warming Potential (GWP) valid for the commitment period), the implementation of this landfill gas recovery and utilization project will also reduce the effects of air pollution on surrounding environments and minimize the risks of an explosion due to the concentration of accumulated landfill gas.

In an E-mail sent by PP to the CDM Registration and Issuance Team of UNFCCC using CDM-RENN-FORM /3/ dated 20/01/2016, the project participants expressed their intention to request a renewal of crediting period for the project activity in accordance with the CDM PCP version 01.0. The secretariat confirmed the receiving of the un-validated PDD and CDM-RENN-FORM. The CDM-RENN-FORM and the updated PDD was sent to the secretariat within 270 to 180 days prior to the date of expiration of the current crediting period.

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 5 findings which include:

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

The PP has responded these findings by modifying the project design, rectifying the PDD and providing adequate additional explanations and evidences. Applus+ LGAI confirms that all the findings have been “closed out” before submitting the request for renewal of crediting period.

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 20.5 dated 26/03/2018, meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence Applus+ LGAI submitted the request for renewal of the crediting period of the project activity.

## SECTION B. Validation team, technical reviewer and approver

### B.1. Validation team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk review	On-site inspection	Interview(s)	Validation findings
1.	Team Leader	EI	Shen	Meng	Applus+ Shanghai	x	x	x	x

### B.2. Technical reviewer and approver of the validation report for RCP

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

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## SECTION C. Means of validation

### C.1. Desk/document review

The PDD version 14.0 dated 19/01/2016 for the 2<sup>nd</sup> crediting period which was submitted by the Client to EB for notifying the intention of renewal of crediting period was reviewed by the assessment team against the approved methodology and other relevant criteria to verify the correctness, credibility, and interpretation of the presented information.

During the desk review, the relevant documents, including the registered PDD, the updated PDD, the previous monitoring reports and corresponding verification reports for the 1<sup>st</sup> crediting period, the latest MoC, technical specifications of equipments and other relevant background documents were provided and assessed. A complete list of these documents and evidence material reviewed is included in Appendix 3 to this report. The project description in the PDD for the renewable crediting period was verified from these documents. The validation team could confirm the status of the project design, construction, operation and monitoring plan etc. And the baseline scenario information also can be confirmed as it was defined by the applied methodology ACM0001 version 18.0.

It should be noticed that, after the notification of the intention of renewal of crediting period, the PP applied the 4<sup>th</sup> post registration change (PRC-2467-004) which has been audited by TÜV NORD CERT GMBH and approved by EB dated 15/11/2016. The same change was included in the updated PDD version 19.0 and the same version of PDD has been made public available at UNFCCC website (<http://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/view>). The validation of the renewal of crediting period is completed dated in December 2017 which is later than the 4<sup>th</sup> post registration change, the PDD version 19.0 was also reviewed by the assessment team for keeping continuity (note that PDD version 19.0 was still for the 1<sup>st</sup> crediting period though it is later than PDD version 14.0). The PDD version 14.0 (completed for the 2<sup>nd</sup> crediting period) which was submitted by PP to UNFCCC for requesting the renewal of crediting period was considered as the original version for the validation. The relevant change (PRC-2467-004) was not validated by the assessment team this time since it has already been audited by TÜV NORD CERT GMBH and approved by EB.

### C.2. On-site inspection

The follow-up interviews through telephone, skype and email were held by the assessment team, which is focused on the issues identified during the desk review. The response from the representatives of the PP and the consultant were received to close the issued identified. Besides, the assessment team conducted site visit during 10-11 December 2017 to confirm the project implementation status. The subject of site visit was listed as below:

Duration of on-site inspection: 10-11/12/2017				
No.	Activity performed	Site location	Date	Team member
1.	<ul style="list-style-type: none"> <li>- Implementation status of the project activity;</li> <li>- Permanent change from the registered monitoring plan occurred during this monitoring period;</li> <li>- The compliance with revised PDD.</li> </ul>	Bukit Tagar, Mukim Sg. Tinggi, Hulu Selangor District in the State of Selangor, Malaysia	10-11/12/2017	Meng (Simon) Shen

### C.3. Interviews



No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Mohd Zain	Zainal Fikry B	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	10-11/12/2017	<ul style="list-style-type: none"> <li>- Basic information, technology of the project, etc;</li> <li>- Monitor Data: meter readings, control and maintenance, QA&amp;QC systems</li> <li>- Status of the project activity and any modifications with respect to the registered PDD.</li> <li>- Applicability to the latest methodology.</li> <li>- National and local policies and changes</li> <li>- Baseline of the project and its updates</li> <li>- The lifetime of the project activity</li> <li>- Emission Factors and their updates</li> <li>- Monitoring plan and changes.</li> </ul>	Meng (Simon) Shen
2	Chen	Saw Ling	Eco-Ideal			
3	Chua	Ming Yin	Consulting Sdn Bhd			
4	Yong	Chen Kait				

#### C.4. Sampling approach

Not applicable for the project activity.

#### C.5. Clarification requests, corrective action requests and forward action requests raised

Area of validation findings	No. of CL	No. of CAR	No. of FAR
Compliance with PDD form	0	2	0
Application and selection of methodologies and standardized baselines	0	1	0
Validity of original baseline or its update	0	0	0
Estimated GHG emission reductions or net anthropogenic GHG removals	0	2	0
Validity of monitoring plan	0	0	0
Crediting period	0	0	0
Project participants	0	0	0
Others (please specify)	0	0	0
<b>Total</b>	0	5	0

### SECTION D. Validation findings

#### D.1. Compliance with PDD form

<b>Means of validation</b>	<p>The assessment team has verified the format against the "PDD form" template to confirm whether the correct format of PDD form is used.</p> <p>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.</p>
<b>Findings</b>	The PP of the project activity notified EB of the intention to renew the crediting period dated 20/01/2016. The latest version of "Project design document form for

	<p>CDM project activities" is version 06.0" at the time. However as of the submission of the final PDD, EB has updated the CDM VVS for project activities version 01.0 as well as the PDD template. The latest PDD form was version 10.1. Thereby the assessment team issued CAR #1 requesting PP update the PDD form version. As the response, the PP has updated the PDD template version number to version 10.1. The assessment team confirmed that the correct PDD form is applied thereby closed out the CAR.</p> <p>The same information from the registered PDD has been transferred to the updated PDD.</p> <p>The PDD version 14.0 which was submitted to EB for notifying the intention of the renewal of crediting period was completed dated 19/01/2016. After the notification, the PP applied the post registration change related to the project design change. The change included the increasing of power generation approximately 2MW and upload to the grid by year 2015 and including of diesel generator as backup for project activities during the power failure of the grid. This is the 4<sup>th</sup> notification of change request (PRC-2467-004) published in UNFCCC on 11/10/2016 and was approved by UNFCCC on 15/11/2016. After the change, the PDD version has been updated to version 19.0 (note that the PDD version 19.0 is still for the 1<sup>st</sup> crediting period). In addition, there is another revision of monitoring plan during the renewal crediting period. The revision is related to the shutdown of Flare No.1 and converting Flare No.1 to GSS F1. Gas engine No. 1 which was attached to Flare 2 previously has been converted to GSS F1. Therefore, the assessment team issued CAR #2, requesting PP demonstrating the above mentioned changes in the PDD.</p> <p>As the response, the PP has included the 4<sup>th</sup> notification of change request (PRC-2467-004) in the relevant section and in appendix 7 of the updated PDD. Since the same change has been audited by TÜV NORD CERT GMBH in the validation report of post registration change dated 05/09/2016, the assessment team will not audit the same change again. For the change occurred during the validation of the renewal of crediting period, the assessment team validated it in the validation report of post registration change attached. The PP has already included the same change in the updated PDD since version 20.3. The assessment team confirmed that the change is in compliance with the approved methodology ACM0001 version 18.0 and relevant requirements in the CDM PS for project activities version 01.0. Thereby the CAR #2 is closed out.</p>
<b>Conclusion</b>	<p>The updated PDD complies with the applicable PDD form with version 10.1 and instructions therein for filling out the PDD.</p> <p>Information transferred to the later valid version of the PDD form is materially the same as that in the registered PDD.</p>

## D.2. Application and selection of methodologies and standardized baselines

<b>Means of validation</b>	The assessment team has checked the correctness of the application of the approved methodology to determine the continued validity of the baseline or its update, and to estimate the emission reductions for the applicable crediting period of the registered CDM project activity.
<b>Findings</b>	<p>The project was originally registered based on methodology ACM0001 version 08.0. The updated PDD version 14.0 sending to UNFCCC for notifying the intention of renewal of crediting period applied ACM0001 version 16.0 which was of its latest version at that time. However, when finalizing the validation report of the renewal of crediting period, ACM0001 has been updated to version 18.0. The assessment team issued CAR #3 requesting PP update the applied methodology. As the response, PP has applied the methodology ACM0001 version 18.0 in the updated PDD since version 20.3. The assessment team confirmed that this is appropriate because the methodology ACM0001 version 18.0 was of its latest version at the time of submission of the request for renewal of crediting period to UNFCCC. Therefore the CAR #3 is closed out.</p> <p>The updated PDD did not apply standardized baseline.</p>

The project activity correctly applied the approved consolidated baseline and monitoring methodology ACM0001 "Flaring or use of landfill gas", version 18.0.

The project applied "Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" version 03.0.1 and below tools of their latest version:

- Emissions from solid waste disposal sites (version 07.0)
- Project emissions from flaring (version 02.0.0)
- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 02.0)
- Tool to calculate the emission factor for an electricity system (version 5.0)
- Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)
- Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)

Methodology ACM0001 is applicable to project activity which:

- (a) Install a new LFG capture system in a new or existing SWDS; or
- (b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:
  - (i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and
  - (ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.
- (c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:
  - (i) Generating electricity;
  - (ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or
  - (iii) Supplying the LFG to consumers through a natural gas distribution network.
  - (iv) Supplying compressed/liquefied LFG to consumers using trucks;
  - (v) Supplying the LFG to consumers through a dedicated pipeline;
- (d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.

It is verified that the project involves the installation of new LFG capture systems in an existing SWDS where no LFG capture system was installed prior to the implementation of the project activity. So the corresponding to the applicability criteria (a) set above is met by the project activity. The project activity is expected to generate electricity so the applicability criteria (c)(i) is applicable to the project activity.

Meanwhile, as stated in the updated PDD version 20.5, the landfill site consists of multi-phases (landfill cells) for MSW landfilling to cater for the continuous incoming waste received. Development of new phases (cells) (up to 17 phases according to landfill design) is necessary when the current cells have reached its designed capacity. The assessment team confirmed that the development of new phases is in compliance with the applied methodology which has been demonstrated in section D.2 of this report.

The assessment team interviewed with the project owner of the project activity that the landfill site receives MSW from Kuala Lumpur city and Selayang District without any further sorting except landfilling. Thereby it could confirm that the project activity will not reduce the amount of organic waste that would be recycled in the absence of the project activity so the project meets the **applicability criteria (d)**.

Moreover, the methodology ACM0001 is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:

- a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and
- b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln;
  - (i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or
  - (ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary.
- c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.

The procedure to identify the baseline scenario confirms that the most plausible baseline scenario is atmospheric release of the LFG. Meanwhile, the electricity would be generated in the grid thus option b is applicable for the project activity. Since the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is (a), the ACM0001 is applicable to the project activity.

Methodology ACM0001 is not applicable:

- a) In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace;
- b) If the management of the SWDS in the project activity is deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.

It is confirmed by the assessment team that the project activity does not apply other approved methodology. The management of the SWDS is not changed during the crediting to increase the methane generation.

The applicable tools are also demonstrated by the PP in the updated PDD to confirm the applicability.

- The "Emissions from solid waste disposal sites" (version 07.0) is applicable for waste disposal sites where the CDM project activity mitigates methane emissions from a specific existing SWDS by capturing and flaring or combusting the methane. The methane is generated from waste disposed in the past.
- The "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 02.0) is applicable for the purpose of calculating project emissions in case where a project activity consumes electricity from the grid (Scenario A of Section I of the Tool). For the project activity, since electricity will be sourced from the grid, then the tool is applicable.
- The "Project emissions from flaring" (version 02.0.0) is used to determine  $PE_{\text{flare},y}$  as required by the ACM0001 "Flaring or use of landfill gas" (version 18.0). The project involves enclosed flares LFG as flammable greenhouse gases and methane is the component with the highest concentration in the flammable residual gas. The source of the residual gas is from a biogenic source, i.e. landfill gas. The project does not involve the use of the auxiliary fuels. The specification of operation has been provided by the manufacturer. Therefore, the "Project emissions from flaring" (version 02.0.0) is applicable for the project activity.
- The "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) is applicable for the purpose to determine the mass flow of greenhouse gases such as  $CO_2$ ,  $CH_4$ ,  $N_2O$ ,  $SF_6$  or PFC. The mass flow of a particular greenhouse gas is calculated based on

	<p>measurements of: (a) the total volume flow or mass flow of the gas stream, (b) the volumetric fraction of the gas in the gas stream and (c) the gas composition and water content. Typical applications of this tool are methodologies where the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions, which is the case of the present project activity, and then the tool is applicable.</p> <ul style="list-style-type: none"> <li>• The “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” version 03.0.1 shall be used for the assessment of continued validity of the original baseline and its update when the renewal of the crediting period is conducted.</li> <li>• The “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” (version 02) is applicable for the purpose of calculating the project CO<sub>2</sub> emissions from the combustion of fossil fuels in cases where CO<sub>2</sub> emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. For the current project activity, since the quantity of fuel combusted and its properties are monitored, then the tool is applicable.</li> <li>• The "Tool to calculate the emission factor for an electricity system" (version 05.0) is applicable for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary. For the current project activity, since electricity will be sourced from the grid, then the tool is applicable.</li> </ul> <p>The assessment team has validated the documentation referred to in the PDD and verified the documentation content for verifying the justification of the applicability of the methodology and confirmed that the documentation referred to in the PDD is correctly quoted and interpreted. The assessment team has also crosschecked the information provided in the PDD with the documentation other than from the PDD based on the local and sectoral knowledge of the assessment team. Following documentation has been reviewed by the assessment team:</p> <ul style="list-style-type: none"> <li>- Technical specification of gas engines GE 1, GE 2, GE 3<sup>/4/</sup>;</li> <li>- Technical specification of gas engines GE 4<sup>/5/</sup>.</li> </ul>
<b>Conclusion</b>	<p>Applus+ LGAI confirms that the application of the baseline methodology is transparent and conservative, and confirms that the chosen baseline and monitoring methodology i.e. ACM0001 version 18.0 is applicable to the project activity.</p>

### D.3. Validity of original baseline or its update

<b>Means of validation</b>	<p>The assessment team has validated the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period of the registered CDM project activity at the time of requesting renewal of crediting period of the project activity, via applying the steps from the Methodological Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” version 03.0.1.</p>
<b>Findings</b>	<p>For the second crediting period, the continued validity of the original baseline has been assessed in the updated PDD. Applus+ LGAI confirms that there have been no changes in the relevant national and/or sectoral regulations on building LFG collection flaring system as well as power generation system using collected LFG since the previous crediting period. On the other hand, the baseline scenario for venting LFG to the atmosphere without collection was still valid according to methodology ACM0001 version 18.0.</p> <p>The information presented in the updated PDD has been validated by an initial document review of all data. Further confirmation has been made based on the review of information from similar projects and/or technologies. The sources</p>

referenced in the PDD have been quoted correctly. The information was verified against credible sources such as Department of Solid Waste Management as well as all environmental regulation and laws, there are no policy changes for LFG capturing for landfill and power generation using captured LFG. Meanwhile, the assessment team checked the communication records between the project owner and the officer from the Department of National Solid Waste Management, KPKT about whether there is any change in the regulatory framework. It is clearly stated in the response from the government dated 07/01/2016 that there is no specific regulation and legal requirement for the landfills in Malaysia to extract and utilize landfill gas.

The steps from the Methodological Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" version 03.0.1 as per CDM VVS for project activities version 01.0 were applied to assess the continued validity of the baseline and/or to update the baseline at the renewal of a crediting period:

**Step 1: Assess the validity of the current baseline for the next crediting period**

The CDM VVS for project activities version 01.0 requires assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:

**Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies**

In assessing the continued validity of the baseline, a change in the relevant national and/or sectoral regulations between two crediting periods has to be examined at the start of the new crediting period. If at the start of the project activity, the project activity was not mandated by regulations, but at the start of the second or third crediting period regulations are in place that enforce the practice or norms or technologies that are used by the project activity, the new regulation (formulated after the registration of the project activity) has to be examined to determine if it applies to existing project or not.

At the start of the project activity, legislation in Malaysia did not require landfills to collect nor utilize the gas generated hence it was not mandated by regulations. After the registration of the project activity, no new laws/policies have appeared to change such situations. Therefore, Bukit Tagar Sanitary Landfill is not required to capture and flare LFG at the start of the second crediting period by any mandatory law. As a conclusion, currently in Malaysia there are no laws or regulations mandating capture and flaring of landfill gas. The information was verified against credible sources such as Department of Solid Waste Management as well as all environmental regulation and laws, there are no policy changes for LFG capturing for landfill and power generation using captured LFG. Meanwhile, the assessment team checked the communication records between the project owner and the officer from the Department of National Solid Waste Management, KPKT about whether there is any change in the regulatory framework.

The fundamental elements of the baseline have not changed since the project was first registered, and the market structure, regulatory framework, and functioning remains the same. The current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period.

Applus+ LGAI confirms that no relevant mandatory national and/or sectoral policies applicable to the project activity came into effect after the submission of the project activity for validation.

**Step 1.2: Assess the impact of circumstances**

	<p>The assessment team confirmed that there is no impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions.</p> <p><u>Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested</u></p> <p>This sub-step is not applicable because the baseline scenario identified at the validation of the project activity was not the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would not undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology. Therefore, the current baseline does not need to be updated.</p> <p><u>Step 1.4: Assessment of the validity of the data and parameters</u></p> <p>There are some parameters, which were determined at the start of the first crediting period for an ex-ante estimation of GHG emission reductions which should be updated. For example, the Global Warming Potential (<math>GWP_{CH_4}</math>) and Grid Emission Factor (<math>EF_{EL,k,y}</math>) etc.</p> <p>This parameter is properly described in the following section D.4.</p> <p><b><u>Conclusion on step 1:</u></b></p> <p>Applus+ LGAI confirms that the current baseline is still valid as per methodology ACM0001 version 18.0.</p> <p><b><u>Step 2: Update the current baseline and the data and parameters</u></b></p> <p><u>Step 2.1: Update the current baseline</u></p> <p>The baseline emissions for the second crediting period have been updated, without reassessing the baseline scenario, based on the latest approved version of the methodology ACM0001 version 18.0. This update was applied in the context of the sectoral policies and circumstances that are applicable at the time of requesting for renewal of the crediting period, which has not changed as to affect the project. More details for the updated baseline emissions for the second crediting period can be seen in section D.4.</p> <p><u>Step 2.2: Update the data and parameters</u></p> <p>All the parameters keep being valid for the second crediting period. More details can be seen in section D.4.</p> <p>The parameters described under step 1.4 were properly updated considering the latest versions of methodology ACM0001 version 18.0 etc.</p>
<b>Conclusion</b>	<p>Applus+ LGAI confirms that there have been no changes in the relevant national and/or sectoral regulations on building LFG collection flaring system as well as power generation system using collected LFG since the previous crediting period. On the other hand, the baseline scenario for venting LFG to the atmosphere without collection was still valid according to methodology ACM0001 version 18.0.</p>

#### D.4. Estimated emission reductions or net anthropogenic removals

<b>Means of validation</b>	<p>The assessment team has verified the estimated GHG emission reductions in the updated PDD according to the applicable requirements in the CDM project standard for project activities and methodology ACM0001 version 18.0 as well as applicable methodological tools.</p>
<b>Findings</b>	<p>The calculation of the emissions reductions exactly follow the procedures described in the methodology ACM0001 version 18.0 and relevant tool.</p>

Applus+ LGAI has assessed the calculation of project emissions, baseline emissions, leakage emissions and emission reductions. Corresponding calculations have been carried out based on calculation spreadsheet. The consistency of the parameters and equations presented in the updated PDD, as well as calculation spreadsheet etc., has been compared with the information and requirements presented in the methodology and respective tools.

The assumptions and data used to determine the emission reductions are listed in the updated PDD and all the sources have been checked. Based on the information reviewed it is confirmed that the sources used are correctly quoted and interpreted in the PDD. The values presented in the PDD are considered reasonably based on the documentation and references reviewed and the results of the interviews.

The estimation of the emission reductions are considered correct as the calculations have been reproduced by the assessment team with the attainment of the same results.

The emission reductions are calculated by the difference between baseline emissions ( $BE_y$ ) and project emissions ( $PE_y$ ) and leakage ( $LE_y$ ).

### **(1) Baseline emissions**

Baseline emissions are determined according to equation 1 of ACM0001 version 18.0 and comprise the following sources:

- Methane emissions from the SWDS in the absence of the project activity;
- Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;
- Heat generation using fossil fuels in the absence of the project activity; and
- Natural gas used from the natural gas network in the absence of the project activity.

To estimate the baseline scenario the ACM0001 version 18.0 uses:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad (1)$$

Where:

$BE_y$	=	Baseline emissions in year y (tCO <sub>2</sub> e)
$BE_{CH_4,y}$	=	Baseline emissions of methane from the SWDS in year y (t CO <sub>2</sub> e/yr)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year y (t CO <sub>2</sub> /yr)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year y (t CO <sub>2</sub> /yr)
$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year y (t CO <sub>2</sub> /yr)

Since heat generation and natural gas network is not applicable in the project activity, baseline emissions comprise a) and b) of above.

Step A: Baseline emissions of methane from the SWDS ( $BE_{CH_4,y}$ )

Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account:

$$BE_{CH_4} = \left( (1 - OX_{top\_layer}) \times F_{CH_4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH_4} \quad (2)$$

Where:



$BE_{CH_4}$	=	Baseline emissions of methane from the SWDS in year $y$ (t CO <sub>2</sub> e/yr)
$OX_{top\_layer}$	=	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)
$F_{CH_4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year $y$ (t CH <sub>4</sub> /yr)
$F_{CH_4,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year $y$ (t CH <sub>4</sub> /yr)
$GWP_{CH_4}$	=	Global warming potential of CH <sub>4</sub> (t CO <sub>2</sub> e/t CH <sub>4</sub> )

The *ex-ante* estimation of the amount of methane that would have been destroyed/combusted during the year, in tonnes of methane ( $F_{CH_4,PJ,y}$ ) has been carried using the latest version of the approved "Emissions from solid waste disposal sites" (Version 07.0), considering the following additional equation:

Step A.1.1: Ex ante estimation of  $F_{CH_4,PJ,y}$

$$F_{CH_4,PJ,y} = \eta_{PJ} \times BE_{CH_4,SWDS,y} / GWP_{CH_4} \quad (3)$$

Where:

$F_{CH_4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year $y$ (t CH <sub>4</sub> /yr)
$BE_{CH_4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year $y$ (t CO <sub>2</sub> e/yr)
$\eta_{PJ}$	=	Efficiency of the LFG capture system that will be installed in the project activity
$GWP_{CH_4}$	=	Global warming potential of CH <sub>4</sub> (t CO <sub>2</sub> e/t CH <sub>4</sub> )

$BE_{CH_4,SWDS,y}$  is determined using the methodological tool "Emissions from solid waste disposal sites" (Version 07.0). The following guidance should be taken into account when applying the tool:

- $f_y$  in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation 2 of this methodology;
- In the tool,  $x$  begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and
- Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

The methane generation from the landfill in the absence of the project activity at year  $y$  ( $BE_{CH_4,SWDS,y}$ ), is calculated as per the "Emissions from solid waste disposal sites" (Version 07.0), as follows:

$$BE_{CH_4,SWDS,y} = \phi \cdot (1-f) \cdot GWP_{CH_4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot (1-e^{-k_j}) \quad (4)$$

Where:

$BE_{CH_4,SWDS,y}$	=	Methane emissions avoided during the year $y$ from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year $y$ (tCO <sub>2</sub> e)
$\phi$	=	Model correction factor to account for model uncertainties
$f$	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
$GWP_{CH_4}$	=	Global Warming Potential (GWP) of methane, valid for the

	relevant commitment period
$OX$	= Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
$F$	= Fraction of methane in the SWDS gas (volume fraction)
$DOC_f$	= Fraction of degradable organic carbon (DOC) that can decompose
$MCF$	= Methane correction factor
$W_{j,x}$	= Amount of organic type $j$ prevented from disposal in the SWDS in the year $x$ (tonnes)
$DOC_j$	= Fraction of degradable organic carbon (by weight) in the waste type $j$
$k_j$	= Decay rate for the waste type $j$
$j$	= Waste type category (index)
$x$	= Year since the landfill started receiving wastes [ $x$ runs from the first year of landfill operation ( $x=1$ ) to the year for which emissions are calculated ( $x=y$ )] Note: this definition represents a correction of the Tool as given in ACM0001, version 18.0.
$y$	= Year for which methane emissions are calculated

Since ACM0001 version 18.0 further clarifies that “*Sampling to determine the different waste types is not necessary; the waste composition can be obtained from previous studies*”, this option has been used in for the project activity.

ACM0001, version 18.0 also states: “*The efficiency of the degassing system which will be installed in the project activity should be taken into account while estimating the ex-ante estimation.*” This is taken into consideration through the utilization of a default capture efficiency value for the total of LFG generated.

At the renewal of the crediting period, the following data should be updated according to default values suggested in the most recently published IPCC Guidelines for National Greenhouse Gas Inventories:

- Oxidation factor ( $OX$ );
- Fraction of methane in the SWDS gas ( $F$ );
- Fraction of degradable organic carbon ( $DOC$ ) that can decompose ( $DOC_f$ );
- Methane correction factor ( $MCF$ );
- Fraction of degradable organic carbon (by weight) in each waste type  $j$  ( $DOC_j$ );
- Decay rate for the waste type  $j$  ( $k_j$ ).

Respectively, if the most recent IPCC Guidelines suggest different categorization of waste types, solid waste disposal sites or climate conditions, these should be applied respectively.

Determining the amounts of waste types  $j$  disposed in the SWDS ( $W_{j,x}$  or  $W_{j,y}$ )

Since only one type of waste is disposed in the landfill site (in this case municipal solid waste) then  $W_{j,x} = W_x$  and  $W_{j,y} = W_y$  and the waste sampling is not required. For such reason, Application A of the Methodological Tool “Emissions from solid waste disposal sites.” (version 07.0) will be used in the project activity as follows:

Since the administration of the landfill had the specific information on historic information on amounts, composition and origin of the waste in SWDS administration documents, such data is used as a more reliable data.

Step A.1.2: Ex post determination of  $F_{CH_4,PJ,y}$

During the crediting period,  $F_{CH_4,PJ,y}$  is determined as per methodology ACM0001 version 18.0, considering the sum of the quantities of methane flared and used (as applicable) in power plant(s), boiler(s), air heater(s), kiln(s) and natural gas distribution network and/or to the trucks, as follows:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} + F_{CH_4,HG,y} + F_{CH_4,NG,y} \quad (5)$$

Where:

- $F_{CH_4,PJ,y}$  = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH<sub>4</sub>/yr)  
 $F_{CH_4,flared,y}$  = Amount of methane in the LFG which is destroyed by flaring in year y (t CH<sub>4</sub>/yr)  
 $F_{CH_4,EL,y}$  = Amount of methane in the LFG which is used for electricity generation in year y (t CH<sub>4</sub>/yr)  
 $F_{CH_4,HG,y}$  = Amount of methane in the LFG which is used for heat generation in year y (t CH<sub>4</sub>/yr)  
 $F_{CH_4,NG,y}$  = Amount of methane in the LFG which is sent to the natural gas distribution network and/or to the trucks in year y (t CH<sub>4</sub>/yr)

Since the project activity includes electricity generation but it does not include heat generation nor use of landfill gas as natural gas, the equation (5) above can be simplified to:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} \quad (6)$$

The following equation based on ACM0001 (Version 18.0) was used to calculate the amount of methane in the LFG which is destroyed by flaring in year y:

$$F_{CH_4,flared,y} = F_{CH_4,sent\_flare,y} - (PE_{flare,y} / GWP_{CH_4}) \quad (7)$$

Where:

- $F_{CH_4,flared,y}$  = Amount of methane in the LFG which is destroyed by flaring in year y (t CH<sub>4</sub>/yr)  
 $F_{CH_4,sent\_flare,y}$  = Amount of methane in the LFG which is sent to the flare in year y (t CH<sub>4</sub>/yr)  
 $PE_{flare,y}$  = Project emissions from flaring of the residual gas stream in year y (t CO<sub>2</sub>e/yr)  
 $GWP_{CH_4}$  = Global warming potential of CH<sub>4</sub> (t CO<sub>2</sub>e/t CH<sub>4</sub>)

According to ACM0001 (Version 18.0), the default value for  $GWP_{CH_4} = 25$  t CO<sub>2</sub>e/t CH<sub>4</sub> with reference to decision 4/CMP7 and paragraph 66 of the EB 69 Meeting Report.

$F_{CH_4,sent\_flare,y}$  is determined using the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0).  $F_{CH_4,sent\_flare,y}$  is determined on a dry basis applying the option B of the tool. The assessment team verified the steps for determining the parameter in the updated PDD and confirmed that the assumptions and equations applied are in line with the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0). Default values, such as Molecular mass of H<sub>2</sub>O, CO<sub>2</sub>, CH<sub>4</sub>, O<sub>2</sub> etc., have been applied for determining the parameter which is in line with the tool. The data and parameters that will be determined ex post via monitoring has been listed in section B.7.1 of the PDD.

$PE_{flare,y}$  is determined using the methodological tool "Project emissions from flaring" (Version 02.0.0). LFG is flared through more than one flare, and hence,  $PE_{flare,y}$  is the sum of the emissions for each flare determined separately.  $PE_{flare,y}$  calculation procedure is given in the following steps:

- Step 1: Determination of the methane mass flow of the residual gas  
 Step 2: Determination of the flare efficiency  
 Step 3: Calculation of project emissions from flaring

For step 1, mass flow of methane in the residual gaseous stream in the minute m ( $F_{CH_4,m}$ ) is determined using the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0).  $F_{CH_4,m}$  is determined

on a dry basis applying option B.

For step 2, Option A from the methodological tool "Project emissions from flaring" (*Version 02.0.0*), i.e. a default value for flare efficiency is applied. According to the methodological tool "Project emissions from flaring" (*Version 02.0.0*), the flare efficiency for the minute  $m$  ( $\eta_{\text{flare},m}$ ) is 90% when the following two conditions are met to demonstrate that the flare is operating:

- (i) The temperature of the flare ( $T_{\text{EG},m}$ ) and the flow rate of the residual gas to the flare ( $F_{\text{RG},m}$ ) is within the manufacturer's specification for the flare ( $\text{SPEC}_{\text{flare}}$ ) in minute  $m$ ; and
- (ii) The flame is detected in minute  $m$  ( $\text{Flame}_m$ ).

Otherwise  $\eta_{\text{flare},m}$  is 0%.

For step 3, following equation based on the methodological tool "Project emissions from flaring" (*Version 02.0.0*) is used to calculate the project emissions from flaring of the residual gas in year  $y$ :

$$PE_{\text{flare},y} = GWP_{\text{CH}_4} \times \sum_{m=1}^{525600} F_{\text{CH}_4, \text{RG},m} \times (1 - \eta_{\text{flare},m}) \times 10^{-3} \quad (8)$$

Where:

- $PE_{\text{flare},y}$  = Project emissions from flaring of the residual gas in year  $y$  (tCO<sub>2</sub>e)
- $GWP_{\text{CH}_4}$  = Global warming potential of methane valid for the commitment period (t CO<sub>2</sub>e/t CH<sub>4</sub>)
- $F_{\text{CH}_4, \text{RG},m}$  = Mass flow of methane in the residual gas in the minute  $m$  (kg)
- $\eta_{\text{flare},m}$  = Flare efficiency in minute  $m$

$F_{\text{CH}_4, \text{EL},y}$  is determined using the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (*Version 03.0*) and monitoring the working hours of the power plant(s). This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year  $y$  ( $Op_{j,h,y}$ ).

The assessment team confirmed that the process of ex post determination of the  $F_{\text{CH}_4, \text{PJ},y}$  has been clearly demonstrated in the updated PDD. Parameters for ex post determination of the  $F_{\text{CH}_4, \text{PJ},y}$  are clearly identified and listed in the monitoring plan of the PDD. The monitoring of these parameters will be validated in below section.

Step A.2: Determination of  $F_{\text{CH}_4, \text{BL},y}$

The following table based on Table 3 of ACM0001 (*Version 18.0*) was used to determine the amount of methane in the LFG that would be flared in the baseline in year  $y$ :

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1	No	No

Hence, in this situation,  $F_{\text{CH}_4, \text{BL},y} = 0$ .

An *ex ante* estimate of  $F_{\text{CH}_4, \text{PJ},y}$  is required to estimate baseline emission of methane from the SWDS in order to estimate the emission reductions of the proposed project activity in the CDM-PDD.  $BE_{\text{CH}_4, \text{SWDS},y}$  is determined using the methodological tool "Emissions from solid waste disposal sites" (*Version 07.0*).

As a result of verifying the Summarised amount received and projected amounts of

waste at the Bukit Tagar sanitary landfill (listed in the appendix 4 to the PDD version 14.0), it is found that the annually waste received is not consistent with the summarized amount of monthly waste received. The assessment team issued CAR #4 requesting PP correct the amount of waste as well as the calculated  $BE_{CH_4,SWDS,y}$ . As the response, the PP revised the amount of waste ( $W_{j,x}$ ) before 2016 (year 2016 was included) according to the Weight bridge record of Bukit Tagar Sanitary Landfill. For year after 2016, an increase rate of 5% was considered to anticipate the annual amount of waste which is line with the project design. The table of amount of solid waste type j disposed in the SWDS in the year x listed in section B.6.3 has also been updated. The calculation result of  $BE_{CH_4,SWDS,y}$  is also corrected accordingly. The assessment checked the data listed in appendix 4 of the PDD and confirmed that correct figures are quoted. The calculation result of  $BE_{CH_4,SWDS,y}$  is thereby corrected applying the updated data. The assessment team confirmed that the calculation of  $BE_{CH_4,SWDS,y}$  is correct thereby closed the CAR #4.

The methane emissions avoided during the year from preventing waste disposal at the solid waste disposal in the site have been calculated applying the inputs values.

Parameter title	Data	Source
$OX_{top\_layer}$	0.1	Emissions from solid waste disposal sites, version 07.0
$\phi$	0.75	Emissions from solid waste disposal sites, version 07.0
F	0.5	2006 IPCC Guidelines for National Greenhouse Gas Inventories
$f_y$	0	Emissions from solid waste disposal sites, version 07.0
$\eta_{PJ}$	90%	ACM0001 "Flaring or use of landfill gas" version 18.0
OX	0.1	Emissions from solid waste disposal sites, version 07.0
$DOC_f$	0.5	2006 IPCC Guidelines for National Greenhouse Gas Inventories
MCF	1.0	2006 IPCC Guidelines for National Greenhouse Gas Inventories
$DOC_j$	See below	2006 IPCC Guidelines for National Greenhouse Gas Inventories
$k_j$	See below	2006 IPCC Guidelines for National Greenhouse Gas Inventories
$EF_{grid,OM,y}$	0.6532 tCO <sub>2</sub> /MWh	The OM data was derived from Green Tech Centre (GTC) CDM Secretariat of host country. was 0.6532 tCO <sub>2</sub> /MWh With the data from GTC the applied OM value is calculated in accordance to the tool to calculate the emission factor for an electricity system version 05.0 where WOM = 0.25 for 2 <sup>nd</sup> crediting period.
$EF_{grid,BM,y}$	0.7350 tCO <sub>2</sub> /MWh	The BM data was derived from Green Tech centre (GTC) CDM Secretariat of host country. was 0.7350 tCO <sub>2</sub> /MWh With the data from GTC the applied BM value is calculated in accordance to the tool to calculate the emission factor for an electricity system version 05.0 where WBM = 0.75 for 2 <sup>nd</sup> crediting

		period.
$EF_{grid,CM,y}$ ( $EF_{EL,k,y}$ )	0.7146 tCO <sub>2</sub> /MWh	The combined grid emission factor is calculated using OM and BM EF data derived from GTC using the tool to calculate the emission factor for an electricity system version 05.0.
TDL <sub>y</sub>	7.74%	The value is calculated based on the data derived from TNB 2016 annual report for year 2014 to 2016 average TDL. From year 2014-2016, the calculated TDL of 7.74% is compared with the TDL for year 2016 of 7.39% and is higher. The value is applied for project emission from 2017 onwards is therefore, considered conservative.
GWP <sub>CH4</sub>	25	UNFCCC
D <sub>CH4</sub>	0.0007168	2006 IPCC Guidelines for National Greenhouse Gas Inventories

Data of DOC<sub>j</sub>:

Waste type	DOC <sub>j</sub> wet waste
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24
Nappies	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

Data of k<sub>j</sub>:

Waste type	k <sub>j</sub>
Pulp, paper, cardboard (other than sludge), textiles	0.07
Wood, wood products and straw	0.035
Other (non-food) organic putrescible, garden and park waste	0.17
Food, food waste, sewage sludge, beverages and tobacco	0.40

The amount of solid waste type j disposed in the SWDS in the year x is tabulated as below:

Year	Type of waste						Total (t)
	Food waste	Paper / cardboard	Textiles	Wood	Garden and park waste	Nappies	
2016	468,141	182,672	21,019	43,484	26,767	37,490	779,573
2017	491,548	191,805	22,070	45,658	28,105	39,365	818,552
2018	516,126	201,396	23,174	47,941	29,510	41,333	859,480
2019	541,932	211,465	24,333	50,338	30,986	43,399	902,454
2020	569,029	222,039	25,549	52,855	32,535	45,569	947,576
2021	597,480	233,141	26,827	55,498	34,162	47,848	994,955
2022	627,354	244,798	28,168	58,273	35,870	50,240	1,044,703
2023	658,722	257,037	29,576	61,186	37,664	52,752	1,096,938

$BE_{CH_4,SWDS,y}$  is calculated using equation 4 mentioned above. The assessment team verified the ER calculation spreadsheet and confirmed that the calculation process is correct. The result is depicted as below:

Crediting Year	$BE_{CH_4,SWDS,y}$ captured (tCO <sub>2</sub> e)
28/08/2016 – 31/12/2016	99,966
01/01/2017 – 31/12/2017	296,062
01/01/2018 – 31/12/2018	291,768
01/01/2019 – 31/12/2019	300,073
01/01/2020 – 31/12/2020	306,290
01/01/2021 – 31/12/2021	318,672
01/01/2022 – 31/12/2022	329,153
01/01/2023 – 27/08/2023	226,457

$F_{CH_4,PJ,y}$  is calculated using equation 3 mentioned above:

Crediting Year	$\eta_{PJ}$	$BE_{CH_4,SWDS,y}$ (tCO <sub>2</sub> e)	$GWP_{CH_4}$	$F_{CH_4,PJ,y}$
28/08/2016 – 31/12/2016	0.90	99,966	25	3,599
01/01/2017 – 31/12/2017	0.90	296,062	25	10,658
01/01/2018 – 31/12/2018	0.90	291,768	25	10,504
01/01/2019 – 31/12/2019	0.90	300,073	25	10,803
01/01/2020 – 31/12/2020	0.90	306,290	25	11,026
01/01/2021 – 31/12/2021	0.90	318,672	25	11,472
01/01/2022 – 31/12/2022	0.90	329,153	25	11,850
01/01/2023 – 27/08/2023	0.90	226,457	25	8,152

$BE_{CH,y}$  is calculated using equation 2 mentioned above:

Crediting Year	$OX_{top\_layer}$	$F_{CH_4,PJ,y}$	$F_{CH_4,BL,y}$	$GWP_{CH_4}$	$BE_{CH,y}$
28/08/2016 – 31/12/2016	0.1	3,599	0	25	80,972
01/01/2017 – 31/12/2017	0.1	10,658	0	25	239,811
01/01/2018 – 31/12/2018	0.1	10,504	0	25	236,332
01/01/2019 – 31/12/2019	0.1	10,803	0	25	243,059
01/01/2020 – 31/12/2020	0.1	11,026	0	25	248,095
01/01/2021 – 31/12/2021	0.1	11,472	0	25	258,124
01/01/2022 – 31/12/2022	0.1	11,850	0	25	266,614
01/01/2023 – 27/08/2023	0.1	8,152	0	25	183,430

The calculation process has been included in the ER spreadsheet which has been verified by the assessment team as correct.

Step B: Baseline emissions associated with electricity generation ( $BE_{EC,y}$ )

The baseline emissions associated with electricity generation in year  $y$  ( $BE_{EC,y}$ ) have been calculated using the Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation version 2.0 considering the electricity capacity to be installed. The estimated electricity generated during year  $y$  is calculated with the installed capacity and the expected operational hours in year  $y$ .  $TDL_y$  is also considered according to the tool.

$$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EF,k,y} \times (1 + TDL_{k,y}) \quad (9)$$

Where:

- $EC_{BL,k,y}$  = Quantity of electricity that would be consumed by the baseline electricity consumer  $k$  in year  $y$  (MWh/yr)  
 $EF_{EF,k,y}$  = Emission factor for electricity generation for source  $k$  in year  $y$  (t CO<sub>2</sub>/MWh)  
 $TDL_{k,y}$  = Average technical transmission and distribution losses for providing electricity to source  $k$  in year  $y$

It is found that the emission factor of the grid for Malaysia has been updated. The latest national data was published by Green Tech Centre (GTC) CDM secretariat 2014. Meanwhile, the Transmission and Distribution Loses applied in the PDD should also been updated. The assessment team issued CAR #5 requesting PP apply the latest data. As the response, the PP has applied the value  $EF_{EL,k,y}$  (0.7146 tCO<sub>2</sub>/MWh for 2014) which is calculated from the latest release of grid emission factor published by Green Tech Centre (GTC) CDM Secretariat, based on the methodological tool "Tool to calculate the emission factor for an electricity system" (Version 5.0). The Transmission and Distribution Loses ( $TDL_{k,y}$ ) value applied in this PDD 7.39% for year 2016, and is 7.74% for year 2017 and onwards.. This value is calculated from the average of  $TDL_{k,y}$  from 2014-2016 obtained from TNB 2016 annual report. The assessment team verified the calculation process mentioned in the updated PDD since version 20.3 of  $EF_{EL,k,y}$  and confirmed the calculation process is in line with the "Tool to calculate the emission factor for an electricity system" (Version 5.0). The calculation of  $EF_{OM}$ ,  $EF_{BM}$  and  $EF_{CM}$  ( $EF_{EL,k,y}$ ) is consistent with the data published by GTC CDM secretariat. Meanwhile,  $TDL_{k,y}$  of 7.39% for year 2016 is applied in the updated PDD.  $TDL_{k,y}$  of 7.74% is applied from 2017 onwards, which was calculated from the average of  $TDL_{k,y}$  from year 2014-2016 sourced from the Tenaga Nasional Berhad (TNB) Annual Report 2016. The assessment team confirmed the data source and calculation result is correct. Thereby, the CAR #5 is closed out.

The assessment team confirmed the data of electricity generation is estimated appropriately. The accurate data will be monitored during crediting period.

Crediting Year	Estimated power generation from LFG (MWh)	CoEF of grid power (tCO <sub>2</sub> eq/MWh)	$TDL_{k,y}$	Ex-ante emissions (tCO <sub>2</sub> e) from power generation
28/08/2016 – 31/12/2016	14,454	0.7146	0.0739	11,092
01/01/2017 – 31/12/2017	43,362	0.7146	0.0774	33,385
01/01/2018 – 31/12/2018	43,362	0.7146	0.0774	33,385
01/01/2019 – 31/12/2019	43,362	0.7146	0.0774	33,385
01/01/2020 – 31/12/2020	43,362	0.7146	0.0774	33,385
01/01/2021 – 31/12/2021	43,362	0.7146	0.0774	33,385
01/01/2022 – 31/12/2022	43,362	0.7146	0.0774	33,385
01/01/2023 – 27/08/2023	28,908	0.7146	0.0774	22,257

Step C: Baseline emissions associated with heat generation ( $BE_{HG,y}$ )

Since the project will not generate heat, the baseline emissions associated with heat generation in year  $y$  ( $BE_{HG,y}$ ) are 0.

Step D: Baseline emissions associated with natural gas use ( $BE_{NG,y}$ )

Since the project will not use LFG in natural gas distribution, the baseline emissions



associated with natural gas generation in year  $y$  ( $BE_{NG,y}$ ) are 0.

Finally, the following tables below contains the  $BE_y$  values obtained from the application of the equation 1 for the ACM0001 version 18.0:

Crediting Year	Baseline emissions of methane from SWDS (tCO <sub>2</sub> e)	Baseline emissions from power generation (tCO <sub>2</sub> e)	Total BE (tCO <sub>2</sub> e)
28/08/2016 – 31/12/2016	80,972	11,092	92,064
01/01/2017 – 31/12/2017	239,811	33,385	273,195
01/01/2018 – 31/12/2018	236,332	33,385	269,717
01/01/2019 – 31/12/2019	243,059	33,385	276,444
01/01/2020 – 31/12/2020	248,095	33,385	281,480
01/01/2021 – 31/12/2021	258,124	33,385	291,509
01/01/2022 – 31/12/2022	266,614	33,385	299,999
01/01/2023 – 27/08/2023	183,430	22,257	205,686

Applus+ LGAI confirms that all data sources and assumptions are appropriate and calculations are correct, applicable to the proposed CDM project activity and will result in a conservative estimate of the emission reductions.

## **(2) Project emissions**

To estimate the project emissions, the ACM0001 version 18.0, considers the emissions from consumption of electricity in the project case and the fact that possible CO<sub>2</sub> emissions coming from other fuels than the recovered methane (contained in the landfill gas), should be accounted for as project emissions. The general equation for project emissions in the project activity is as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} \quad (10)$$

Where

$PE_{EC,y}$  = Emissions from consumption of electricity due to the project activity in year  $y$  (t CO<sub>2</sub>/yr). The project emissions from electricity consumption ( $PE_{EC,y}$ ) will be calculated following the latest version of “*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*” version 02.0.

$PE_{FC,j,y}$  = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year  $y$  (t CO<sub>2</sub>/yr). The project emissions from fossil fuel combustion ( $PE_{FC,j,y}$ ) will be calculated following the latest version of “*Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion*” version 02.

$PE_{EC,y}$  will be calculated using the “*Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*” version 02.0, as follows:

The project emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (11)$$

Where:

- $PE_{EC,y}$  = Are the project emissions from electricity consumption by the project activity during the year  $y$  ( $tCO_2 / yr$ )  
 $EC_{PJ,y}$  = Is the quantity of electricity consumed by the project activity during the year (MWh)  
 $EF_{EL,i,y}$  = Is the emission factor for the grid in year  $y$  ( $tCO_2/MWh$ )  
 $TDL_{j,y}$  = Are the average technical transmission and distribution losses in the grid in year  $y$  for the voltage level at which electricity is obtained from the grid at the project site

The combined margin emission factor of the applicable electricity system is estimated using the procedures of the latest approved version of the. "Tool to calculate the emission factor for an electricity system version 05.0 ( $EF_{EL,j,y} = EF_{grid,CM,y}$ ).

Crediting Year	Electricity consumption (MWh)	COEF	TDL	$PE_{EC,y}$ ( $tCO_2e$ )
28/08/2016 – 31/12/2016	237	0.7146	0.0739	182
01/01/2017 – 31/12/2017	662	0.7146	0.0774	510
01/01/2018 – 31/12/2018	662	0.7146	0.0774	510
01/01/2019 – 31/12/2019	662	0.7146	0.0774	510
01/01/2020 – 31/12/2020	662	0.7146	0.0774	510
01/01/2021 – 31/12/2021	662	0.7146	0.0774	510
01/01/2022 – 31/12/2022	662	0.7146	0.0774	510
01/01/2023 – 27/08/2023	441	0.7146	0.0774	340

$PE_{FC,y}$  will be calculated using the "Tool to calculate project or leakage  $CO_2$  emissions from fossil fuel combustion" version 02, as follows:

$CO_2$  emissions from fossil fuel combustion in process  $j$  are calculated based on the quantity of fuels combusted and the  $CO_2$  emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad (12)$$

Where:

- $PE_{FC,j,y}$  =  $CO_2$  emissions from fossil fuel combustion in process  $j$  during the year  $y$  ( $tCO_2/yr$ )  
 $FC_{i,j,y}$  = Is the quantity of fuel type  $i$  combusted in process  $j$  during the year  $y$  (mass or volume unit/yr)  
 $COEF_{i,y}$  = Is the  $CO_2$  emission coefficient of fuel type  $i$  in year  $y$  ( $tCO_2 /$  mass or volume unit);  $i$  are the fuel types combusted in process  $j$  during the year  $y$

The  $CO_2$  emission coefficient  $COEF_{i,y}$  will be calculated using option B based on net calorific value and  $CO_2$  emission factor of the fuel(s) type(s) used. Option A cannot be applied because the necessary data is not available.

The type(s) of fossil fuel(s) to be used will depend on the choice of the developer (i.e. natural gas, fuel oil, diesel, etc.), and the corresponding emission factors will be taken from the IPCC default values, in case there is no data available. In ex-ante emission calculation, the diesel consumption is considered zero, because the diesel generator installed at the site is used only in emergency case when there is no electricity import from the national grid. The fuel consumption will be monitored

during the actual implementation.

The project emissions in the project activity are calculated as per equation 10 mentioned above, with the following results:

Crediting Year	Project emissions (tCO <sub>2</sub> e) from power consumption	Project emissions (tCO <sub>2</sub> e) from fossil fuel consumption	Total PE (tCO <sub>2</sub> e)
28/08/2016 – 31/12/2016	182	0	182
01/01/2017 – 31/12/2017	510	0	510
01/01/2018 – 31/12/2018	510	0	510
01/01/2019 – 31/12/2019	510	0	510
01/01/2020 – 31/12/2020	510	0	510
01/01/2021 – 31/12/2021	510	0	510
01/01/2022 – 31/12/2022	510	0	510
01/01/2023 – 27/08/2023	340	0	340

Applus+ LGAI confirms that all data sources and assumptions are appropriate and calculations are correct, applicable to the proposed CDM project activity and will result in a conservative estimate of the emission reductions.

### **(3) Leakage**

According to the methodology, the project activity leakage do not take into account, then  $LE_y = 0$ .

### **(4) Emission reductions**

Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average *ex-ante* estimation of emission reduction conservatively calculated to be 283,788 tCO<sub>2</sub>e per year for the selected 7 years crediting period. Total emission reductions during the second crediting period are estimated to be 1,985,514 tCO<sub>2</sub>e.

Year	Baseline emissions (tCO <sub>2</sub> e)	Project emissions (tCO <sub>2</sub> e)	Leakage (tCO <sub>2</sub> e)	Emission reductions (tCO <sub>2</sub> e)
28/08/2016 – 31/12/2016	92,064	182	0	91,882
01/01/2017 – 31/12/2017	273,195	510	0	272,685
01/01/2018 – 31/12/2018	269,717	510	0	269,207
01/01/2019 – 31/12/2019	276,444	510	0	275,934
01/01/2020 – 31/12/2020	281,480	510	0	280,970
01/01/2021 – 31/12/2021	291,509	510	0	290,999
01/01/2022 – 31/12/2022	299,999	510	0	299,489
01/01/2023 – 27/08/2023	205,686	340	0	216,475
Total	1,990,095	3,580	0	1,986,514
Total number of crediting years	7			
Annual average over the crediting period	284,299	511	0	283,788

The emission reduction calculated in the final PDD is differ from the result in PDD version 14.0 which was submitted to EB for notifying the intention of renewal of crediting period. The reason for the difference is due to the correction of parameter  $W_{i,x}$ , GWP of CH<sub>4</sub>,  $FE_{EL,k,y}$  ( $EF_{grid,CM,y}$ ) and  $TDL_{k,y}$ . The assessment team confirmed

	that the revised emission reduction calculation result was correct.
<b>Conclusion</b>	<p>Applus+ LGAI is able to confirm the following:</p> <ul style="list-style-type: none"> <li>- All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources;</li> <li>- All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD;</li> <li>- All values used in the PDD are considered reasonable in the context of the proposed CDM project activity;</li> <li>- The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, and leakage emissions;</li> <li>- All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD.</li> </ul>

#### D.5. Validity of monitoring plan

<b>Means of validation</b>	The assessment team has verified the monitoring plan in the updated PDD according to the applicable requirements in the Project Standard, and methodology ACM0001 version 18.0 as well as applicable methodological tools.			
<b>Findings</b>	The project applies methodology ACM0001 version 18.0. The original monitoring plan was updated based on ACM0001 version 18.0 requirements.			
	<b>Parameters</b>	<b>Description</b>	<b>Measurement method and QA/QC procedures</b>	<b>Assessment conclusion</b>
	Management of SWDS	Management of SWDS	<p>Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity.</p> <p>Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.</p> <p>The parameter is measured annually.</p>	Consistent with methodology/tool
	Op <sub>j,h</sub>	Operation of the equipment that consumes the LFG	<p>For each equipment unit using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: Temperature, Flame and Products generated. Flare temperature will be selected for the monitoring. Gas engine operation hour will be used for cross checking.</p> <p>The operation of the equipment that consumes the LFG will be monitored using temperature. The parameter will be measured continuously using temperature transmitter. The transmitter sensor is installed at the middle top of the enclosed flare stack. Minimum operational temperature in the exhaust gas of the enclosed flare is 500°C. The exhaust gas from the enclosed flares is expected to be in the range of 800-1,200°C. Temperatures above 500°C indicate that the flare</p>	Consistent with methodology/tool

			is operated in a reliable way where the default value of destruction efficiency of 90% is valid. Temperature transmitter shall be tested, calibrated and maintained regularly.	
	EG <sub>PJ,y</sub>	Amount of electricity generated using LFG by the project activity in year y	<p>The amount of electricity generated is recorded by installed electricity meters (EL4, EL9, EL10 and EL12). Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double-checked by the electricity distribution company.</p> <p>As a quality control procedure, the amount of electricity actually uploaded to grid will be measured by other electricity meters (EL5, EL11 and EL13) and compared with the net amount derived from above. Lower value of the amount will be taken as the net amount for emission reductions calculations.</p> <p>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.</p>	Consistent with methodology/tool
	EG <sub>EC,y</sub>	Amount of electricity consumed by the project activity in year y	<p>The quantity of electricity consumed by project activity will be recorded by installed electricity meter EL6 which measures the total electricity consumed by the project activity (Flare 2, Gas Engine No.1, Gas Engine No.2, Gas Engine No.3, Gas Engine No.4, GSS No.1, GSS No.2 and GSS F1).</p> <p>In case of temporary situation such as the installed electricity meter (EL6) malfunctions leading to no readings captured, EG<sub>EC,y</sub> shall be estimated or calculated as described as below:</p> <ol style="list-style-type: none"> <li>1. Using the back-up meter EL1 which records the actual power consumption for Flare 2 and GSS F1;</li> <li>2. For Gas Engine No. 2, Gas Engine No.3, Gas Engine No.4, GSS No.1 and GSS No.2, the power consumption will be estimated using the power rating (technical specifications) of the system involved during the power generation. The power consumed will be calculated based on the operating maximum capacity for the full</li> </ol>	Consistent with methodology/tool

			<p>period, including the 10% addition to account for transmission and distribution losses, according to paragraph 232 b)(ii) of “CDM Project Standard for CDM project activities” (Version 01.0). In the case of project GHG emissions related to the consumption of electricity, the estimate shall include an addition of 10% to account for transmission and distribution losses.</p> <p>In the case of temporary situation where EL1 malfunctions leading to no readings captured, the power consumption for Flare 2 and GSS F1 will use the estimated historical data (Sept 2014 to Aug 2016) of 56.93 MWh per month and compared with the calculated future 24 months’ data prior to the malfunction period and, whichever value that is higher will be applied for the project emissions calculation.</p> <p>The higher power consumption selected for the project emissions calculation 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 upper bound of 95% confidence interval with reference to the above-mentioned guideline will be applied. An additional 10% will be added to the upper 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). In the case of project GHG emissions related to the consumption of electricity, the estimate shall include an addition of 10% to account for transmission and distribution losses.</p>	
	$f_y$	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in	<p>The data is sourced from Approved Monitoring Report No. 9 which has been verified by verification DOE.</p>	-

		year y		
	$T_{EG,m}$	Temperature in the exhaust gas of the enclosed flare in minute m	<p>Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. The parameter will be measured once per minute.</p> <p>The temperature of the exhaust gas in the flares is measured by temperature transmitters.</p> <p>The exhaust gas from the enclosed flares is expected to be in the range of 800-1,200°C. Temperatures above 500°C indicate that the flare is operated in a reliable way where the default value of destruction efficiency of 90% is valid. Minimum operational temperature in the exhaust gas of the enclosed flare is 500°C.</p> <p>Temperature measurement equipment is calibrated in accordance with the maintenance schedule</p>	Consistent with methodology/tool
	Flame <sub>m</sub>	Flame detection of flare in the minute m	<p>Measured using a fixed installation optical flame detector: Ultra Violet detector. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off.</p> <p>The flame detection will be monitored and cross checked with the amount of gas sent to flare (FT2) and gas engine (FT3). If there is data for FT2 and FT3, means the flame is on. Equipment will be maintained and calibrated in accordance with manufacturer's recommendations</p>	Consistent with methodology/tool
	$V_{t,wb}$	Volumetric flow of the gaseous stream in time interval t on a wet basis	<p>Onsite record continuously by flow meters. There is an independent flow meter to measure the gas sent to GSS1 (FT3<sub>GSS1</sub>), GSS2 (FT3<sub>GSS2</sub>), and GSS F1 (FT3<sub>GSSF1</sub>).</p> <p>There are two (2) sets of flow meter (FT1<sub>F2</sub> &amp; FT2<sub>F2</sub>) to measure the gas sent to Flare 2. Flow obtained from FT2<sub>F2</sub> will be used for the calculation. During temporary malfunctioning of FT2<sub>F2</sub> or data logging system resulting in unrepresentative data, the value of FT1<sub>F2</sub> will be used for the calculation.</p> <p>Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology(ies).</p>	Consistent with methodology/tool

			Calibration and frequency of calibration is according to manufacturer's specifications	
	$V_{CH_4,m,db}$	Volumetric fraction of greenhouse gas $CH_4$ in minute $m$ on a dry basis	<p>Onsite record continuously by the gas analyzers. Volumetric flow measurement should always refer to the actual pressure and temperature. In case of temporary situation such as the installed <math>CH_4</math> gas analyser mal-functioned or giving unrepresentative results due to data logging problem, the <math>V_{CH_4}</math> shall be measured manually with portable gas analyser. For any affected day, the calculation of the values measured using the portable analyser will be based on the Guidelines to calculate the fraction of methane in the landfill gas from periodical measurements (Version 01). As conservative approach, the lower bound of the 95% Confidence Interval will be applied as per guideline.</p> <p>Calibration should include zero verification with an inert gas (e.g. <math>N_2</math>) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period</p>	Consistent with methodology/tool
	$T_t$	Temperature of the gaseous stream in time interval $t$	<p>Instruments with recordable electronic signal (analogical or digital) are used.</p> <p>Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications</p>	Consistent with methodology/tool
	$P_t$	Pressure of the gaseous stream in time interval $t$	<p>Instruments with recordable electronic signal (analogical or digital) are used.</p> <p>Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated monthly</p>	Consistent with methodology/tool
	$P_{H_2O,t,Sat}$	Saturation pressure of $H_2O$ at temperature $T_t$ in time interval	This parameter is solely a function of the gaseous stream temperature $T_t$ and can be found at reference [1] for a total pressure equal to 101,325 Pa.	Consistent with methodology/tool



		t	[1] Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4 <sup>o</sup> Edition 1994, John Wiley & Sons, Inc.	
	V <sub>CO2,t,db</sub>	Volumetric fraction of gas CO <sub>2</sub> in the gaseous stream in time interval t on a dry basis	The v <sub>CO2</sub> shall be measured manually with portable gas analyser. A minimum sampling frequency of one sample per week to be conducted. As conservative approach, the lower bound of the 95% Confidence Interval will be applied for the data collected.  Calibration should include zero verification with an inert gas (e.g. N <sub>2</sub> ) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period	Consistent with methodology/tool
	V <sub>O2,t,db</sub>	Volumetric fraction of gas O <sub>2</sub> in the gaseous stream in time interval t on a dry basis	Continuous gas analyser operating in dry-basis.  Calibration should include zero verification with an inert gas (e.g. N <sub>2</sub> ) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.	Consistent with methodology/tool
	Status of biogas destruction device	Operational status of biogas destruction devices	Monitoring and documenting may be undertaken by recording the energy production from methane captured or the operation of the flare by means of a flame detector to demonstrate the actual destruction of methane, unless a different method is specified in the underlying methodology/tool. Emission reductions will not accrue for periods in which the destruction device is not operational.  The operational status will be monitored and cross checked with the amount of gas sent to flare (FT2), and also the operating hour for Gas Engines.	Consistent with methodology/tool
	FC <sub>i,j,y</sub>	Quantity of fuel type i combusted in process j during the year y	Onsite measurement using fuel meter. The measurement from fuel meter is in litre, for the calculation, the amount of diesel in litre will be convert to tonne/year by multiply the density of diesel (kg/l).  The consistency of metered fuel consumption quantities should be cross-checked by an annual energy	Consistent with methodology/tool

			balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.	
	EF <sub>CO<sub>2</sub>,i,y</sub>	Weighted average CO <sub>2</sub> emission factor of fuel type i in year y	Default (Option D was applied in the calculation).	Consistent with methodology/tool
	NCV <sub>i,y</sub>	Weighted average net calorific value of fuel type i in year y	Default (Option D was applied in the calculation).	Consistent with methodology/tool
<p>Applus+ LGAI confirms that the monitoring plan contains all necessary parameters which have been clearly described in PDD and that the means of monitoring described in the plan complies with the requirements of the methodology.</p> <p>In the updated PDD, the functions such as data collection, aggregation, verification, calculation, archiving, as well as the maintenance of equipments etc. have been defined. Quality assurance and quality control procedures for recording, maintaining and data archiving etc. will be ensured according to CDM EB rules. The calibration of the meter will be implemented as per national standard. An emergency treatment process has been defined in PDD when the meter is in malfunction. Data management and quality control system are quoted in PDD. The monitoring staffs will be trained based on the training program described in PDD.</p>				
<b>Conclusion</b>	<p>The procedures described in PDD have been recognized by the assessment team through document review and interviews with the relevant personnel. The information together with a physical inspection allows the assessment team to confirm that the proposed monitoring plan is feasible within the project design. The major parameters to be monitored have been discussed with the PPs, especially regarding the location of the meters, the data management and in general the quality assurance and quality control procedures to be implemented in the context of the project. It's Applus+ LGAI's opinion that the project participants are able to implement the monitoring plan and the emission reductions achieved can be reported ex-post for verification.</p>			

#### D.6. Crediting period

<b>Means of validation</b>	The assessment team verified the renewed crediting period according to the requirements in the CDM PS version 01.0.
<b>Findings</b>	This is the second crediting period. As per CDM VVS for project activities version 01.0, the next crediting period of the registered CDM project activity commences on the day immediately after the expiration of the current crediting period. Thereby the crediting period starts from 28/08/2016 to 27/08/2023.
<b>Conclusion</b>	Correct crediting period has been applied in the updated PDD.

#### D.7. Project participants

<b>Means of validation</b>	The assessment team checked the names of the project participants included in the updated PDD with the registered PDD. The assessment team has also confirmed the PP via verifying the MoC made public available at UNFCCC website.
<b>Findings</b>	As indicated in the updated PDD sent by PP to EB for request for renewal of crediting period, the PP was KUB-Berjaya Enviro Sdn. Bhd. (KBE) (Malaysia). The assessment team confirmed with the latest MoC submitted by PP and the MoC made public available at UNFCCC website, and confirmed that the PP indicated in

	the PDD is correct.
<b>Conclusion</b>	The updated PDD correctly indicated the name of PP which is in line with MoC made public available at UNFCCC website.

#### D.8. Post-registration changes

Type of post-registration changes (PRCs)	Confirmation (Y/N)	Validation report for PRCs	
		version	Completion date
Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline	N	N.A.	N.A.
Corrections	N	N.A.	N.A.
Inclusion of a monitoring plan to a registered project activity	N	N.A.	N.A.
Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline	Y	02.0	13/12/2017
Changes to the project design of a registered project activity	N	N.A.	N.A.
Types of changes specific to afforestation and reforestation project activities	N.A.	N.A.	N.A.

#### SECTION E. Internal quality control

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

After confirmation of the PP the validation opinion and relevant documents are submitted to the EB through the UNFCCC web-platform.

#### SECTION F. Validation opinion

Applus+ LGAI has performed a validation of renewal of crediting period of the “Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia” (Ref. No.2467). The validation was performed on the basis of the updated sections of the PDD relating to the baseline, estimated emission reductions and the monitoring plan using the most recent version of baseline and monitoring methodology applicable for the project activity. The final validation opinion was finalized in accordance with the CDM VVS for project activities version 01.0 and the CDM PS for project activities version 01.0 including the assessment of:

- The impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period of the registered CDM project activity at the time of requesting renewal of crediting period of the project activity;
- The correctness of the application of the approved methodology and, where applicable, the approved standardized baseline for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period of the registered CDM project activity.

The review of the project design documentation and the subsequent follow-up interviews have provided Applus+ LGAI with sufficient evidence to determine the validity of the original baseline. The project correctly applies the latest baseline and monitoring methodology ACM0001, “Flaring or use of landfill gas” version 18.0. Applus+ LGAI is able to confirm:

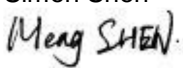

- The updated PDD complies with the valid version of the applicable PDD form and instructions therein for filling out the PDD;

- ii) Information transferred to the latest valid version of the PDD form is materially the same as that in the registered PDD;
- iii) The baseline and monitoring methodology was applied in accordance with the applicable requirements in the Project Standard;
- iv) The baseline, the estimated GHG emission reductions, and the monitoring plan in the updated PDD comply with the applicable requirements in the Project Standard, and the valid version of the methodology that is applicable to the registered CDM project activity;
- v) The next crediting period of the registered CDM project activity commences on the day immediately after the expiration of the current crediting period;
- vi) The names of project participants in the updated PDD are consistent with the latest MoC made public available at UNFCCC website.

Applus+ LGAI is also confirm that there is no proposed post-registration change for the second crediting period when submitting the request for renewal of crediting period of the registered CDM project activity to EB.

Given that the project is implemented as designed and the underlying assumptions do not change, the project is likely to achieve the estimated amount of annual emission reductions of 283,788 tCO<sub>2</sub>e and a total estimated emission reductions of 1,986,514 tCO<sub>2</sub>e over the 2<sup>nd</sup> renewable crediting period as specified within the final PDD.

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 20.5 dated 26/03/2018, meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence Applus+ LGAI submitted the request for renewal of the crediting period of the project activity.

Role	Signature
Team Leader	Simon Shen 
Technical Reviewer	Miguel Cortés 
Approver	Juan Sendín

## 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:

**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 14 Project Design Document version 20.3 Project Design Document version 20.5	19/01/2016 11/12/2017 26/03/2018	Others
/2/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	ER spreadsheet version 1, version 20.1	06/05/2017	Others
/3/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	Intention of renewing crediting period notification form CDM-RENN-FORM	20/01/2016	PP
/4/		Technical specification of gas engines GE 1, GE 2, GE 3		PP
/5/		Technical specification of gas engines GE 4		
/6/		Power Purchasing Agreement		
/7/		The latest national data was published by Green Tech Centre (GTC) CDM secretariat 2014		
/8/		Tenaga Nasional Berhad (TNB) Annual Report 2016		
/9/		Weight bridge record of Bukit Tagar Sanitary Landfill		
/10/	KUB-Berjaya Enviro Sdn. Bhd. (KBE) and Department of National Solid Waste Management, KPKT	Communication email whether there is any change in the regulatory framework	07/01/2016	PP
/11/	KUB-Berjaya Enviro Sdn. Bhd. (KBE)	MoC	28/04/2017	PP
/12/	UNFCCC website	CDM validation and verification standard for project activities, version 01.0	03/03/2017	Others
/13/	UNFCCC website	CDM project cycle procedure for project activities, version 01.0	03/03/2017	Others
/14/	UNFCCC website	CDM project standard for project activities, version 01.0	03/03/2017	Others
/15/	UNFCCC website	Assessment of the validity of the original/current baseline and to update the baseline at the renewal of a crediting period version 03.0.1		Others
/16/	UNFCCC website	ACM0001 Flaring or use of landfill gas version 18.0	04/05/2017	Others
/17/	UNFCCC website	Emissions from solid waste disposal sites, version 07.0		Others
/18/	Green Tech Centre (GTC), CDM Secretariat of host country.	Latest available national data for emission factor OM/BM	2014	Others
/19/	UNFCCC website	Tool to calculate the emission factor for an electricity system version 05.0.0		Others
/20/	UNFCCC website	Information on UNFCCC website <a href="http://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/view">http://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/view</a>		Others
/21/	IPCC	2006 IPCC Guidelines for National Greenhouse Gas Inventories		Others
/22/	Perunding Utama SDN. BHD.	Detailed Environmental Impact Assessment for Proposed Bukit Tagar Landfill Sungai Tinggi, Hulu Selangor, Selangor Darul Ehsan	06/2004	PP

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

Table 1. CL from this validation

<b>CL ID</b>	None	<b>Section no.</b>		<b>Date:</b> DD/MM/YYYY
<b>Description of CL</b>				
<b>Project participant response</b>				<b>Date:</b> DD/MM/YYYY
<b>Documentation provided by project participant</b>				
<i>Revised PDD</i>				
<b>DOE assessment</b>				<b>Date:</b> DD/MM/YYYY

Table 2. CAR from this validation

<b>CAR ID</b>	1	<b>Section no.</b>	D.1	<b>Date:</b> 05/09/2017
<b>Description of CAR</b>				
<i>Before finalizing the validation of the renewal of crediting period, UNFCCC has updated the PDD format to version 10.1. Please apply the latest version of PDD format.</i>				
<b>Project participant response</b>				<b>Date:</b> 11/12/2017
<i>The updated PDD has been applied the latest version of PDD format of version 10.1. Please refer to the updated PDD.</i>				
<b>Documentation provided by project participant</b>				
<i>Revised PDD.</i>				
<b>DOE assessment</b>				<b>Date:</b> 11/12/2017
<i>The assessment team confirmed that the PDD format has been updated to version 10.1 which is the latest version of template available at UNFCCC website. Thereby the CAR is closed out.</i>				

<b>CAR ID</b>	2	<b>Section no.</b>	D.1	<b>Date:</b> 05/09/2017
<b>Description of CAR</b>				
<i>The PDD version 14.0 which was submitted to EB for notifying the intention of the renewal of crediting period was completed dated 19/01/2016. After the notification, the PP applied the post registration change related to the project design change. The change included the increasing of power generation approximately 2MW and upload to the grid by year 2015 and including of diesel generator as backup for project activities during the power failure of the grid. This is the 4th notification of change request (PRC-2467-004) published in UNFCCC on 11/10/2016 and was approved by UNFCCC on 15/11/2016. After the change, the PDD version has been updated to version 19.0 (note that the PDD version 19.0 is still for the 1st crediting period). In addition, there is another revision of monitoring plan during the renewal crediting period. The revision is related to the shutdown of Flare No.1 and converting Flare No.1 to GSSF1. Gas engine No. 1 which was attached to Flare 2 previously has been converted to GSSF1. Please demonstration above mentioned changes in the updated PDD.</i>				
<b>Project participant response</b>				<b>Date:</b> 11/12/2017
<i>The PP has included the 4<sup>th</sup> notification of change request (PRC-2467-004) as well as the change occurred during the validation of the renewal of crediting period in the relevant section and in appendix 7 of the updated PDD.</i>				
<b>Documentation provided by project participant</b>				
<i>Revised PDD.</i>				
<b>DOE assessment</b>				<b>Date:</b> 11/12/2017
<i>Since the same change has been audited by TÜV NORD CERT GMBH in the validation report of post registration change dated 05/09/2016, the assessment team will not audit the same change again. For the change occurred during the validation of the renewal of crediting period, the assessment team validated the same in the validation report of post registration change attached. The PP has already included in the updated PDD version 20.5 the same change. The assessment team confirmed that the change is in compliance with the approved methodology ACM0001 version 18.0 and relevant requirements in the CDM PS for project activities version 01.0. Thereby the CAR #2 is closed out.</i>				



<b>CAR ID</b>	3	<b>Section no.</b>	D.2.	<b>Date:</b> 05/09/2017
<b>Description of CAR</b>				
<i>The updated PDD version 14.0 sending to UNFCCC for notifying the intention of renewal of crediting period applied ACM0001 version 16.0, which has been updated when validating the renewal of crediting period. Please update the version number of methodology.</i>				
<b>Project participant response</b>				<b>Date:</b> 11/12/2017
<i>PP has applied the methodology ACM0001 version 18.0 in the updated PDD version 20.3.</i>				
<b>Documentation provided by project participant</b>				
<i>Revised PDD</i>				
<b>DOE assessment</b>				<b>Date:</b> 11/12/2017
<i>The assessment team confirmed that this is appropriate because the methodology ACM0001 version 18.0 was available at the time of submission of the request for renewal of crediting period to UNFCCC (before 29/12/2017). Therefore the CAR #2 is closed out.</i>				

<b>CAR ID</b>	4	<b>Section no.</b>	D.4.	<b>Date:</b> 05/09/2017
<b>Description of CAR</b>				
<i>As a result of verifying the Summarised amount received and projected amounts of waste at the Bukit Tagar sanitary landfill (listed in the appendix 4 to the PDD version 14.0), it is found that the annually waste received is not consistent with the summarized amount of monthly waste received. Please correct the figures and revised the calculation of <math>BE_{CH_4,SWDS,y}</math>.</i>				
<b>Project participant response</b>				<b>Date:</b> 11/12/2017
<i>The PP revised the amount of waste (<math>W_{j,x}</math>) before 2016 (year 2016 was included) according to the Weight bridge record of Bukit Tagar Sanitary Landfill. For year after 2016, an increase rate of 5% was considered to anticipate the annual amount of waste which is line with the project design. The table of amount of solid waste type j disposed in the SWDS in the year x listed in section B.6.3 has also been updated. The calculation result of <math>BE_{CH_4,SWDS,y}</math> is also corrected accordingly.</i>				
<b>Documentation provided by project participant</b>				
<i>Revised PDD</i>				
<i>Weight bridge record of Bukit Tagar Sanitary Landfill</i>				
<b>DOE assessment</b>				<b>Date:</b> 11/12/2017
<i>The assessment checked the data listed in appendix 4 of the PDD and confirmed that correct figures are quoted. The calculation result of <math>BE_{CH_4,SWDS,y}</math> is thereby corrected applying the updated data. The assessment team confirmed that the calculation of <math>BE_{CH_4,SWDS,y}</math> is correct thereby closed the CAR #4.</i>				

<b>CAR ID</b>	5	<b>Section no.</b>	D.4.	<b>Date:</b> 05/09/2017
<b>Description of CAR</b>				
<i>It is found that the emission factor of the grid for Malaysia has been updated. The latest national data was published by Green Tech Centre (GTC) CDM secretariat 2014. Meanwhile, the Transmission and Distribution Loses applied in the PDD should also been updated. Please update the data in the PDD.</i>				
<b>Project participant response</b>				<b>Date:</b> 11/12/2017
<i>The PP has applied the value of <math>EF_{EL,k,y}</math> (0.7146 tCO<sub>2</sub>/MWh for 2014) which is calculated from the latest release of grid emission factor published by Green Tech Centre (GTC) CDM Secretariat, based on the methodological tool "Tool to calculate the emission factor for an electricity system" (Version 5.0). The Transmission and Distribution Loses (<math>TDL_{k,y}</math>) value applied in this PDD 7.39% for year 2016, and is 7.74% for year 2017 and onwards. This value is calculated from the average of TDL from 2014-2016 obtained from TNB 2016 annual report.</i>				
<b>Documentation provided by project participant</b>				
<i>Revised PDD</i>				
<i>The latest national data was published by Green Tech Centre (GTC) CDM secretariat 2014</i>				
<i>Tenaga Nasional Berhad (TNB) Annual Report 2016</i>				
<b>DOE assessment</b>				<b>Date:</b> 11/12/2017
<i>The assessment team verified the calculation process mentioned in the updated PDD version 20.3 of <math>EF_{EL,k,y}</math> and confirmed the calculation process is in line with the "Tool to calculate the emission factor for an electricity system" (Version 5.0). The calculation of <math>EF_{OM}</math>, <math>EF_{BM}</math> and <math>EF_{CM}</math> (<math>EF_{EL,k,y}</math>) is consistent with the data published by GTC CDM secretariat. Meanwhile, <math>TDL_{k,y}</math> of 7.39% fo year 2016 is applied in the updated PDD. <math>TDL_{k,y}</math> of 7.74% is applied from 2017 onwards, which was calculated from the average of <math>TDL_{k,y}</math> from year 2014-2016 sourced from the Tenaga Nasional Berhad (TNB) Annual Report 2016. The assessment team confirmed the data source and calculation result is correct. Thereby, the CAR #5 is closed out.</i>				

Table 3. FAR from this validation

<b>FAR ID</b>	None	<b>Section no.</b>		<b>Date:</b> DD/MM/YYYY
<b>Description of FAR</b>				
<b>Project participant response</b>				<b>Date:</b> DD/MM/YYYY
<b>Documentation provided by project participant</b>				
<b>DOE assessment</b>				<b>Date:</b> DD/MM/YYYY

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
02.0	31 October 2017	Revision to align with the requirements of the "CDM validation and verification standard for project activities" (version 01.0).
01.0	23 March 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Renewal of crediting period Keywords: crediting period, project activities, validation report		