Monitoring report form
(Version 03.1)

Monitoring report

Title of the project activity	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia
Reference number of the project activity	2467
Version number of the monitoring report	1.0
Completion date of the monitoring report	17/09/2013
Registration date of the project activity	28/08/2009
Monitoring period number and duration of this monitoring period	Monitoring period number: 07 Duration of monitoring period: 01/01/2013 - 31/08/2013 inclusive of both days
Project participant(s)	Japan Carbon Finance, Ltd. (JCF) KUB-Berjaya Enviro Sdn. Bhd. (KBE)
Host Party(ies)	Malaysia
Sectoral scope(s) and applied methodology(ies)	13 : Waste handling and disposal ACM 0001, version 8[1] Consolidated baseline and monitoring methodology for landfill gas project activities
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	175,229 tCO_2e * *Ex-ante for 243 days (Jan 2013 – Aug 2013) – 263,204 x (243/365)*
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	193,581 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012 (if applicable)	Not applicable
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable)	193,581 tCO_2e

1 The ACM 0001 - *Consolidated baseline and monitoring methodology for landfill gas project activities* (Version 8) is no longer valid and is not available for download in UNFCCC. The version has been replaced with Version 8.1.

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Bukit Tagar Sanitary Landfill (BTSL) is operated by KUB-Berjaya Enviro Sdn. Bhd. (KBE) and located in Hulu Selangor, Malaysia. The landfill receives municipal solid waste (MSW) from the country's capital, Kuala Lumpur and Selayang district in Selangor State.

The main objective for the Clean Development Mechanism (CDM) project is to avoid direct emissions of greenhouse gases (GHGs) from the landfill into the atmosphere through active extraction. The gas collected is destructed by high temperature enclosed flares as well as is used for power generation using Gas Engine(s) with high efficiency.

Carbon emissions are reduced through two major activities:

Emission Reduction Aspects	How will emissions be reduced?
Landfill gas (LFG) Extraction and Destruction (Methane (CH_4) avoidance)	Instead of releasing LFG (consisting CH_4) to the atmosphere, the gas will be collected and destroyed in enclosed flares and Gas Engine(s)
Power Generation (Fuel replacement)	Less carbon dioxide (CO_2) will be emitted by replacing electricity generated from grid power with electricity produced from LFG (considered as renewable)

LFG extraction from Advance Cell and Phase 1 Cell has continued to operate during this monitoring period.

Two high temperature enclosed flares with maximum capacity of 2,500 Nm^3/hr have continued to be in operation while a portion of the gas captured was sent to a unit of 1MW Gas Engine (Gas Engine No.1) to generate electricity. The electricity produced by Gas Engine No.1 was exported to the grid during this monitoring period.

Relevant dates for the project activities tabulated below:

Bukit Tagar Project	Construction Start	Commissioned	Continued operation periods
First flaring system	17/06/2008	28/08/2009	Continued to operate
Second flaring system	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)	Not commissioned	Not commissioned
Gas Engine No.3	06/08/2012 (Signed-off Delivery Order)	Not commissioned	Not commissioned

The 7th monitoring period is from 01/01/2013 to 31/08/2013 (inclusive of both days). The total emission reductions achieved during this monitoring period is **193,581 tCO_2e.**

A.2. Location of project activity

Information	Description
Host Party(ies)	Malaysia
Region/ State/ Province, etc.	State of Selangor
City/ Town/ Community, etc.	Mukim Sg. Tinggi, District of Hulu Selangor The project location is situated approximately 5km to the west of the

	Bukit Tagar Interchange along the North-South Expressway and 40km from central Kuala Lumpur. The landfill is easily accessible via expressway and a dedicated Bukit Tagar Interchange has been developed for the access from the North-South Expressway. The landfill is situated in a leased agricultural land, surrounded by hectares of oil palm plantations and rubber trees.
Physical/ Geographical location	

Latitude	Longitude	Description
3°30'168"	101°28'428"	North
3°29'07"	101°28'452"	South
3°29'46"	101°28'20"	West
3°29'69"	101°29'268"	East

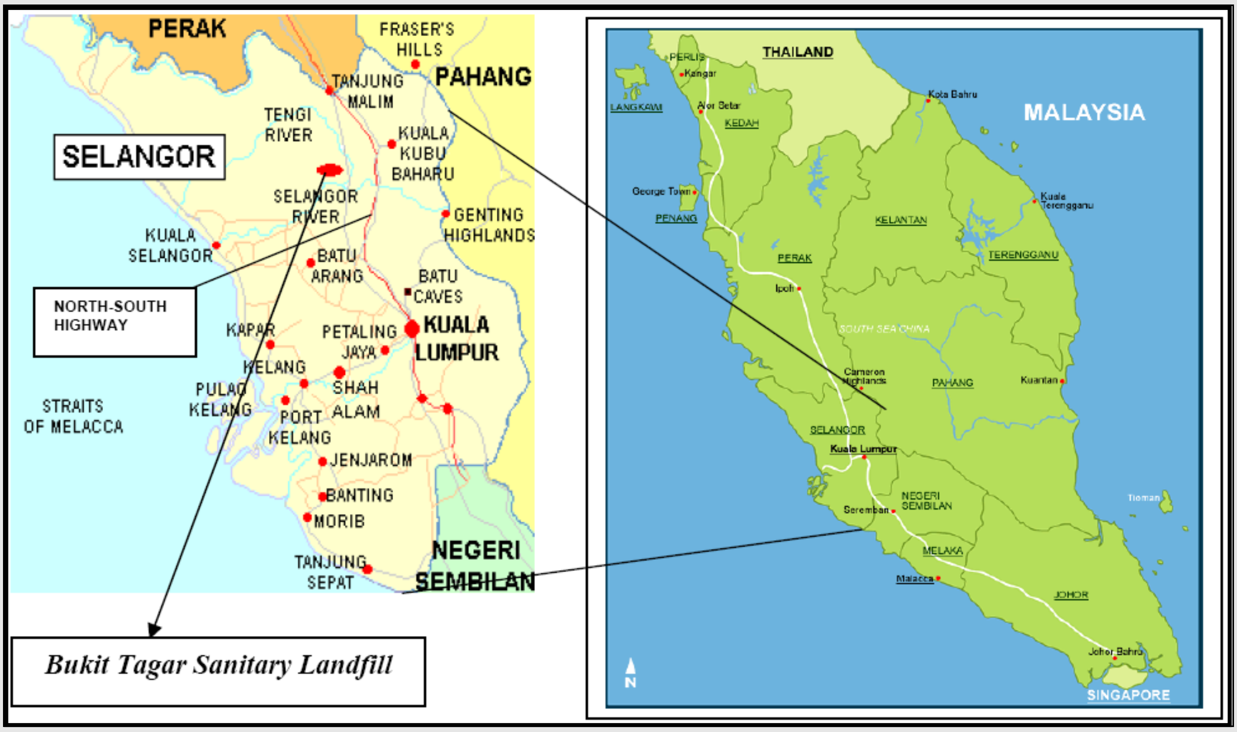


Figure 1: Location of BTSL and Selangor State

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Malaysia **(host)**	KUB-Berjaya Enviro Sdn. Bhd. (KBE) (Private)	No
Japan	Japan Carbon Finance, Ltd. (JCF) (Private)	No

A.4. Reference of applied methodology

The project has applied the following approved methodology and tools:

Approved Methodology:

ACM 0001 – *Consolidated baseline and monitoring methodology for landfill gas project activities* (Version 8)[2]

[2] The ACM 0001 - *Consolidated baseline and monitoring methodology for landfill gas project activities* (Version 8) is no longer valid and is not available for download in UNFCCC. The version has been replaced with Version 8.1.

Methodological Tools referred to include:

- *Tool for the demonstration and assessment of additionality* (Version 5.2, EB 39, Annex 10);
- *Tool to determine project emissions from flaring gases containing methane* (Version 1, EB 28, Annex 13);
- *Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site* (Version 05, EB 55, Annex 18);
- *Tool to calculate the emission factor for an electricity system* (Version 02, EB 50, Annex 14); and
- *Tool to calculate baseline, project and/or leakage emissions from electricity consumption* (Version 1, EB 39, Annex 7)
- *Tool to determine the mass flow of a greenhouse gas in a gaseous stream* (Version 02.0.0, EB 61, Annex 11).

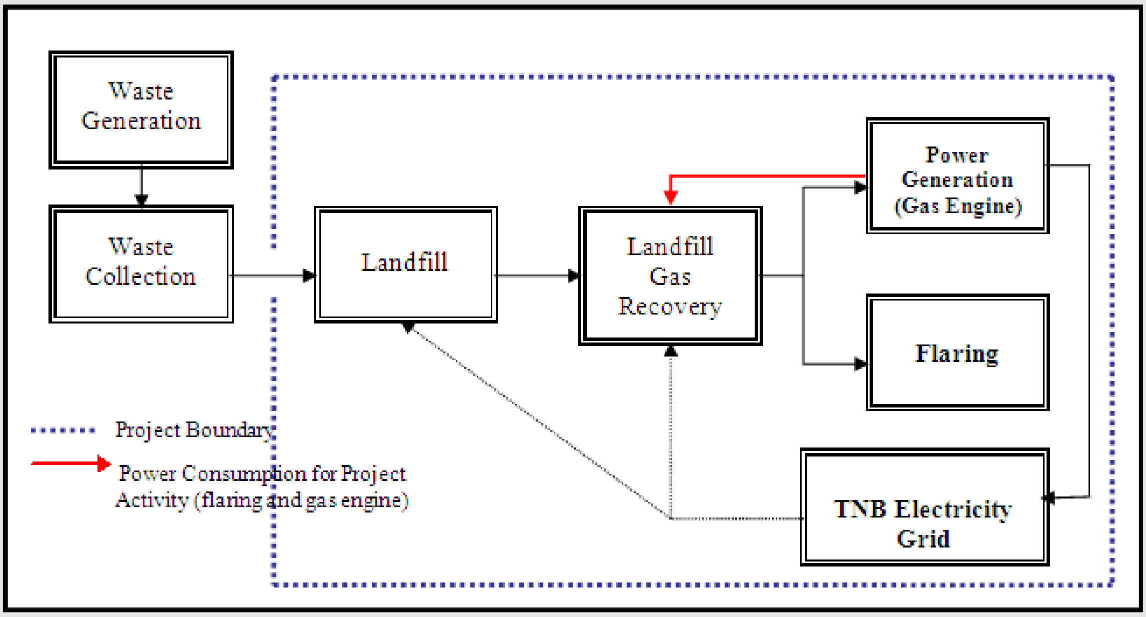
A.5. Crediting period of project activity

The start date of the crediting period of the project activity is 28/08/2009 (date of registration) and the end date of the 1st crediting period is 27/08/2016. The selected crediting period is renewable (7 years). The 7th monitoring period is from 01/01/2013 to 31/08/2013 (inclusive of both days).

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The landfill gas recovery, flaring and power generation system can be illustrated below:



Note:

1. *With reference to paragraph 3, Section A.2, CDM PDD version 7.2, the landfill is being developed in phases. Currently, landfill gas extraction has been implemented on 2 cells in the landfill, i.e. Advance Cell and Phase 1. Both of these phases are included in this project as well as any future phases to be developed in accordance to the PDD.*
2. *1st Notification of change was submitted earlier to remove the on-site power consumption for landfill operation. Notification of change was approved by UNFCCC on 09/05/2012.*
3. *2nd Notification of change was submitted on 25/04/2013 to increase the power generation approximately 3MW and upload to the grid by year 2013 and installation of an additional pipeline and flare system equipped with skid mounted LFG gas blower to handle any excess LFG captured which is expected to be commissioned at the beginning of year 2014. The notification of change was approved by UNFCCC on 09/09/2013.*

Figure 2: Overall LFG Recovery, Flaring and Power Generation Design

Description on the installed technologies

The technology applied and transferred into this project has been implemented and proven in Europe (Denmark and Germany) as well as in China (extraction and flaring system).

Detailed technical description is further described below:

Gas Extraction System in Advance Cell

Q2 Engineering Sdn. Bhd., a subsidiary of Q2 A/S of Denmark was appointed as the turnkey contractor to construct the gas extraction and flaring system for Advance Cell. 42 vertical gas extraction pipes were installed in the landfill to extract the LFG. These wells were connected to 8 units of main gas collection pipes that led to the LFG flaring system.

Figure 3: An Example of Vertical Well Installed in Advance Cell

These vertical wells can be individually regulated and controlled.

First High-Temperature Enclosed Flaring System (Flare No.1)

One unit of high-temperature enclosed flaring system had been installed to flare off the LFG extracted. The flare system included a containerised blower and flaring system with a maximum capacity to flare off 2,500 Nm^3/hr LFG.

Figure 4: Enclosed Flare Installed at Advanced Cell (Flare No.1)

The details of the flare specifications are listed below:

Specifications	Details
Manufacturer	Fairyland Environmental Technology, China
Gas flow	Maximum – 2,500 Nm^3/hr
Retention time	>0.3 seconds at 800-1,000^oC
Gas blower	Twin-lobe roots blower
Gas analysers	Gas analysers for CH_4 and O_2

Gas Analyser and Data Logging

Monitoring of the correct functioning of the flare system was provided by a continuous-logging system which examines the operational parameters of the flare. The gas analyzing system is a multi-functional environmental monitoring equipment that can monitor up to 14 different measurements and data logging channels. Data from the logging system was presented on a local screen (on-line data) and stored in a local personal computer (PC) unit with external communication via Global System for Mobile Communications (GSM).

Data were downloaded directly from the built-in data logger to a PC and were also transmitted to external server and PC as back-up.

Gas Extraction System in Phase 1 Cell

Stage 1 of Phase 1 Cell was completed in August 2010. The cell is still an operational cell which will be filled according to the proposed plan of the landfill sequence at a later stage. The design of the gas extraction wells is based on a series of horizontal gas extraction wells constructed over the entire Phase 1 Cell.

Figure 5: Horizontal Gas Extraction Wells in Phase 1 Cell

Second High-Temperature Enclosed Flaring System (Flare No.2)

The second unit of high-temperature enclosed flaring system was installed to cater for the extra LFG extracted from Phase 1 Cell. The flare system included a containerised blower and flaring system with a maximum capacity to flare off 2,500 Nm^3/hr LFG.

Figure 6: High-Temperature Enclosed Flares

The flare was supplied by the same manufacturer for Flare No.1. Details of the flare specifications are listed below:

Specifications	Details
Manufacturer	Fairyland Environmental Technology, China
Gas flow	Maximum – 2,500 Nm^3/hr
Retention time	>0.3 seconds at 800-1,000^oC
Gas blower	Twin-lobe roots blower
Gas analysers	Gas analysers for CH_4 and O_2

The analyser and data logging system is similar to Flare No.1 (as described above).

<u>Gas Engine Energy Power Plants</u>

A high-efficiency (electrical efficiency > 42%) Gas Engine (net dispatch of 1 MW) was chosen for the generation of electricity from LFG.

Figure 7: High-Efficiency Landfill Gas Engine Used in BTSL

The details of Gas Engine No.1 specifications are listed below:

Specifications	Details
Manufacturer (Origin)	MWM (Germany)
Model	TCG 2020V12
Electric power output (net to grid)	1 MW (total max. gross output 1.2 MW)
Voltage	11 kV
Frequency	50 Hz
Minimum heating value (LHV)	5.9 kWh/m^3

To ensure that good quality LFG arrives at Gas Engine No.1, a LFG pre-treatment system comprising of a chiller (made in Germany) and activated carbon filter was also set up to remove moisture and impurities such as hydrogen sulphide (H_2S) and siloxanes before Gas Engine No.1.

A landfill gas blower was installed to ensure that the required gas pressure for Gas Engine No.1 is maintained.

During the monitoring period, 2 units of 1.56 MW gas engines have been delivered to the site on 06/08/2012. However, due to some technical issues, the gas engines have yet to be commissioned and therefore, no monitoring parameters for the consumption of landfill gas and additional power generated from the new gas engines were recorded and included in this Monitoring Report.

The details of Gas Engine No.2 and Gas Engine No.3 specifications (identical gas engines) are as listed below:

Specifications	Details
Manufacturer (Origin)	MWM (Germany)
Model	TCG 2020 V16
Electric power output	1.56 MW
Voltage	415 V
Frequency	50 Hz
Minimum heating value (LHV)	5.0 kwh/m3

Centralised SCADA System

The Centralized (Supervisory Control and Data Acquisition) SCADA Interface was developed to integrate all existing SCADA or operation monitor system, ranging from individual Flare to Gas Engine(s). The objective of the integrated monitoring system is aimed to improve the efficiency of staff movement, monitoring process and data collection as well as serving as additional storage of database. The new system offered remote monitoring option which allows access through internet connection for view-only if provided with the correct authentication key.

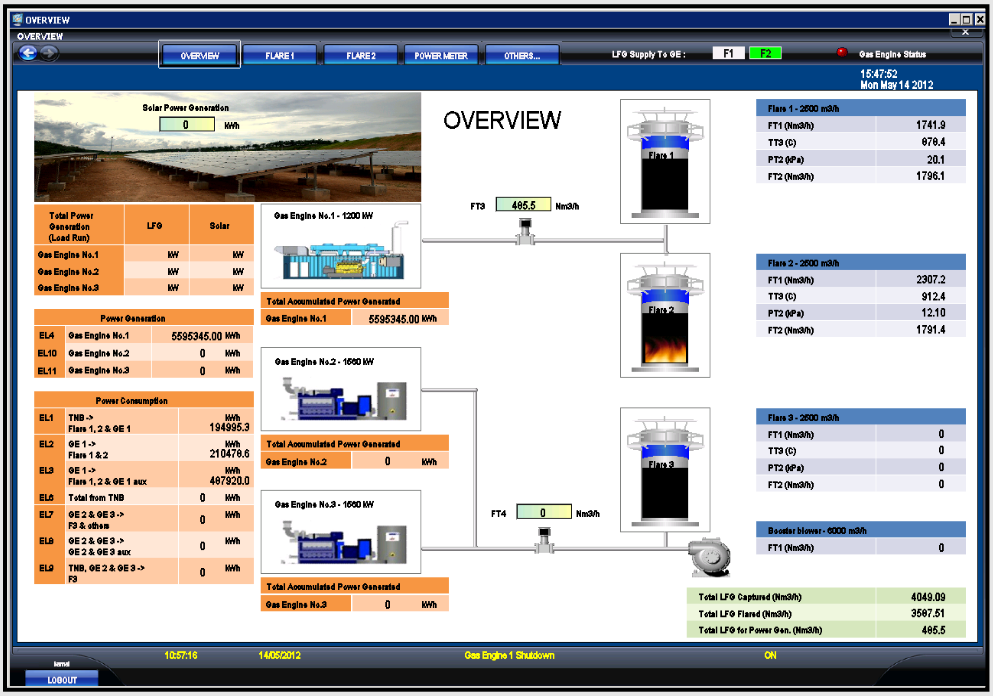


Figure 8: Centralized SCADA Interface

Implementation status of project activity

For the reporting period of 01/01/2013 to 31/08/2013, the key CDM activities implemented are described below:

Gas Extraction System in Advance Cell and Flare No.1

The actual implementation of the flaring system was initiated in August 2009 and has continued through this monitoring period.

The details on the downtime of the system (over the monitoring period covered by this report) are presented in **Appendix 1**.

The total running time for Flare No.1 is 97% during this monitoring period.

Gas Extraction System in Phase 1 Cell and Flare No.2

The flaring system in Phase 1 Cell was completed during the 2nd monitoring period and has started its operation on 07/08/2010. Flare No.2 was located next to Flare No.1 where most of the LFG extracted from Phase 1 Cell is transferred via a transfer pipe and fed to Flare No.2.

The details on the downtime of the system (over the monitoring period covered by this report) are presented in **Appendix 2**.

The total running time for Flare No.2 is 96% during this monitoring period.

Power Generation

During this monitoring period, power generated from Gas Engine No.1 continued to be uploaded to the grid.

The details on the downtime of the Gas Engine No.1 are presented in **Appendix 3**.

Currently, the data recording for the amount of gas channelled to Gas Engine No.1 is linked with the Flare No.2 SCADA system. Hence, the shutdown of Flare No.2 also indicated the shutdown of Gas Engine No.1.

Gas Supply System (Gas Engine No.2 and Gas Engine No.3) is not available for this monitoring period as Gas Engine No. 2 and Gas Engine No. 3 were yet to be in operation.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

No temporary deviations from registered monitoring plan or applied methodology during this monitoring period.

B.2.2. Corrections

No corrections during this monitoring period.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

No permanent changes from registered monitoring plan or applied methodology during this monitoring period.

During the 3rd monitoring period, the revision of monitoring plan was submitted to UNFCCC and approved on 09/05/2012[3].

[3] http://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/view

The revision is related to alternative measurement and handling of data during emergency conditions for methane content, flow meters and electricity meter.

B.2.4. Changes to project design of registered project activity

There is no change to project design of registered project activity during this monitoring period.

During the 3rd monitoring period, the notification of change request was submitted to UNFCCC and approved on 09/05/2012[4].

The change is related to the internal use of power generated for the landfill operation which was not successful and was not approved by the relevant authorities and the grid operator. This was due to the technical constraints and removal of on-site utilization from the PDD.

The 2nd notification of change request was submitted to UNFCCC on 25/04/2013 and was approved by UNFCCC on 09/09/2013.

The change is related to the following:
- Increase of power generation approximately 3MW and upload to the grid by year 2013
- Installation of an additional pipeline and flare system equipped with skid mounted LFG gas blower to handle any excess LFG captured which is expected to be commissioned at the beginning of year 2014

B.2.5. Changes to start date of crediting period

No changes to start date of crediting period during this monitoring period.

B.2.6. Types of changes specific to afforestation or reforestation project activity

Not applicable.

SECTION C. Description of monitoring system

Monitoring Methodology

The basis of the monitoring plan (MP) was formulated based on the approved methodology ACM 0001 – *Consolidated baseline and monitoring methodology for landfill gas project activities* (Version 8).

Tool to determine project emissions from flaring gases containing methane

According to page 10 of the *Tool to determine project emissions from flaring gases containing methane*, in case of enclosed flares and use of the default value for the flare efficiency, the flare efficiency in the hour *h* ($\eta_{flare,h}$) is:

- 0%, if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C for more than 20 minutes during the hour *h*
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour *h* but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*

The manufacturer's specification on proper operation of the flare need to be met in order to apply 90% flare efficiency in the hour *h* whenever the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour *h*.

[4] http://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/view

The manufacturer's specification on proper operation of the flare is monitored through the operating set point for the flare which was pre-set at the SCADA system. Whenever there is an issue where the flare operates below or above the set point; the system will be automatically shut down.

Tool to determine the mass flow of a greenhouse gas in a gaseous stream

The MP also referred to the *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*.

Referring to the tools, for LFG temperatures below 60 ^{o}C, moisture could be neglected due to its very low influence on final results and thus, the measurement in wet or dry basis are not important (as reflected in the amendments to ACM 0001, version 9.1 onwards). In case where the LFG temperature exceeds 60^{o}C, the same basis for both CH_4 concentration and flow measurement will be considered according to the tools.

The detailed description on the calculation applied to the CER Calculation Sheet is as shown in **Appendix 4**.
Transmission and Distribution Losses (TDL_y)

According to page 35 of the registered PDD, the Transmission and Distribution Losses (TDL_y) value applied in this project is 10%. This value was reported in the Tenaga Nasional Berhad (TNB)[5] Annual Report 2007[6] in page 23.

Operation and Management Structure for Monitoring

The organization structure for the Bukit Tagar CDM monitoring team is shown below:

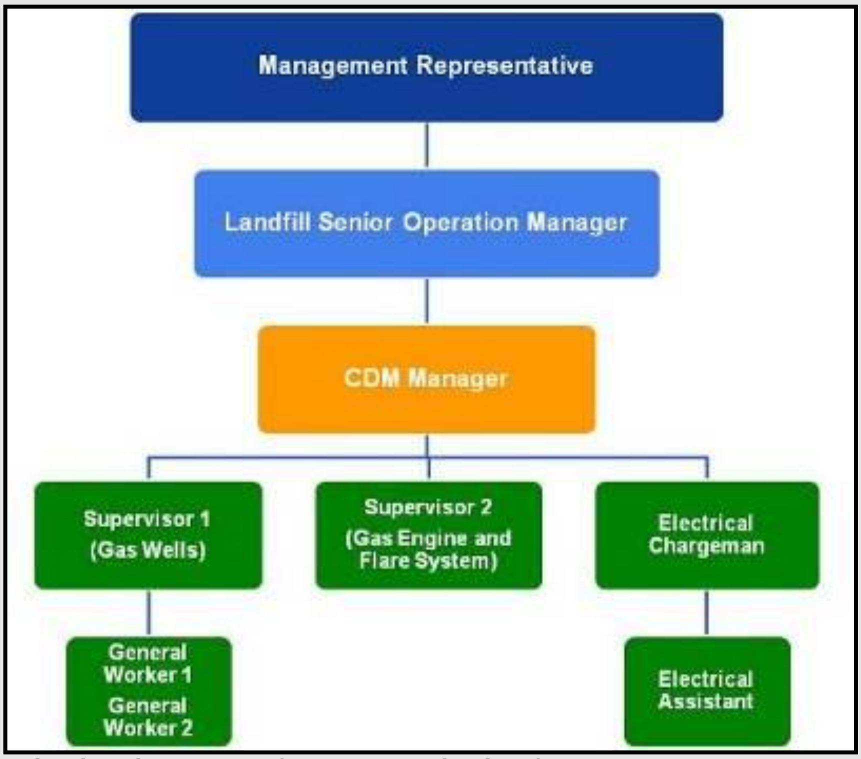


Figure 9: Organisational Structure for CDM Monitoring for BTSL LFG Recovery and Utilisation Project

[5] Tenaga Nasional Berhad is the largest electricity provider in Malaysia and is responsible for the grid transmission and distribution in Peninsular Malaysia.
[6] http://announcements.bursamalaysia.com/EDMS/subweb.nsf/7f04516f8098680348256c6f0017a6bf/303144432ec51 70e482573af00388df6/$FILE/TENAGA-Cover%20to%20Page%2050%20(2.3MB).pdf

The roles and responsibilities of the monitoring team in carrying out the MP are detailed as follow:

Table 1: Responsibilities of the CDM Monitoring Team

Role	Responsibility in CDM monitoring
Management Representative	• Reports to and obtain decisions from management on CDM-related matters • Chairs internal meetings on CDM matters • Signs off official correspondence for external parties
Senior Landfill Operation Manager	• Reports to the management representative (MR) • Oversees entire operation of landfills (including LFG management system) • Covers responsibility of CDM Manager when he is not available
CDM Manager	• Reports to the Senior Landfill Operation Manager • Oversees and coordinates the entire CDM monitoring plan • Verifies and signs off all relevant monitoring records • Ensures Quality Control / Quality Assurance (QC/QA) is carried out • Ensures all data are recorded and necessary documentations are prepared according to the requirements of CDM monitoring • Responsible in optimising the LFG extraction and utilisation system
CDM Consultant	• Provides advice on all CDM-related matters • Prepares monitoring reports for verifications • Liaises with the verifier on verification process • Conducts regular audits on CDM monitoring
Supervisors	• Report to the CDM Manager on CDM monitoring issues • Check and ensure that the flaring system is functional • Ensure all data recording devices are functioning and calibrated as planned (including performing QA/QC) • Check and sign the daily monitoring log sheets for CDM monitoring • Supervise general workers in maintenance work and record monitored parameters for CDM monitoring • Identify maintenance requirement and contact the supplier if maintenance and support are needed • Optimise the flare operation together with the CDM Manager • Responsible with the security of locked Programmable Logic Controller (PLC) control room. The supervisor will hold the door key for the PLC control room
General Workers	• Perform regular operational and maintenance tasks • Record necessary readings in daily monitoring log sheets and request verification from the supervisors on the log sheets • Report any fault to supervisor-in-charge or the electrical chargeman

The team is overall headed by the MR who oversees the entire CDM monitoring implementation. The MR receives direct updates and support from the site staff headed by the Senior Landfill Operation Manager. The Senior Landfill Operation Manager is supported by the CDM Manager who is the key coordinator to all CDM monitoring matters on-site. The CDM Manager is assisted by a group of technicians and workers who will perform the daily recording and checking tasks.

The CDM Consultant (Eco-Ideal Consulting Sdn. Bhd.) was appointed to assist KBE in ensuring that the monitoring plan and requirements were done according to the MP. The consultant played the role of a trainer and conducted independent audits as part of the QA/QC procedures set up for this project.

During this monitoring period, two CDM Management Meetings were held on 31/01/2013 and 15/08/2013 respectively.

Relevant Monitoring Points

The parameters monitored during the monitoring period are illustrated in the following figure:

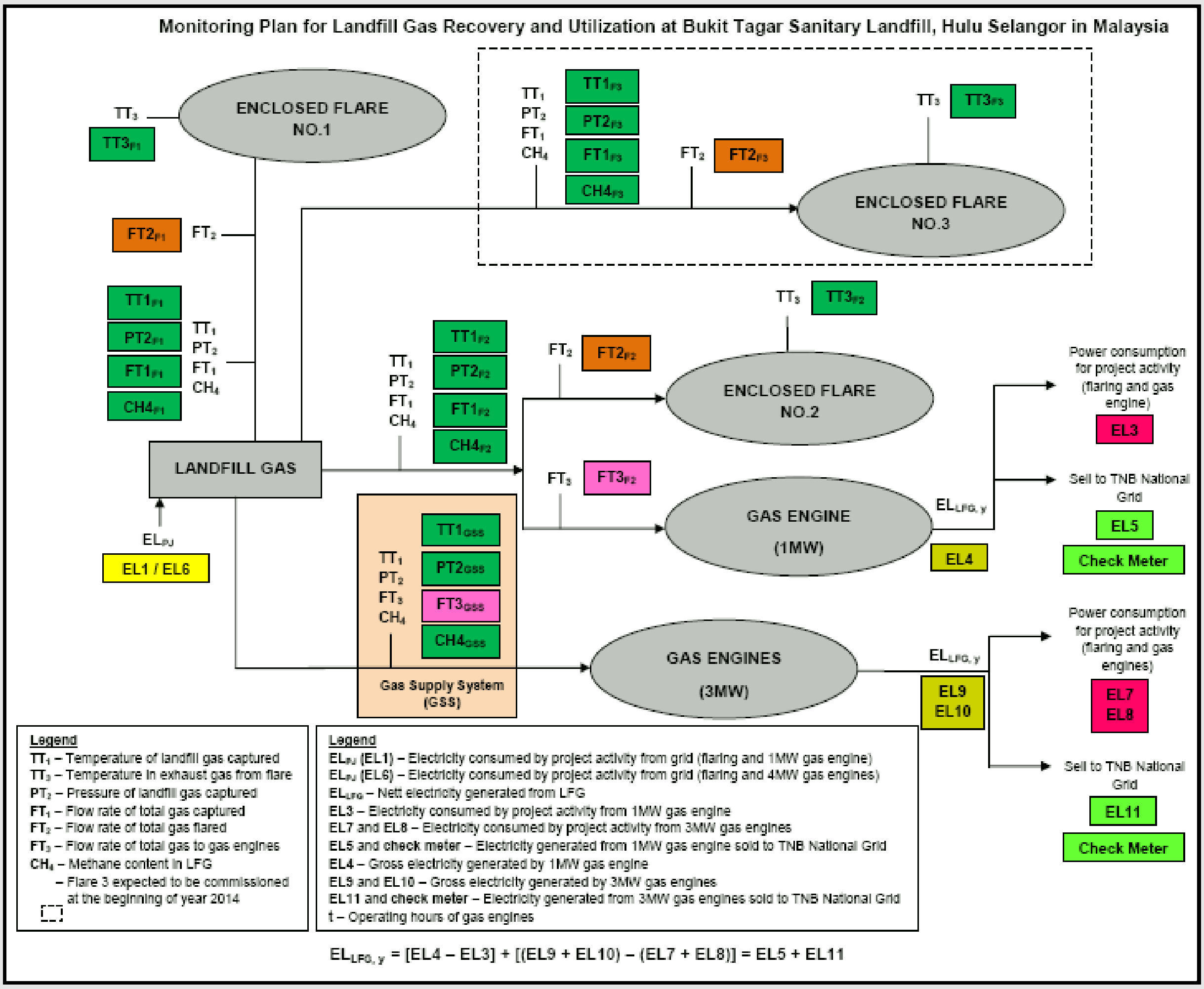


Figure 10: Key Parameters Monitored under the CDM Monitoring Plan

Remark: The power meter used to measure the electricity consumed by Flare No.1 and Flare No.2 from the grid was no longer in use effective from 22/06/2011. The total power consumption by the project activity from the grid (flaring systems and Gas Engine No.1) was measured by the new power meter installed, i.e. EL1. The new gas engines, Gas Supply System (Gas Engine No.2 and Gas Engine No.3) were yet to be commissioned during this monitoring period.

A physical connection has been installed to allow the transfer of gas from Phase 1 Cell to Flare No.1. When Flare No.2 is unable to operate, the gas from Phase 1 Cell will be channelled to Flare No.1 to be flared. A part of the gas will also be transferred to the gen-set for electricity production if required. Necessary monitoring is carried out to ensure compliance with the MP.

<u>Data Recording and Documentation</u>

All relevant data/measurements of the parameters taken were recorded and kept in an appropriate format and archived after the crediting period to ensure that the data are accessible especially during the monitoring and verification process of the project.

Data was recorded in the following way:

<u>Continuous Monitoring – Data in Softcopy:</u>
Data logger (automatic recording in computer)

Manual Recording – Data in Hardcopy:

Daily monitoring log sheets and record books (manual recording)

Based on the MP, key parameters (temperature, pressure, flow of gas, CH_4 concentration in biogas) were continuously monitored and recorded via the data logger at the control room.

As a back-up data recording system, the on-site workers were required to manually record certain monitored parameters in daily monitoring log sheets. These records were filed and kept in the office which can be accessible by the CDM Manager and technicians whenever necessary. These log sheets (in hard copies) were scanned for electronic filing on a monthly basis.

A summary of the data directly monitored is tabulated below:

Table 2: CDM Monitoring Parameters, Frequency and Archiving

Parameter	CDM ID	Equipment ID	Monitoring equipment	Recording frequency	Documentations	Data archive
Temperature	$T_{TT1,F1}$ $T_{TT1,F2}$ $T_{TT1,GSS}$	$TT_{1,Flare No.1/Flare No.2/GSS}$	Thermocouple	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Flare Temperature	$T_{Flare,F1}$ $T_{Flare,F2}$	$TT_{3,Flare No.1/Flare No.2}$	Thermocouple	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Pressure	$P_{PT2,F1}$ $P_{PT2,F2}$ $P_{PT2,GSS}$	$PT_{2,Flare No.1/Flare No.2/GSS}$	Pressure Gauge	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Flowrate	$LFG_{total,Flare No.1/Flare No.2,y}$ $LFG_{flare,Flare No.1/Flare No.2,y}$ $LFG_{electri}$	$FT_{1,Flare No.1/Flare No.2}$ $FT_{2,Flare No.1/Flare No.2}$ $FT_{3,Flare No.2}$	V-Cone Differential Pressure Flowmeter	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving

	city,Flare No.2,y $LFG_{electricity,GSS,y}$	$FT_{3,GSS}$				
Methane Fraction	$W_{CH4,Flare\ No.1/Flare\ No.2/GSS,y}$	$CH_{4,Flare\ No.1/Flare\ No.2/GSS}$	Continuous Infrared Gas Analyser	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Electricity consumed by the project	$EL_{PJ,y}$ $EL_{PJ,GE,auxiliary\ \&\ flare,y}$	EL_{PJ} (EL1 and EL6) $EL_{PJ,GE,auxiliary\ \&\ flare}$ (EL3, EL7 and EL8)	kWh meter	Daily (manual)	Softcopy (scanned copy) Hardcopy	Data recorded will be compiled into MS Excel and aggregated for monthly amount Daily log sheet will be scanned for archiving
Electricity generated by LFG	$EL_{LFG,GE,total,y}$	$EL_{LFG,GE,total}$ (EL4, EL9 and EL10)	kWh meter	Daily (manual)	Softcopy (scanned copy) Hardcopy	Data recorded will be compiled into MS Excel and aggregated for monthly amount Daily log sheet will be scanned for archiving
	$EL_{LFG,y}$	EL_{LFG} (EL5 and EL11, TNB main energy meters) TNB check energy meters	kWh meter	Daily (manual)	Softcopy (scanned copy) Hardcopy	TNB joint meter reading certificate will be scanned for archiving

NOTE:

Data recorded by the flow meters were normalised to Nm^3 with the temperature and pressure monitored automatically via the software. Thus, there was no need to normalise the recorded flow further. The new gas engines, Gas Supply System (Gas Engine No.2 and Gas Engine No.3) was yet to be commissioned during this monitoring period.

Monitoring Equipment and Equipment Calibration

The list of CDM monitoring equipment used is shown in Table 3 & Table 4 below:

Table 3: List of CDM Monitoring Equipment and Calibration for Flare No.1

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Next Calibration Date	Recommended Frequency of Calibration
Flare System													
1	Temperature Transmitter	Temperature (T)	$TT_{1,Flare No.1}$	$T_{TT1,F1}$	°C	PR Electronics	5335A	100944768	≤ ± 0.05% of span	0-100°C	07/12/2012 & SB 121016 (01/01/2013 - 31/08/2013)	06/12/2013	Annually
2	Temperature Transmitter	Flare Temperature ($T_{flare,y}$)	$TT_{3,Flare No.1}$	$T_{Flare,F1}$	°C	1. PR Electronics	5335A	100906480	≤ ± 0.05% of span	0-1200°C	07/12/2012 & SB 121015 (01/01/2013 - 30/05/2013)	06/12/2013	Annually
						2. Honeywell	STT25M-0-EN0-000-000-000-00-3H	B235039237	±0.5%	0-1200°C	24/12/2011 & 4401703917 (30/05/2013 - 25/07/2013)	23/12/2012	Annually
						3. PR Electronics	5335A	110910943	≤ ± 0.05% of span	0-1200°C	19/07/2013 & CTT 1260-13 (25/07/2013 - 31/08/2013)	18/07/2014	Annually
3	Pressure Sensor	Pressure Transmitter (P)	$PT_{2,Flare No.1}$	$P_{PT2,F1}$	kPa	Rosemount	3051TG1A2B21AB 4E5M5Q4	02492864	±0.25%	0-2 to 0-207 kPa	21/12/2012 & SB 121094 (01/01/2013 - 31/08/2013)	20/12/2013	Annually
4	Flow Meter	Total Biogas Flow Rate ($LFG_{total,y}$)	$FT_{1,Flare No.1}$	$LFG_{total,Flare No.1,y}$	NM^3/hr	Kingsway Vcone Flow transmitter	3051 / KVS10IIKC23FSN	4972946 / FT119 (8102101)	±1%	3-5000Nm^3/h	28/04/2011 & SB 110591 (01/01/2013 - 25/04/2013)	27/04/2013	24 months
											25/04/2013 & CTP 1139-13 (25/04/2013 - 31/08/2013)	24/04/2015	24 months
5	Flow Meter	Flaring Biogas Flow Rate ($LFG_{flare,y}$)	$FT_{2,Flare No.1}$	$LFG_{flare,Flare No.1,y}$	NM^3/hr	Kingsway Vcone Flow transmitter	3051 / KVS10IIKC23FSN	02768008	±1%	3-5000Nm^3/h	21/12/2012 & SB 121096 (01/01/2013 - 31/08/2013)	20/12/2014	24 months
Gas Analysers													
6	CH_4 Meter	Methane fraction of LFG	$CH_{4,Flare No.1}$	$W_{CH4,Flare No.1,y}$	%	Guardian Plus	97460	1. 28931	±2% of full scale	0-100%	26/04/2012 & SB 120288 (01/01/2013 - 09/03/2013)	25/04/2013	Annually
								2. 32560	±2% of full scale	0-100%	14/03/2013 & E-1359/0413 (09/03/2013 - 31/08/2013)	13/03/2014	Annually

Span Gas			
No	**Parameters**	**Analysis date**	**Best if used by**
1	N_2, CH_4	18/02/2009	18/02/2014
		01/08/2011	01/08/2021
2	N_2, CO_2	03/02/2009	03/02/2014
3	N_2, O_2	26/10/2009	26/10/2019
		09/01/2012	09/01/2022

During this monitoring period, the equipment which has an overdue calibration is as listed below:

1. TT3 - The maximum permissible error of ±0.5% which is the equipment accuracy error was applied to TT3 from 30/05/2013 - 25/07/2013 as a conservative approach
2. CH4 - The maximum permissible error of ±2% which is the equipment accuracy error was applied to CH4 from 09/03/2013 - 14/03/2013 as a conservative approach

Table 4: List of CDM Monitoring Equipment and Calibration for Flare No.2

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Next Calibration Date	Recommended Frequency of Calibration
Flare System													
1	Temperature Transmitter	Temperature (T)	$TT_{1,Flare No.2}$	$T_{TT1,F2}$	°C	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B839917437	±0.5% of span	0-100°C	27/04/2012 & SB 120297 (01/01/2013 - 25/04/2013)	26/04/2013	Annually
											25/04/2013 & CTT 1171-13 (25/04/2013 - 31/08/2013)	24/04/2014	Annually
2	Temperature Transmitter	Flare Temperature ($T_{flare,y}$)	$TT_{3,Flare No.2}$	$T_{Flare,F2}$	°C	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B838901937	±0.5% of span	0-1200°C	27/04/2012 & SB 120299 (01/01/2013 - 25/04/2013)	26/04/2013	Annually
											25/04/2013 & CTT 1172-13 (25/04/2013 - 31/08/2013)	24/04/2014	Annually
3	Pressure Sensor	Pressure Transmitter (P)	$PT_{2,Flare No.2}$	$P_{PT2,F2}$	kPa	Rosemount	3051TG1A2B21AB4E 5Q4	5584784	±0.25%	0-2 to 0-207 kPa	27/04/2012 & SB 120296 (01/01/2013 - 25/04/2013)	26/04/2013	Annually
											25/04/2013 & CTP 1134-13 (25/04/2013 - 31/08/2013)	24/04/2014	Annually
4	Flow Meter	Total Biogas Flow Rate ($LFG_{total,y}$)	$FT_{1,Flare No.2}$	$LFG_{total,Flare No.2,y}$	NM^3/hr	Kingsway Flow transmitter (Rosemount)	3051CD1A22A1AM5K 5Q4 / KVS10IIKC23FSN	5476626 / FT141 (10031702)	±0.5%	3-5000Nm^3/h	29/04/2011 & SB 110601 (01/01/2013 - 25/04/2013)	28/04/2013	24 months
											25/04/2013 & CTP 1136-13 (25/04/2013 - 31/08/2013)	24/04/2015	24 months
5	Flow Meter	Flaring Biogas Flow Rate ($LFG_{flare,y}$)	$FT_{2,Flare No.2}$	$LFG_{flare,Flare No.2,y}$	NM^3/hr	Kingsway Flow transmitter (Rosemount)	3051CD1A22A1AM5K 5Q4 / KVS10IIKC23FSN	5476627 / FT140 (10031701)	±0.5%	3-5000Nm^3/h	29/04/2011 & SB 110600 (01/01/2013 - 25/04/2013)	28/04/2013	24 months
											25/04/2013 & CTP 1137-13 (25/04/2013 - 31/08/2013)	24/04/2015	24 months
6	Flow Meter	Flow Rate of Total Gas to Energy ($LFG_{electricity,y}$)	$FT_{3,Flare No.2}$	$LFG_{electricity,Flare No.2,y}$	NM^3/hr	Kingways Control Flow transmitter (Rosemount)	3051CD1A22A1AM5 B4K5Q4	02768007	±0.5%	200-2000Nm^3/h	04/10/2012 & 80424527 (PO) (01/01/2013 - 31/08/2013)	03/10/2014	24 months

Gas Analysers												
7	CH_4 Meter	Methane fraction of LFG	$CH_{4,Flare No.2}$	$W_{CH4,Flare No.2,y}$	%	Guardian Plus	97460	31453	±2% of full scale	0-100%	14/12/2012 & E-1181/1212 (01/01/2013 - 31/08/2013)	13/12/2013	Annually
Power Generation and Electricity Consumption												
8	Power meter	Electricity consumed (from grid for flaring system & GE)	EL_{PJ} (EL1)	$EL_{PJ,y}$	kWh	IME	NEMO 96HD+ (MF96021)	2167 8900 35	Class 0.5S (±0.5%)	0-400/5A	10/05/2011 & 2167 8900 35 (01/01/2013 - 31/08/2013)	09/05/2014	36 months
9	Power meter	Electricity consumed (from GE for Flare 1, Flare 2 & GE auxiliaries)	$EL_{PJ,GE,auxiliary \& flare}$ (EL3)	$EL_{PJ,GE,auxiliary \& flare,y}$	kWh	IME	NEMO 96HD+ (MF96021)	2175 4100 36	Class 0.5S (±0.5%)	0-500/5A	21/06/2012 & 2175 4100 36 (01/01/2013 - 31/08/2013)	20/06/2015	36 months
10	Power meter	Total electricity generation (MWh) - recorded by project site	$EL_{LFG,GE,total}$ (EL4)	$EL_{LFG,GE,total,y}$	kWh (to be converted to MWh)	EDMI Limited	Mk6E	210225256	Class 0.5S	99999999.99kWh	23/07/2012 & SP/RA/2012/314/001-001 (01/01/2013 - 31/08/2013)	22/07/2014	24 months
11	Power meter	Electricity sell to grid (MWh) - recorded by grid operator	EL_{LFG} (EL5)	$EL_{LFG,y}$	kWh	Itron	SL761A071	53099690	Class 0.20	999999999kWh	01/04/2011 & TNBM-QR-064 (01/01/2013 - 31/08/2013)	31/03/2016	5 years
12	Power meter	Electricity sell to grid (MWh) - check energy meter recorded by grid operator	-	-	kWh	Itron	SL761A071	53099691	Class 0.20	999999999kWh	01/04/2011 & TNBM-QR-064 (01/01/2013 - 31/08/2013)	31/03/2016	5 years

Span Gas			
No	Parameters	Analysis date	Best if used by
1	N_2, CH_4	04/10/2010	04/10/2020
2	N_2, CO_2	04/10/2010	04/10/2020
3	N_2, O_2	04/10/2010	04/10/2020

Data Collection (for the whole monitoring period)

Based on the monitoring plan, key flaring parameters (temperature, pressure, flow of gas, CH_4 concentration in LFG) were continuously monitored and recorded via the data logger at the flare system control room. Continuous flaring data were logged and archived in every minute in the database file. These raw data were compiled and analysed for the calculation of Certified Emission Reductions (CERs).

As a back-up data recording system, the on-site workers have manually recorded certain monitored parameters in the Daily Monitoring Log Sheets. These records were scanned into soft copies for electronic filing on a monthly basis.

Data recorded manually (not recorded in the data logger system), i.e. electricity consumed were recorded in daily monitoring log sheets on a daily basis and compiled in Microsoft (MS) Excel format weekly.

Data Processing

The data logged were archived in .db file format and compiled.

Data recorded were further processed to yield the results required. A specific computation programme (in MS Access) was developed by the CDM Consultant to process continuously-monitored data to the required format and summary. An example of data aggregation on-site for flow rate of LFG at the main pipe is shown as follows:

Parameter: FT_1 (Flow rate of LFG at main pipe)

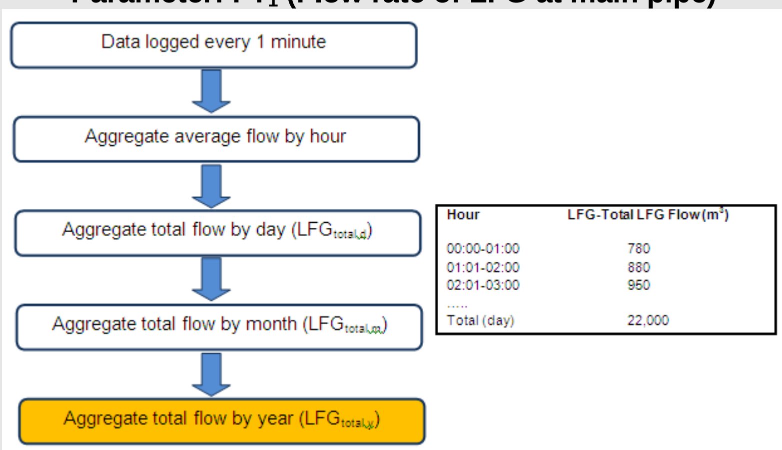


Figure 11: Example of Data Aggregation for Continuous Monitoring

Raw data logged at one (1) minute's interval were used to compute the hourly average. Subsequently, daily readings were computed, followed by aggregation into monthly and finally, yearly summaries.

Similar average values were computed for parameters such as the temperature, pressure and % CH_4.

In accordance to the *Tool to determine project emissions from flaring gases containing methane* (EB 28, Annex 13), 3 conditional default values for flare efficiency can be used for the calculation of CERs. The main criteria or condition for choosing the right default values for each hour is to assess the exhaust gas temperature from the flare stack ($T_{flare,h}$). On the other hand, all the operational parameters (temperature, pressure, etc.) related to CDM monitoring will also have to be taken into account as these parameters can affect $T_{flare,h}$. Therefore, the data of these parameters were recorded continuously through the PLC system.

Quality Assurance and Quality Control (QA & QC)

Documented Procedures and QA/QC Measures

QA/QC was applied throughout the monitoring period:

- Daily inspection of LFG extraction, flaring and monitoring systems;
- Checking and counter-signing of data forms by the CDM Manager;
- Data security (restricted access, password control) was applied to ensure the integrity of data;
- Inspection, observations, incidents and follow-up actions were documented;
- Independent audits were carried out by external consultants; and
- Data was analysed on a weekly basis to determine any irregularities.

Data Management and Storage

A proper data back-up system has been set up to ensure that the data will not be compromised in case of any unforeseen incidents at site resulting in total loss of data. The retention/archiving period for verification and CER issuance documents should be kept in electronic form for at least 2 years after the crediting period.

Continuous Monitoring (data logging system)

The data from continuous monitoring (data logger) was primarily stored in the hard disk located in the flare control room. To ensure that all data recorded are safe and properly archived, the following back-up system was applied for this project:

Types of back-up	Frequency	Back-up location
Manual back-up using a portable hard disk (HD)	Monthly	At the flare
Automatic back-up to the CDM Manager's PC located at the site office, BTSL	Weekly	On-site (site office)
Data server in the CDM Consultant's office (Eco-Ideal Consulting Sdn. Bhd., C-7-2, Wisma Goshen, Plaza Pantai, Kuala Lumpur, Malaysia)	Weekly	Off-site (consultant's office)

The data stored in the data server located at the CDM Consultant's office will be used as the primary back-up data in case of any emergency situation resulting in the loss of data from the flare data recording system.

The automatic data back-up system based on internet data transmission can be illustrated as follows:

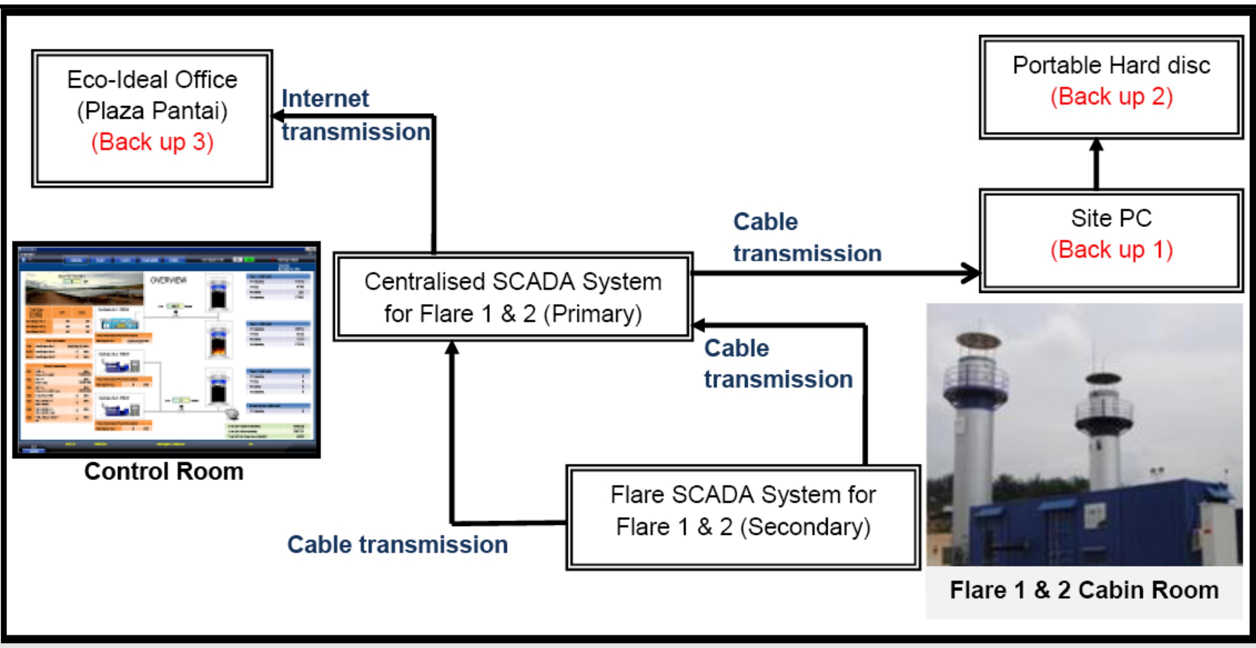


Figure 12: Automatic Data Back-Up for Flaring System at BTSL

Manual Recording

Daily operational data (consisting of CDM parameters monitored) recorded manually was backed-up by scanning all the daily monitoring log sheets on a weekly basis. These data were primarily stored in the computer at the cabin office next to the flare cabin. A copy of these scanned log sheets were handed to the CDM Consultant on a monthly basis for secondary back-up.

Independent Audits and Control Measures

All procedures for audit and QC measures were detailed in the CDM Audit Plan and Procedures. An independent audit relevant to the 7th monitoring period was conducted by the consultant (Eco-Ideal Consulting Sdn. Bhd.):

- Audit No. 10 – 28/08/2013

The independent audit served as an important QC measure to ensure that all the monitoring required are done in accordance to the plan. Through the audit, the project can pre-empt any potential problems, issues as well as identify improvement measures during the monitoring period.

Training

Training is important to ensure that all the involved staff is provided with the needed knowledge and skills to undertake their roles effectively according to the CDM MP.

During this monitoring period, training has been conducted by the CDM consultants to the site officers on 28/08/2013.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter	**Regulatory requirement relating to landfill gas projects**
Unit	-
Description	Regulatory requirement relating to landfill gas projects
Source of data	There is no regulatory requirement to recover and utilize landfill gas in Malaysia. Confirmation from the Department of National Solid Waste Management of the Ministry of Housing and Local Government regarding regulation aspects of landfill gas has already been obtained at the beginning of the earliest crediting period, i.e. during the 1st monitoring period (28/08/2009 – 28/02/2010).
Value (s) applied	NA
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**GWP_{CH4}**
Unit	tCO_2e/tCH_4
Description	Global Warming Potential (GWP) for CH_4
Source of data	With reference to decision 4/CMP7 and paragraph 66 of the EB 69 Meeting Report, for the second commitment period of the Kyoto Protocol, the global warming potentials used by Parties to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of the greenhouse gases listed in Annex A to the Kyoto Protocol shall be those listed in the column entitled “Global Warming Potential for Given Time Horizon” in Table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon, i.e. 25 tCO_2/tCH_4
Value (s) applied	25
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**D_{CH4}**
Unit	t_{CH4}/m^3_{CH4}
Description	CH_4 density at standard temperature and pressure
Source of data	ACM 0001 – *Consolidated baseline and monitoring methodology for landfill gas project activities* (Version 8)
Value (s) applied	0.0007168
Purpose of data	Baseline and Project emission calculation
Additional Comment	-

Data / Parameter	**Φ**
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	This uncertainty factor was adopted and the value is 0.9 based on recommendations in the *Tool to determine methane emissions avoided from dumping waste at solid waste disposal site*
Value (s) applied	0.9

Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**f**
Unit	-
Description	Fraction of methane captured at the solid waste disposal site (SWDS) and flared, combusted or used in another manner
Source of data	There is no methane flared, combusted or used for other purposes in the baseline scenario
Value (s) applied	0
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**OX**
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Site-visit reveals that this landfill is well managed and soil cover is applied on a daily basis. Therefore, the value 0.1 was applied as recommended by *the Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*
Value (s) applied	0.1
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**F**
Unit	%
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	This value was applied based on the recommendation of the IPCC in the *Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*
Value (s) applied	0.5
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**DOC_f**
Unit	%
Description	Fraction of degradable organic carbon (DOC) that can decompose
Source of data	This value was applied based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value (s) applied	0.5
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**MCF**
Unit	-
Description	Methane Correction Factor
Source of data	This value was applied based on the recommendation of the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. BTSL site is a fully

	anaerobically-managed SWDS. The waste received at the landfill was deposited at a specific tipping phase and there was no scavenging of waste in the landfill. Wastes were covered daily with compacted soil. Compaction as well as levelling is practiced based on the international landfill operational practices
Value (s) applied	1.0
Purpose of data	Baseline emission calculation
Additional Comment	-

Data / Parameter	**DOC_j**
Unit	-
Description	Fraction of degradable organic carbon (by weight) in the waste type *j*
Source of data	The above values were adopted from IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4)
Value (s) applied	The following values for the different waste fraction (types) were applied:
Purpose of data	Baseline emission calculation
Additional Comment	-

DOC_j

Waste type *j*	**DOC_j (% wet basis)**	**DOC_j (% dry basis)**
Wood and wood products	**43**	50
Pulp, paper and cardboard (other than sludge)	**40**	44
Food, food waste, beverages and tobacco (other than sludge)	**15**	38
Textiles	**24**	30
Garden, yard and park waste	**20**	49
Glass, plastic, metal, other inert waste	**0**	0
Nappies	**24**	60

Data / Parameter	**kj**
Unit	-
Description	Decay rate for the waste type *j*
Source of data	The above values were adopted from IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)

Value (s) applied	The following values for the different waste fraction (types) were applied:

Waste type *j*		Boreal and Temperature (MAT<20°C)		Tropical (MAT>20°C)	
		Dry (MAP/PET<1)	Wet (MAP/PET>1)	Dry (MAP<1000 mm)	Wet (MAP>1000 mm)
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0/06	0.045	**0.07**
	Wood, wood products and straw	0.02	0.03	0.025	**0.035**
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.1	0.065	**0.17**
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	**0.4**

Purpose of data	Baseline emission calculation
Additional Comment	The project site is located in the State of Selangor, Malaysia. The climate is tropical with an annual mean 24-hr temperature of approximately 27°C and annual mean precipitation of around 2,700 mm. These values were long-term averages documented in the Environmental Impact Assessment (EIA) Report prepared for the landfill in 2005. Thus, the K-values for tropical temperature and wet climate were used

D.2. Data and parameters monitored

Data / Parameter	$LFG_{total,y}$
Unit	m^3
Description	Total amount of LFG captured during the project at normal temperature and pressure
Measured/ Calculated/	Measured

<table>
<tr><td>Default</td><td></td></tr>
<tr><td>Source of data</td><td>Continuous measurement by flow meter during operation of project activity.

This parameter was measured continuously and separately for both flares, i.e. Flare No.1 and Flare No.2. Therefore, 2 sets of equipment were used for the monitoring period.

During temporary malfunctioning of flow meter or data logging system resulting in unrepresentative data, the value of LFG_{total} for the affected period will be taken as the sum of LFG_{flare} and $LFG_{eletricity.}$</td></tr>
<tr><td>Value (s) of monitored parameter</td><td><u>Flare No.1</u>
According to ACM 0001, version 8[7], page 15 of section III monitoring methodology, the amount of landfill gas generated (in m^3 using a continuous flow meter), where the total quantity (LFG_{total}), as well as the quantities fed to the flare (s) (LFG_{flare}), to the power plant (s) ($LFG_{electricity}$) are measured continuously. In the case where LFG is just flared, one flow meter for each flare can be used provided that these meters used are calibrated periodically by an officially accredited entity; The total LFG captured was the same as the total LFG flared for Flare No.1 during the monitoring period as total LFG captured in Flare No1 was only sent to flare.

<u>Flare No.2</u>
According to ACM 0001, version 8, page 15 of section III monitoring methodology, the amount of landfill gas generated (in m^3 using a continuous flow meter), where the total quantity (LFG_{total}), as well as the quantities fed to the flare (s) (LFG_{flare}), to the power plant (s) ($LFG_{electricity}$) are measured continuously. In the case where LFG is just flared, one flow meter for each flare can be used provided that these meters used are calibrated periodically by an officially accredited entity. From 01/06/2011, the total LFG captured (FT1) is the summation of total LFG flared (FT2) and total LFG electricity (FT3). As a conservative approach, during normal operation, the values of FT1 will be compared with the total of FT2 and FT3 and the lower value of the FT will be used for ER calculation.

For the comparison, there are 2 cases which will happen:

1. <u>When FT1 is greater than FT2 + FT3</u>

When FT1 is greater, the total values of FT2 + FT3 will be used and presented as the value of FT1 in the ER calculation as a conservative approach.

2. <u>When FT1 is lower than FT2 + FT3</u>

When FT1 is lower, FT1 will then be used in the ER calculation as a conservative approach.

<table>
<tr><th>Months</th><th>Flare No.2
FT1 Value (Nm³)</th><th>Flare No.2
Total of FT2 & FT3 Value (Nm³)</th></tr>
<tr><td>January 13</td><td>1,614,745</td><td>1,602,089</td></tr>
<tr><td>February 13</td><td>1,487,105</td><td>1,469,384</td></tr>
</table>
</td></tr>
</table>

[7] The ACM0001 - *Consolidated baseline and monitoring methodology for landfill gas project activities* (Version 8) is no longer valid and is not available for download in UNFCCC. The version has been replaced with Version 8.1.

March 13	1,487,105	1,610,391
April 12	1,473,314	1,440,627
May 13	1,415,068	1,348,091
June 13	955,875	934,343
July 13	1,347,269	1,315,778
August 13	1,578,555	1,521,846
Total	**11,359,035**	**11,242,549**

From the monthly comparison of the FT1 & FT2 + FT3 values above, the lower value between the two is taken for the calculation of CERs.

Months	Flare No.1 Value (Nm^3)	Flare No.2 Value (Nm^3)
January 13	1,195,626	1,602,089
February 13	1,131,772	1,469,384
March 13	1,126,950	1,610,391
April 13	1,087,733	1,440,627
May 13	1,138,978	1,348,091
June 13	983,543	934,343
July 13	1,143,918	1,315,778
August 13	1,140,358	1,521,846
Total	**8,948,878**	**11,242,549**

For this monitoring period for Flare No.2, the total values of FT2 + FT3 was used in the ER calculation since FT1 is greater than FT2 + FT3.

Monitoring equipment

Item	Flare No.1 Description	Flare No.1 Description
	01/01/2013 – 25/04/2013	**25/04/2013 – 31/08/2013**
Type	Differential Pressure Transmitter – Kingsway Vcone, Flow transmitter – Rosemount	Differential Pressure Transmitter – Kingsway Vcone, Flow transmitter – Rosemount
Accuracy class	± 1%	± 1%
Serial No.	4972946 (Rosemount) / FT1 – FT119 (8102101)	4972946 (Rosemount) / FT1 – FT119 (8102101)
Calibration frequency	24 months	24 months
Date of last calibration	28/04/2011	25/04/2013
Validity	24 months	24 months

Item	Flare No.2 Description	Flare No.2 Description
	01/01/2013 – 25/04/2013	**25/04/2013 – 31/08/2013**
Type	Differential Pressure Transmitter – Kingsway Vcone, Flow transmitter – Rosemount	Differential Pressure Transmitter – Kingsway Vcone, Flow transmitter – Rosemount
Accuracy	± 0.5%	± 0.5%

	class		
	Serial No.	5476626 (Rosemount) / FT1 – FT141 (10031702)	5476626 (Rosemount) / FT1 – FT141 (10031702)
	Calibration frequency	24 months	24 months
	Date of last calibration	29/04/2011	25/04/2013
	Validity	24 months	24 months
Measuring/ Reading/ Recording frequency	Measured continuously with a flow meter. Data was aggregated on both monthly and yearly basis		
Calculation method (if applicable)	NA		
QA/QC procedures	Flow meters were tested, calibrated and maintained regularly		
Purpose of data	Project emission calculation		
Additional comment	-		

Data / Parameter	**$LFG_{flare,y}$**
Unit	m^3
Description	Total amount of LFG sent to flare at normal temperature and pressure
Measured/ Calculated/ Default	Measured
Source of data	Continuous measurement by flow meter during operation of project activity. This parameter was measured separately for both of the flares, i.e. Flare No.1 and Flare No.2. Therefore, 2 sets of equipment were used for the monitoring period. During temporary malfunctioning of flow meter or data logging system resulting in unrepresentative data, the value of LFG_{flare} for the affected period will be derived by subtracting $LFG_{electricity}$ from LFG_{total}.

Value (s) of monitored parameter	**Flare No.2**

Flare No.2

From 01/06/2011, the total LFG flared continued to be measured by FT2. As a conservative approach, during normal operation, the value of FT1 will be compared with the total of FT2 and FT3 and the lower value of the FT will be used for ER calculation.

For the comparison, there are 2 cases which will happen:

1. *When FT1 is greater than FT2 + FT3*

   The value of FT2 will be used in the ER calculation as a conservative approach.

2. *When FT1 is lower than FT2 + FT3*

   The value of FT1 will be used to calculate the proportion of FT2 by ratio (formula: FT2 value = FT2 / (FT2 + FT3) * FT1.) The calculated value of the proportion of FT2 will be used in the ER calculation as a conservative approach.

Months	Flare No.1 Value (Nm^3)	Flare No.2 Value (Nm^3)
January 13	1,195,626	1,297,312
February 13	1,131,772	1,176,253
March 13	1,126,950	1,310,044
April 13	1,087,733	1,178,702
May 13	1,138,978	1,201,288
June 13	983,543	934,343
July 13	1,143,918	1,272,421
August 13	1,140,358	1,230,711
Total	**8,948,878**	**9,601,074**

From the monthly comparison of the FT1 & FT2 + FT3 in this monitoring period, the value of FT2 was used in the ER calculation since FT1 is greater than FT2 + FT3.

Monitoring equipment

Item	Flare No.1 Description
	01/01/2013 – 31/08/2013
Type	Differential Pressure Transmitter – Kingsway Vcone, Flow transmitter – Rosemount
Accuracy class	± 1%
Serial No.	02768008
Calibration frequency	24 months
Date of last calibration	21/12/2012
Validity	24 months

Item	Flare No.2 Description	Flare No.2 Description
	01/01/2013 – 25/04/2013	**25/04/2013 – 31/08/2013**
Type	Differential Pressure Transmitter – Kingsway	Differential Pressure Transmitter – Kingsway

	<table><tr><td></td><td>Vcone, Flow transmitter – Rosemount</td><td>Vcone, Flow transmitter – Rosemount</td></tr><tr><td>Accuracy class</td><td>± 0.5%</td><td>± 0.5%</td></tr><tr><td>Serial No.</td><td>5476627 (Rosemount) / FT2 – FT140 (10031701)</td><td>5476627 (Rosemount) / FT2 – FT140 (10031701)</td></tr><tr><td>Calibration frequency</td><td>24 months</td><td>24 months</td></tr><tr><td>Date of last calibration</td><td>29/04/2011</td><td>25/04/2013</td></tr><tr><td>Validity</td><td>24 months</td><td>24 months</td></tr></table>
Measuring/ Reading/ Recording frequency	Measured continuously with flow meter. Data was aggregated on both monthly and yearly basis
Calculation method (if applicable)	Raw data logged at 1 minute's interval were used to compute the hourly average. Subsequently, daily readings were computed, followed by aggregation into monthly and finally, yearly records
QA/QC procedures	Flow meters were tested, calibrated and maintained regularly
Purpose of data	Baseline and Project emission calculation
Additional comment	-

Data / Parameter	**$LFG_{electricity,y}$**
Unit	m^3
Description	Amount of landfill gas combusted in power plant (Gas Engine No.1, 2 and 3) at normal temperature and pressure
Measured/ Calculated/ Default	Measured
Source of data	Continuous measurement by flow meter during operation of project activity. This parameter was measured separately for the gas engines, i.e. Gas Engine No. 1 (1 meter) and Gas Supply System (GSS, including Gas Engine No. 2 and Gas Engine No. 3 – 1 meter). Therefore, 2 sets of equipment have to be used for the monitoring period. However, during this monitoring period, GSS was yet to be commissioned. Thus, only 1 set of equipment were used, i.e. for Gas Engine No. 1. During temporary malfunctioning of flow meter or data logging system resulting in unrepresentative data, the value of $LFG_{electricity}$ for the affected period will be derived by subtracting LFG_{flare} from LFG_{total}.

<table>
<tr><td>Value (s) of monitored parameter</td><td>

<u>Flare No.2</u>
From 01/06/2011, the total LFG for electricity is measured by FT3. As a conservative approach, during normal operation, the value of FT1 will be compared with the total of FT2 and FT3 and the lower value of the FT will be used for ER calculation.

For the comparison, there are 2 cases which will happen:

1. <u>When FT1 is greater than FT2 + FT3</u>

The value of FT3 will be used in the ER calculation as a conservative approach

2. <u>When FT1 is lower than FT2 + FT3</u>

The value of FT1 will be used to calculate the proportion of FT3 by ratio (formula: FT3 value = FT3 / (FT2 + FT3) * FT1. The calculated value from the proportion of FT3 will be used in the ER calculation as a conservative approach.

<table>
<tr><th>Months</th><th>Flare No.2 Value (Nm³)</th></tr>
<tr><td>January 13</td><td>304,777</td></tr>
<tr><td>February 13</td><td>293,131</td></tr>
<tr><td>March 13</td><td>300,348</td></tr>
<tr><td>April 13</td><td>261,926</td></tr>
<tr><td>May 13</td><td>146,802</td></tr>
<tr><td>June 13</td><td>0</td></tr>
<tr><td>July 13</td><td>43,357</td></tr>
<tr><td>August 13</td><td>291,135</td></tr>
<tr><td>Total</td><td>1,641,475</td></tr>
</table>

From the monthly comparison of the FT1 & FT2 + FT3 in this monitoring period, the value of FT3 was used in the ER calculation since FT1 is greater than FT2 + FT3.

<u>GSS (Gas Engine No. 2 and 3)</u>
Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th rowspan="2">Item</th><th>Flare No.2
Description</th></tr>
<tr><th>01/01/2013 – 31/08/2013</th></tr>
<tr><td>Type</td><td>Differential Pressure Transmitter – Kingsway Vcone, Flow transmitter – Rosemount</td></tr>
<tr><td>Accuracy class</td><td>± 0.5%</td></tr>
<tr><td>Serial No.</td><td>02768007</td></tr>
<tr><td>Calibration frequency</td><td>24 months</td></tr>
<tr><td>Date of last calibration</td><td>04/10/2012</td></tr>
<tr><td>Validity</td><td>24 months</td></tr>
</table>
</td></tr>
</table>

	Flare No.2 From 11:15 (17/05/2013) – 11:49 (25/07/2013), the gas engine underwent a major engine fault. During this period, no data was available for $\mathbf{LFG_{electricity,y}}$ (FT3). **GSS (Gas Engine No. 2 and 3)** Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Measuring/ Reading/ Recording frequency	Measured with flow meter. Data will be aggregated both monthly and yearly
Calculation method (if applicable)	Raw data logged at 1 minute's interval were used to compute the hourly average. Subsequently, daily readings were computed, followed by aggregation into monthly and finally, yearly records
QA/QC procedures	Flow meters were tested, calibrated and maintained regularly
Purpose of data	Baseline and Project emission calculation
Additional comment	-

Data / Parameter	$\mathbf{PE_{flare,y}}$
Unit	tCO_2e
Description	Project emissions from flaring of the residual gas stream in year *y*
Measured/ Calculated/ Default	Calculated
Source of data	Calculated as per the *Tool to determine project emissions from flaring gases containing methane* (EB 28, Annex 13, page 10). This parameter was measured separately for both of the flares, i.e. Flare No.1 and Flare No.2. Therefore, 2 sets of equipment were used for the monitoring period.
Value (s) of monitored parameter	(see table below)
Monitoring equipment	Refer to $\mathbf{T_{flare}}$ below
Measuring/ Reading/ Recording frequency	As per the *Tool to determine project emissions from flaring gases containing methane* (EB 28, Annex 13, page 10). As the project has installed an enclosed flaring system, the default value of 0.90 for enclosed flare efficiency for flare temperatures above 500^0C for more than 40 minutes in an hour was applied and monitored during the monitoring period. This is conservative as the enclosed flare was typically designed to operate at a much higher temperature (>900^0C).
Calculation method (if applicable)	As per the *Tool to determine project emissions from flaring gases*

Months	Flare No.1 Value (tCO_2e)	Flare No.2 Value (tCO_2e)
January 13	1,137	1,421
February 13	1,052	1,297
March 13	1,119	1,493
April 13	1,124	1,408
May 13	1,206	1,418
June 13	1,009	1,044
July 13	1,210	1,415
August 13	1,140	1,395
Total	**8,996**	**10,893**

	containing methane (EB 28, Annex 13, page 10)
QA/QC procedures	As per the *Tool to determine project emissions from flaring gases containing methane* (EB 28, Annex 13, page 10)
Purpose of data	Project emission calculation
Additional comment	-

Data / Parameter	$\mathbf{w_{CH4}}$
Unit	m^3 CH4 / m^3 LFG
Description	Fraction of CH_4 in LFG
Measured/ Calculated/ Default	Measured
Source of data	Continuous measurement by using certified equipment. This parameter was measured separately for both flares and the gas engines, i.e. Flare No.1 (1 meter), Flare No.2 & Gas Engine No.1 (1 meter) and GSS (Gas Engine No. 2 and Gas Engine No. 3 – 1 meter). Therefore, 3 sets of equipment have to be used for the monitoring period. However, during this monitoring period, GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be commissioned. Thus, only 2 sets of equipment were used, i.e. for Flare No. 1 and Flare No. 2 & Gas Engine No.1. In case of temporary situation such as the installed CH_4 gas analyser malfunctioned or gave unrepresentative results due to data logging problem, the w_{CH4} shall be measured manually with a portable gas analyser according to ACM 0001 Version 8. At least 8 hourly samples shall be taken per operating day. 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 1). As a conservative approach, the lower bound of the 95% Confidence Interval will be applied as per the guideline.
Value (s) of monitored parameter	(see table below)

Months	Flare No.1 Value	Flare No.2 Value
January 13	0.52	0.61
February 13	0.52	0.61
March 13	0.52	0.63
April 13	0.55	0.63
May 13	0.58	0.64
June 13	0.56	0.59
July 13	0.56	0.62
August 13	0.54	0.60
Average	**0.54**	**0.62**

GSS (Gas Engine No. 2 and 3)

Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.

<table>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td rowspan="2">Item</td><td>Flare No.1 Description</td><td>Flare No.1 Description</td></tr>
<tr><td>01/01/2013 – 09/03/2013</td><td>09/03/2013 – 31/08/2013</td></tr>
<tr><td>Type</td><td>Guardian Plus (97460) Infra-Red Gas Monitor</td><td>Guardian Plus (97460) Infra-Red Gas Monitor</td></tr>
<tr><td>Accuracy class</td><td>± 2%</td><td>± 2%</td></tr>
<tr><td>Serial No.</td><td>28931</td><td>32560</td></tr>
<tr><td>Calibration frequency</td><td>Annually</td><td>Annually</td></tr>
<tr><td>Date of last calibration</td><td>26/04/2012</td><td>14/03/2013</td></tr>
<tr><td>Validity</td><td>1 year</td><td>1 year</td></tr>
</table>
<table>
<tr><td rowspan="2">Item</td><td>Flare No.2 Description</td></tr>
<tr><td>01/01/2013 – 31/08/2013</td></tr>
<tr><td>Type</td><td>Guardian Plus (97460) Infra-Red Gas Monitor</td></tr>
<tr><td>Accuracy class</td><td>± 2%</td></tr>
<tr><td>Serial No.</td><td>31453</td></tr>
<tr><td>Calibration frequency</td><td>Annually</td></tr>
<tr><td>Date of last calibration</td><td>14/12/2012</td></tr>
<tr><td>Validity</td><td>1 year</td></tr>
</table>
<u>Flare No.1</u>
On 09/03/2013, there was a change of gas analyser from the 28931 unit to 32560 unit. The maximum permissible error of ±2% which is the equipment accuracy error was applied to the CH4 data from 09/03/2013 – 14/03/2013 for the overdue calibration of the 32560 unit as a conservative approach.
<u>GSS (Gas Engine No. 2 and 3)</u>
Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td>The CH_4 fraction were measured continuously with certified equipment or measured manually with a portable gas analyser during emergency cases</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Raw data logged at 1 minute’s interval was used to compute the daily average readings</td></tr>
<tr><td>QA/QC procedures</td><td>The CH_4 gas analyser was checked and calibrated regularly according to the manual given by the manufacturer</td></tr>
<tr><td>Purpose of data</td><td>Baseline and Project emission calculation</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

Data / Parameter	**T ($T_{TT1,F1}$, $T_{TT1,F2}$ and $T_{TT1,GSS}$)**
Unit	°C
Description	Temperature of the LFG
Measured/ Calculated/ Default	Measured
Source of data	Continuous measurement by temperature meter. This parameter was measured separately for both flares and the gas engines, i.e. Flare No.1 (1 meter), Flare No.2 (1 meter) and GSS (Gas Engine No. 2 and Gas Engine No. 3 – 1 meter). Therefore, 3 sets of equipment have to be used for the monitoring period. However, during this monitoring period, GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be commissioned. Thus, only 2 sets of equipment were used, i.e. for

	Flare No. 1 and Flare No. 2.
Value (s) of monitored parameter	see below

Months	Flare No.1 Value (°C)	Flare No.2 Value (°C)
January 13	54.27	46.24
February 13	53.41	45.53
March 13	54.70	47.41
April 13	51.11	44.46
May 13	52.96	44.58
June 13	50.93	41.39
July 13	53.04	43.56
August 13	54.51	45.14
Average	**53.12**	**44.79**

Flare No.1

Referring to the *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*, version 2.0, for LFG temperatures below 60^{o}C, moisture could be neglected due to its very low influence on final results and thus, the measurement in wet or dry basis is not important (as reflected in the amendments to ACM 0001, version 9.1 onwards). In the case where the LFG temperature exceeds 60^{o}C, the same basis for both methane concentration and flow measurement will be considered according to the tools.

During this monitoring period, there were several periods of which the LFG temperature exceeds 60^{o}C. Hence, the tool was applied in the CER Calculation sheet as a conservative approach. The details of the calculation are as attached in **Appendix 4**.

GSS (Gas Engine No. 2 and 3)

Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.

Monitoring equipment

Item	Flare No.1 Description	Flare No.2 Description	
	01/01/2013 – 31/08/2013	01/01/2013 – 25/04/2013	25/04/2013 – 31/08/2013
Type	PR Electronics	Honeywell (STT25M-0-EN0-000-000-000-00-3D) Temperature Transmitter	Honeywell (STT25M-0-EN0-000-000-000-00-3D) Temperature Transmitter
Accuracy class	≤ ± 0.05% of span	± 0.5% of span	± 0.5% of span
Serial No.	100944768	B839917437	B839917437
Calibration frequency	Annually	Annually	Annually
Date of last calibration	07/12/2012	27/04/2012	25/04/2013
Validity	1 year	1 year	1 year

	GSS (Gas Engine No. 2 and 3) Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Measuring/ Reading/ Recording frequency	Measured continuously by temperature meter
Calculation method (if applicable)	Raw data logged at 1 minute's interval was used to compute the daily average readings
QA/QC procedures	The temperature transmitter was calibrated regularly according to the manual given by the manufacturer
Purpose of data	Baseline and Project emission calculation
Additional comment	-

Data / Parameter	**P ($P_{PT2,F1}$, $P_{PT2,F2}$ and $P_{PT2,GSS}$)**
Unit	kPa
Description	Pressure of the LFG
Measured/ Calculated/ Default	Measured
Source of data	Continuous measurement by pressure transmitter. This parameter was measured separately for both flares and the gas engines, i.e. Flare No.1 (1 meter), Flare No.2 (1 meter) and GSS (Gas Engine No. 2 and Gas Engine No. 3 – 1 meter). Therefore, 3 sets of equipment have to be used for the monitoring period. However, during this monitoring period, GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be commissioned. Thus, only 2 sets of equipment were used, i.e. for Flare No. 1 and Flare No. 2.
Value (s) of monitored parameter	(see tables below)

Gauge pressure (Months)	Flare No.1 Value (kPa)	Flare No.2 Value (kPa)
January 13	17.71	10.81
February 13	17.47	10.87
March 13	17.15	11.12
April 13	15.85	9.73
May 13	17.89	10.09
June 13	14.94	8.23
July 13	17.31	10.10
August 13	17.45	10.51
Average	**16.97**	**10.18**

Absolute pressure (Months)	Flare No.1 Value (kPa)	Flare No.2 Value (kPa)
January 13	119.03	112.13
February 13	118.79	112.19
March 13	118.47	112.44
April 13	117.18	111.06
May 13	119.21	111.41
June 13	116.27	109.55
July 13	118.64	111.42
August 13	118.77	111.84
Average	**118.30**	**111.51**

Referring to the *Tool to determine the mass flow of a greenhouse gas in a gaseous stream* (Version 2.0), page 11, pressure at normal conditions is 101,325 Pa. The values of the absolute pressure are calculated by adding

	the ambient pressure at normal conditions to the gauge pressure. **GSS (Gas Engine No. 2 and 3)** Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Monitoring equipment	(see table below) **GSS (Gas Engine No. 2 and 3)** Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Measuring/ Reading/ Recording frequency	Measured continuously by a pressure transmitter
Calculation method (if applicable)	Raw data logged at 1 minute's interval was used to compute the daily average readings
QA/QC procedures	The meter was checked and calibrated regularly according to the manual given by the manufacturer
Purpose of data	Baseline and Project emission calculation
Additional comment	-

Monitoring equipment:

Item	Flare No.1 Description	Flare No.2 Description	
	01/01/2013 – 31/08/2013	**01/01/2013 – 25/04/2013**	**25/04/2013 – 31/08/2013**
Type	Rosemount (3051TG1A2B21AB4E5M5Q4) Pressure Transmitter	Rosemount (3051TG1A2B21AB4E5Q4) Pressure Transmitter	Rosemount (3051TG1A2B21AB4E5Q4) Pressure Transmitter
Accuracy class	± 0.25%	± 0.25%	± 0.25%
Serial No.	02492864	5584784	5584784
Calibration frequency	Annually	Annually	Annually
Date of last calibration	21/12/2012	27/04/2012	25/04/2013
Validity	1 year	1 year	1 year

Data / Parameter	**EL_{LFG}**
Unit	MWh
Description	Net amount of electricity generated using landfill gas
Measured/ Calculated/ Default	Measured
Source of data	Data as measured by electricity meters. This parameter was measured separately for the gas engines, i.e. Gas Engine No.1 (1 meter) and GSS (Gas Engine No. 2 and Gas Engine No. 3 – 1 meter for each gas engine). Therefore, 3 sets of equipment have to be used for the monitoring period. However, during this monitoring period, GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be commissioned. Thus, only 1 set of equipment were used, i.e. for Gas Engine No.1.

Value (s) of monitored parameter	

Months	Net electricity generated (Total electricity generated (EL4) – electricity consumed from GE for Flare No.1 & Flare No.2 & GE auxiliaries (EL3) (MWh)	Electricity sell to grid (MWh) - recorded by grid operator EL5 (MWh)	
		Main energy meter	Check energy meter
January 13	567.11	555.94	556.21
February 13	527.95	523.53	523.79
March 13	567.26	556.29	556.57
April 13	490.22	480.64	480.88
May 13	260.34	266.09	266.23
June 13	0.00	0.00	0.00
July 13	73.79	78.13	78.17
August 13	547.36	536.53	536.81
Total	**3,034**	**2,997**	**2,999**

The reading for EL3 is tabulated under quantity of electricity consumed by project activity ($EL_{PJ,y}$) table below.

There were 2 power meters used to measure the amount of electricity sold to the grid, i.e. the main energy meter and check energy meter. Only the readings recorded by the main energy meter was used by the grid operator and the project participant in the calculation of CERs while the readings recorded by the check energy meter were only used to check or confirm on the readings recorded by the main energy meter.

From the comparison of the EL4 – EL3 and EL5 (main meter) values above, the lower value between the two is taken for the calculation of CERs.

Months	Net amount of electricity generated (MWh)
January 13	555.94
February 13	523.53
March 13	556.29
April 13	480.64
May 13	260.34
June 13	0.00
July 13	73.79
August 13	536.53
Total	**2,987**

GSS (Gas Engine No. 2 and 3)

Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.

<table>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th rowspan="3">Item</th><th>Flare No.2 Description (EL4)</th><th colspan="2">Flare No.2 Description (EL5)</th></tr>
<tr><th rowspan="2">01/01/2013 – 31/08/2013</th><th colspan="2">01/01/2013 – 31/08/2013</th></tr>
<tr><th>Main energy meter</th><th>Check energy meter</th></tr>
<tr><td>Type</td><td>EDMI Limited (Mk6E) Power Meter</td><td colspan="2">Itron (SL761A071) Power Meter</td></tr>
<tr><td>Accuracy class</td><td>Class 0.5S</td><td colspan="2">Class 0.20</td></tr>
<tr><td>Serial No.</td><td>210225256</td><td>53099690</td><td>53099691</td></tr>
<tr><td>Calibration frequency</td><td>24 months</td><td colspan="2">5 years</td></tr>
<tr><td>Date of last calibration</td><td>23/07/2012</td><td colspan="2">01/04/2011</td></tr>
<tr><td>Validity</td><td>24 months</td><td colspan="2">5 years (Type 2 according to the Malaysian Grid Code, version 1/2010)</td></tr>
</table>
There was no reading from 18/05/2013 – 25/07/2013 for EL4 as there was no power generated from Gas Engine No. 1 (engine was still undergoing major overhaul).
<u>GSS (Gas Engine No. 2 and 3)</u>
Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency</td><td> Measured continuously with electricity meter installed. The net amount of electricity generated shall be derived by deducting the amount consumed by the project activity (EL3, EL7 and EL8) from the gross generated amount recorded by installed electricity meter (EL4, EL9 and EL10). </td></tr>
<tr><td>Calculation method (if applicable)</td><td>NA</td></tr>
<tr><td>QA/QC procedures</td><td> As a quality control procedure, the amount of electricity actually uploaded to grid will be measured by other electricity meters (EL5 and EL11) and compared with the net amount derived from above. Lower value of the amount will be taken as the net amount for emission reduction calculations. Electricity meters (except the meters owned by the grid operator, i.e. EL5 and EL11) will be checked and calibrated regularly according to manufacturer’s recommendations. The meters EL5 and EL11 are owned by the grid operator and thus, it is not within the control of the project. The calibration of this meter will be based on the grid operator’s requirement and standard practice. </td></tr>
<tr><td>Purpose of data</td><td>Baseline emission calculation</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

Data / Parameter	**$CEF_{elec,PR,y}$**
Unit	tCO_2/MWh
Description	Carbon emission factor of electricity
Measured/ Calculated/ Default	Calculated
Source of data	Grid connected baseline for Peninsular Malaysia for 2011 by Malaysian

	Green Technology Corporation (MGTC)
Value (s) of monitored parameter	**0.747** tCO_2/MWh based on the latest released grid connected baseline emission factor for Peninsular Malaysia for 2011
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	To be re-calculated with the latest release of grid connected baseline emission factor. The emission factor for year 2011 was applied for this monitoring period as this was the latest publicly released data for the grid emission factor for Malaysia during this monitoring period.
Calculation method (if applicable)	The $\mathbf{CEF_{elec,PR,y}}$ was calculated based on the *Tool to calculate the emission factor for an electricity system* (Version 2, EB 50)
QA/QC procedures	NA
Purpose of data	Baseline and Project emission calculation
Additional comment	-

Data / Parameter	**Operation of the energy plant (t)**
Unit	Hours
Description	Operation of the energy plant
Measured/ Calculated/ Default	Measured
Source of data	Based on actual documented operating hours. This parameter was measured separately for the gas engines, i.e. Gas Engine No.1 (1 meter), GSS (Gas Engine No. 2 and Gas Engine No. 3 – 1 meter for each gas engine). However, during this monitoring period, GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be commissioned. Thus, only the data for Gas Engine No.1 was recorded.
Value (s) of monitored parameter	(see table below)

Months	**Operating time (hr)**
January 13	720
February 13	661
March 13	718
April 13	673
May 13	377
June 13	0
July 13	127
August 13	666
Total	**3,942**

The operating time is calculated by using the reading on the 1st day of the following month (m+1) to deduct the reading on the 1st day of the current month (m). The reading used is the total of the operating time at operation hour and operation hour since oil change as stated in the Daily Monitoring Log Sheet for Gas Engine No.1, row No. 6.

	GSS (Gas Engine No. 2 and 3) Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Monitoring equipment	The operation time of the Gas Engine No.1 is recorded by the Gas Engine SCADA system known as Total Energy Management (TEM) Evo System. The operation hour of the Gas Engine No.1 is based on the signal provided by the power meter (EL4). **GSS (Gas Engine No. 2 and 3)** Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Measuring/ Reading/ Recording frequency	The operation time is recorded continuously and aggregated into monthly data. A daily reading and recording is taken.
Calculation method (if applicable)	NA
QA/QC procedures	The system will be checked periodically by the engine manufacturer during servicing. The source of the operational hours is from the power meters EL4, EL9 and EL10 which is calibrated regularly according to requirement by the manufacturer.
Purpose of data	NA
Additional comment	-

Data / Parameter	**$EL_{PJ,y}$**
Unit	MWh
Description	Quantity of electricity consumed by project activity
Measured/ Calculated/ Default	Measured
Source of data	Based on continuous measurement by sealed electricity meter installed. This parameter was measured separately for: a) Flare No. 1, Flare No. 2 and Gas Engine No.1 – 1 meter (EL1) b) Flare No. 1, Flare No. 2, Gas Engine No.1 and GSS (Gas Engine No. 2 and Gas Engine No. 3) – 1 meter (EL6) However, during this monitoring period, GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be commissioned. Thus, only the data for Flare No. 1, Flare No. 2 and Gas Engine No.1 (EL1) was recorded.
Value (s) of monitored parameter	

Months	Electricity consumed (from grid for project activity-flaring system & Gas Engine No.1) (EL1) (MWh)	Electricity consumed (from GE for Flare No.1 & Flare No.2 & GE auxiliaries) (EL3) (MWh)
January 13	81.63	0.00
February 13	49.61	30.41
March 13	78.47	2.62
April 13	68.91	2.86
May 13	49.75	7.81
June 13	23.57	0.00
July 13	39.12	0.00

	<table><tr><td>August 13</td><td>78.01</td><td>0.00</td></tr><tr><td>**Total**</td><td>**469**</td><td>**44**</td></tr></table> Electricity consumed from the Gas Engine for Flare No.1 & Flare No.2 and Gas Engine No.1 auxiliaries (EL3) is not included in the calculation of project emission as the electricity is generated from landfill gas. **GSS (Gas Engine No. 2 and 3)** Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Monitoring equipment	<table><tr><td rowspan="2">**Item**</td><td>**Electricity consumed (from grid for Flare No.1 & Flare No.2) (EL1)**</td><td>**Electricity consumed (from GE for Flare No.1 & Flare No.2 & GE auxiliaries) (EL3)**</td></tr><tr><td>**01/01/2013 – 31/08/2013**</td><td>**01/01/2013 – 31/08/2013**</td></tr><tr><td>Type</td><td>IME NEMO 96HD+ (MF96021) Power Meter</td><td>IME NEMO 96HD+ (MF96021) Power Meter</td></tr><tr><td>Accuracy class</td><td>Class 0.5S (± 0.5%)</td><td>Class 0.5S (± 0.5%)</td></tr><tr><td>Serial No.</td><td>2167 8900 35</td><td>2175 4100 36</td></tr><tr><td>Calibration frequency</td><td>36 months</td><td>36 months</td></tr><tr><td>Date of last calibration</td><td>10/05/2011</td><td>21/06/2012</td></tr><tr><td>Validity</td><td>3 years according to manufacturer's recommendation</td><td>3 years according to manufacturer's recommendation</td></tr></table> **Flare No.2** There was no reading recorded from 01/01/2013 - 19/02/2013, 02/03/2013, 04/03/2013 – 01/04/2013, 03/04/2013 – 13/05/2013, 16/05/2013 – 17/05/2013 and 26/07/2013 – 31/08/2013 as no electricity from gas engine was used for gas engine auxilliaries and flare. There was no reading from 18/05/2013 – 25/07/2013 for EL3 as there was no power generated from Gas Engine No. 1 (engine was still undergoing major overhaul). **GSS (Gas Engine No. 2 and 3)** Data not available for this monitoring period as GSS (Gas Engine No. 2 and Gas Engine No. 3) was yet to be in operation.
Measuring/ Reading/ Recording frequency	Continuous measurement
Calculation method (if applicable)	NA
QA/QC procedures	The electricity meter was tested and calibrated as per the specifications prescribed by the manufacturer
Purpose of data	Project emission calculation
Additional comment	-

Data / Parameter	$T_{flare,y}$

Unit	°C
Description	Temperature in exhaust gas of the enclosed flare
Measured/ Calculated/ Default	Measured
Source of data	Continuous measurement by temperature meter. This parameter was measured separately for both flares, i.e. Flare No.1 and Flare No.2. Therefore, 2 sets of equipment were used for the monitoring period.
Value (s) of monitored parameter	(see table below)
Monitoring equipment	(see tables below)

Months	**Flare No.1 Value (°C)**	**Flare No.2 Value (°C)**
January 13	754.19	830.66
February 13	749.85	841.21
March 13	745.52	867.50
April 13	774.05	844.28
May 13	886.14	876.14
June 13	772.89	771.15
July 13	817.38	856.84
August 13	782.72	827.79
Average	**785.34**	**839.45**

Item	**Flare No.1 Description**		
	01/01/2013 – 30/05/2013	**30/05/2013 –25/07/2013**	**25/07/2013 – 31/08/2013**
Type	PR Electronics	Honeywell	PR Electronics
Accuracy class	≤ ± 0.05% of span	± 0.5%	≤ ± 0.05% of span
Serial No.	100906480	B235039237	110910943
Calibration frequency	Annually		
Date of last calibration	07/12/2012	24/12/2011	19/07/2013
Validity	1 year		

Item	**Flare No. 2 Description**	
	01/01/2013 – 25/04/2013	**25/04/2013 – 31/08/2013**
Type	Honeywell (STT25M-0-EN0-000-000-000-00 3D)Temperature Transmitter	
Accuracy class	± 0.5% of span	
Serial No.	B838901937	
Calibration frequency	Annually	
Date of last calibration	27/04/2012	25/04/2013
Validity	1 year	

Flare No.1

On 30/05/2013, there was a change of temperature transmitter from the 100906480 unit to B235039237 unit. Later, on 25/07/2013, the B235039237

	unit was replaced with 110910943 unit. The maximum permissible error of +0.5% was applied from 30/05/2013 - 25/07/2013 as a conservative approach. In normal cases, when MPE is not required to be applied to TT3 readings, TT3 readings below 500°C will not be taken into account as it is the base elimination temperature. However, in this case where MPE of 0.5% is required to be applied, the base elimination temperature has become 502.5 °C (500 °C x (100% + 0.5%)). With the error, the minimum temperature is 502.5 °C and any readings below this temperature are eliminated in the calculation, if any. However, there were no readings found between 500°C and 502.5°C and therefore, the CER calculations were not affected.
Measuring/ Reading/ Recording frequency	The enclosed flare is monitored continuously by a temperature meter
Calculation method (if applicable)	Data logged at 1 minute's interval was used to determine the default flaring efficiency for each hour in accordance to the *Tool to determine project emissions from flaring gases containing methane* (EB 28, Annex 13)
QA/QC procedures	The temperature meter was tested and calibrated as per the specifications prescribed by the manufacturer
Purpose of data	Project emission calculation
Additional comment	-

Data / Parameter	**Relevant policies and circumstances at the beginning of each crediting period**
Unit	NA
Description	NA
Measured/ Calculated/ Default	NA
Source of data	Monitoring of change of policies and circumstances was done by consultation with relevant governmental authorities (Department of Environment and Department of National Solid Waste Management, Malaysia)
Value (s) of monitored parameter	Not applicable during this monitoring period as it is not at the beginning of the next crediting period
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	To be checked at the beginning of each crediting period
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	NA
Additional comment	-

D.3. Implementation of sampling plan

Not applicable

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

The total baseline emissions according to ACM0001 (Version 8) were calculated according to the equations below:

$$BE_y = (MD_{project,y} - MD_{BL,y}) \cdot GWP_{CH4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} + ET_{LFG,y} \cdot CEF_{ther,BL,y}$$

BEy	Baseline emissions in year *y* (tCO_2e)
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario
$MD_{BL,y}$	The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirements, in tonnes of methane (tCH_4)
GWP_{CH4}	Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4
$EL_{LFG,y}$	Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year *y* (MWh)
$CEF_{elec,BL,y}$	CO_2 emissions intensity of the baseline source of electricity displaced (tCO_2e/MWh)
$ET_{LFG,y}$	The quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from on-site/off-site fossil fuel fired boiler, during the year *y* (TJ)
$CEF_{ther,BL,y}$	CO_2 emissions intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation (tCO_2e/TJ)

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y}$$

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH_4)
$MD_{electricity,y}$	Quantity of methane destroyed by generation of electricity (tCH_4)
$MD_{thermal,y}$	Quantity of methane destroyed for the generation of thermal energy (tCH_4)
$MD_{PL,y}$	Quantity of methane sent to the pipeline for feeding to the natural gas distribution network (tCH_4)

$$MD_{flared,y} = (LFG_{flare,y} \cdot w_{CH4} \cdot D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$$

$MD_{flared,y}$	Quantity of methane destroyed by flaring (tCH_4)
$LFG_{flare,y}$	Quantity of landfill gas fed to the flare(s) during the year *y* (m^3)
w_{CH4}	Average methane fraction of the landfill gas as measured during the year *y* (m^3CH_4 / m^3LFG)
D_{CH4}	Methane density (tCH_4 / m^3CH_4)
$PE_{flare,y}$	Project emission from flaring of the residual gas stream in year *y* (tCO_2e). This will be determined following the procedure set in the *"Tool to determine project emissions from flaring gases containing methane"*.

$$MD_{electricity,y} = LFG_{electricity,y} \cdot w_{CH4,y} \cdot D_{CH4}$$

$MD_{electricity,y}$	Quantity of methane destroyed be generation of electricity (tCH_4)
$LFG_{electricity,y}$	Quantity of landfill gas fed into the electricity generator (m^3LFG)
$w_{CH4,y}$	Average methane fraction of the landfill gas as measured during the year *y* (m^3CH_4 / m^3LFG)

Determination of $MD_{project,y}$ for Flare No.1

	$MD_{flared,y} = \{LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$								$MD_{project,y}$
Month	Quantity of LFG to Flare No.1 Flare No. 1,y (Nm3)	Methane average fraction Flare No.1 WCH4	Density of Methane Flare No.1 DCH4 (t/Nm3)	Total methane Flare No.1 (tCH4)	Global Warming Potential Flare No.1 GWP (tCO2/tCH4)	Emissions from methane Flare No.1 (tCO2e)	PE Flare No.1 (tCO2e)	Quantity of Methane destroyed by flaring MD flared,y (tCH4)	Quantity of methane that would have been destroyed MD project,y (tCH4)
Jan-13	1,195,626	0.52	0.0007168	447.98	25	11,199.61	1,136.61	402.52	402.52
Feb-13	1,131,772	0.52	0.0007168	420.67	25	10,516.87	1,052.22	378.59	378.59
Mar-13	1,126,950	0.52	0.0007168	419.86	25	10,496.45	1,118.77	375.11	375.11
Apr-13	1,087,733	0.55	0.0007168	431.61	25	10,790.21	1,123.58	386.66	386.66
May-13	1,138,978	0.58	0.0007168	475.92	25	11,898.04	1,205.51	427.70	427.70
Jun-13	983,543	0.56	0.0007168	395.04	25	9,875.95	1,009.23	354.67	354.67
Jul-13	1,143,918	0.56	0.0007168	461.81	25	11,545.18	1,210.09	413.40	413.40
Aug-13	1,140,358	0.54	0.0007168	440.26	25	11,006.46	1,140.43	394.64	394.64

Determination of $MD_{project,y}$ for Flare No.2

	$MD_{flared,y} = \{LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / GWP_{CH4})$								$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4}$			$MD_{project,y}$
Month	Quantity of LFG to Flare No.2 Flare No.2,y (Nm3)	Methane average fraction Flare No.2 WCH4	Density of Methane Flare No.2 DCH4 (t/Nm3)	Total methane Flare No.2 (tCH4)	Global Warming Potential Flare No.2 GWP (tCO2/tCH4)	Emissions from methane Flare No.2 (tCO2e)	PE Flare No.2 (tCO2e)	Quantity of Methane destroyed by flaring MD flared,y (tCH4)	Quantity of Landfill Gas Fed into the Electricity Generator No. 1 LFG electricity,y (m^3 LFG)	Average methane fraction of the landfill gas as measured WCH4	Quantity of methane destroyed by generation of electricity MD electricity,y (tCH4)	Quantity of methane that would have been destroyed MD project,y (tCH4)
Jan-13	1,297,312	0.61	0.0007168	568.56	25	14,214.04	1,421.39	511.71	304,777.23	0.61	133.57	645.28
Feb-13	1,176,253	0.61	0.0007168	518.38	25	12,959.47	1,297.20	466.49	293,130.77	0.61	129.18	595.67
Mar-13	1,310,044	0.63	0.0007168	589.63	25	14,740.77	1,493.39	529.90	300,347.90	0.63	135.18	665.08
Apr-13	1,178,702	0.63	0.0007168	535.62	25	13,390.45	1,407.82	479.31	261,925.61	0.63	119.02	598.33
May-13	1,201,288	0.64	0.0007168	550.23	25	13,755.86	1,418.45	493.50	146,802.15	0.64	67.24	560.74
Jun-13	934,343	0.59	0.0007168	394.49	25	9,862.22	1,043.90	352.73	0.00	0.59	0.00	352.73
Jul-13	1,272,421	0.62	0.0007168	561.70	25	14,042.45	1,415.15	505.09	43,356.83	0.62	19.14	524.23
Aug-13	1,230,711	0.60	0.0007168	525.97	25	13,149.32	1,395.41	470.16	291,134.93	0.60	124.42	594.58

	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13
Total quantity of LFG Flare & LFG Electricity (column B + column J)	1,602,089	1,469,384	1,610,391	1,440,627	1,348,091	934,343	1,315,778	1,521,846
Total quantity of LFG Total	1,614,745	1,487,105	1,641,668	1,473,314	1,415,068	955,875	1,347,269	1,578,555

For Flare No.2, from the monthly comparison of the FT1 and FT2 + FT3 in this monitoring period, the value of FT2 was used in the CER calculation since FT1 is greater than FT2 + FT3. Details on how the comparison was made and which values were used are explained in Section D.2 above for the parameters LFG_{total}, LFG_{flare} and $LFG_{electricity}$.

Determination of BE_y

	$(MD_{project,y} - MD_{BL,y}) * GWP_{CH4}$	BEy Flare No.1	$(MD_{project,y} - MD_{BL,y}) * GWP_{CH4}$	$EL_{LFG,y} \cdot CEF_{elec,BL,y}$			BEy Flare No.2
Month	Emissions from Flare No.1 (tCO2e)	Total Baseline Emissions Flare No.1 (tCO2e)	Emissions from Flare No.2 (tCO2e)	Total electricity generated EL,LFG,y (MWh)	CoEF for electricity Flare No.2 CEF electricity,y	Baseline Emission from electricity generation Flare No.2 (tCO2e)	Total Baseline Emissions Flare No.2 (tCO2e)
Jan-13	10,063.00	10,063.00	16,131.94	555.94	0.747	415.28	16,547.23
Feb-13	9,464.65	9,464.65	14,891.86	523.53	0.747	391.08	15,282.94
Mar-13	9,377.68	9,377.68	16,626.93	556.29	0.747	415.55	17,042.47
Apr-13	9,666.62	9,666.62	14,958.19	480.64	0.747	359.04	15,317.23
May-13	10,692.53	10,692.53	14,018.44	260.34	0.747	194.47	14,212.91
Jun-13	8,866.72	8,866.72	8,818.31	0.00	0.747	0.00	8,818.31
Jul-13	10,335.10	10,335.10	13,105.78	73.79	0.747	55.12	13,160.90
Aug-13	9,866.03	9,866.03	14,864.49	536.53	0.747	400.79	15,265.28

For this project, the following applies:

1. $MD_{thermal,y}$ and $MD_{PL,y}$ are not applicable (=0) to this project since there are no heat generation and

feeding to natural gas pipeline

2. For this project, $MD_{BL,y}$ is zero since there are no destruction or combustion of methane today due to regulatory a 2nd contractual requirements
3. $ET_{LFG,y}$ and $CEF_{ther,BL,y}$ are not applicable (=0) to this project since there are no thermal energy production
4. Density of methane for Flare No.2 LFG is obtained from ACM 0001, version 8.0, page 14
5. Power generation of landfill gas was only implemented in June 2011
6. The grid connected baseline for Peninsula Malaysia for 2011 was applied to this project and the $CEF_{electricity,y}$ calculated was 0.747tCO_2/MWh
7. $MD_{electricity,y}$ is not applicable (=0) for Flare No.1 during this monitoring period as no LFG from Flare No.1 sent to Gas Engine No.1
8. $EL_{LFG,y}$ and $CEF_{elec,BL,y}$ are not applicable (=0) for Flare No.1 during this monitoring period as no LFG from Flare No.1 sent to Gas Engine No.1
9. The total electricity generated is the amount based on the invoices to the grid operator (Tenaga National Berhad) which is the lower reading from the comparison between (EL4 - EL3) and EL5

E.2. Calculation of project emissions or actual net GHG removals by sinks

The total project emissions according to ACM0001 (Version 8) were estimated according to the equations below:

$$PE_y = PE_{EC,y} + PE_{FC,j,y}$$

$$PE_{EC,y} = EC_{PJ,y} \cdot EF_{grid,y} \cdot (1+TDL_y)$$

$PE_{EC,y}$	Project emissions from consumption of electricity by the project activity during the year y (tCO2e/yr)
$EC_{PJ,y}$	Quantity of electricity consumed by the project activity during the year y (MWh)
TDL_y	Average technical transmission and distribution losses in the ECPG in the year y for the voltage level at which electricity is obtained from the grid at the project site
EF_{grid}	Emission factor for the grid in year y (tCO2eq/MWh)

Month	Electricity consumed by project activity ELPJ,y (MWh)	Coefficient for grid electricity EF grid,y	Transmission and Distribution Losses TDL,y	Total Project Emission from project activity (tCO2e)
Jan-13	81.63	0.747	0.1	67.07
Feb-13	49.61	0.747	0.1	40.77
Mar-13	78.47	0.747	0.1	64.48
Apr-13	68.91	0.747	0.1	56.62
May-13	49.75	0.747	0.1	40.88
Jun-13	23.57	0.747	0.1	19.37
Jul-13	39.12	0.747	0.1	32.15
Aug-13	78.01	0.747	0.1	64.10

For this project, the following applies:

1. $PE_{fc,y}$ is zero as no heat from fossil fuel is used to generate electricity for this project
2. The grid connected baseline for Peninsula Malaysia for 2011 was applied to this project and the $EF_{grid,y}$ calculated was 0.747tCO_2/MWh
3. TDL = 10% adopted as stated in PDD page 35 (TNB annual report 2007) (http://announcements.bursamalaysia.com/EDMS%5Csubweb.nsf/LsvAllByID/8B0DC73587EFBC114825750B0033ED71?OpenDocument)

E.3. Calculation of leakage

No leakage.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
January 13	26,609	68	0	26,541
February 13	24,746	41	0	24,705
March 13	26,419	65	0	26,354
April 13	24,983	57	0	24,926
May 13	24,904	41	0	24,863
June 13	17,684	20	0	17,664
July 13	23,495	33	0	23,462
August 13	25,131	65	0	25,066
Total	**193,971**	**390**	**0**	**193,581**

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	175,229	193,581

** Ex-ante for 243 days (January – August 13) – 263,204 x (243/365)*

E.6. Remarks on difference from estimated value in registered PDD

The total CERs claimed was about 9% higher as compared to the value reported in the ex-ante calculations. The higher CERs for this monitoring period were mainly due to:

1. The default value of GWP updated from 21 to 25. With reference to decision 4/CMP7 and paragraph 66 of the EB 69 Meeting Report, for the second commitment period of the Kyoto Protocol, the global warming potentials used by Parties to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of the greenhouse gases listed in Annex A to the Kyoto Protocol shall be those listed in the column entitled “Global Warming Potential for Given Time Horizon” in Table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon, i.e. 25 tCO_2/tCH_4. This factor has contributed a significant impact to the increase in CERs.
2. The ex-post average methane concentration of 62% which was higher compared to the ex-ante value of 50% (at the time of registration as stated in the approved, revised PDD. Please refer to the revised PDD, version 7.2 and 6th monitoring period CER Calculation Sheet for details).
3. Both flares have low downtime and have operated at high efficiency (refer to 7th monitoring period CER Calculation Sheet and System Shutdown Forms recorded on-site).

Month	Time (minute) from January - August 2013		% of total flare running time
	Total actual flare running time	Total time	
Flare 1	338,705	349,920	97
Flare 2	337,558	349,920	96

Note: The total running time of the flares is calculated from the information provided in the System Shutdown Forms recorded on-site

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	Not applicable	193,581

Appendix 1: Details on the downtime of Flare No.1

Date	Flaring stopped		Reason	Remarks
	From	To		
07/01/2013	8:45	15:30	Maintenance	F1 - to check flame arrester (differential pressure) filter elements for flame arrester
14/01/2013	19:31	19:44	Exceed Set Point Limit	Flare 1 shut down at 19:31, CH4 exceed set point limit
17/01/2013	15:35	15:54	Equipment Breakdown	To check CO2 analyzer signal output = 0%. Check signal isolator and found that power for signal isolator problem. Change signal isolator
31/01/2013	9:21	16:51	Maintenance	Relocate chiller box panel - preparation for installation of partition to analyser - cold room with air-cond
03/03/2013	5:57	6:31	Equipment Breakdown	Gas analyzer MCB trip due to GE1 engine tripped - F4 close - power surge
05/03/2013	9:08	16:22	Maintenance	Service Flare 1 Maintenance: 1. Condensate tank 2. Moisture separator filter + pump + change filter
07/03/2013	21:33		Power Failure	Due to power surge, main flare is not detected and blower - No. 1 tripped. Flare 1 unable to detect pilot/main flame. After several trial unable to restart
08/03/2013		9:05		
08/03/2013	20:42		Equipment Breakdown	F1 - CH4 reading too low, unable to restart. Found that CH4 analyzer reading incorrect. Changed CH4 analyser
09/03/2013		10:22		
12/03/2013	8:41	8:58	Power Failure	Power surge. Caused Flare 1 shutdown
12/03/2013	11:23	12:41	Maintenance	Flare 1 shutdown - requested by Hydrocare for blower service
13/03/2013	11:07	12:39	Equipment Breakdown	Flare 1 - CO2 analyser problem to send for repair. One Gasmaster using constant value CO2 @ 40.00 for temporary measure
28/03/2013	9:34	11:24	Maintenance	Contractor - Chein Soon to take measurement for flare stack roof - replacement for flare stack roof
03/04/2013	6:44	7:06	Maintenance	To isolate / check LFG system due to Flare 2 CH4 analyzer problem
10/04/2013	14:23	15:33	Maintenance	Interlinx to install UPS (replace old unit) at Flare 1 control room
16/04/2013	9:15	9:58	Maintenance	Need to shutdown to check and

				change MCCB for MSB panel LV room
18/04/2013	11:15	17:02	Others	Istiq - to install partition at Flare 1 for Gas Analyser
19/04/2013	18:37	18:44	Exceed Set Point Limit	CH4 below danger set point
23/04/2013	8:45	9:34	Equipment Breakdown	To check on air compressor for pneumatic valve malfunction
23/04/2013	14:54	16:11	Equipment Breakdown	Main flare not detected. Blower fault. Unable to restart immediately due to 'pilot flame not detected' problem
24/04/2013	9:10	10:23	Equipment Breakdown	To re-check air compressor for pneumatic valve tariff - problem with contractor - replace
25/04/2013	14:10	17:07	Others	Annual calibration - CDM equipment. 2 equipments - PT1/FT1 + replace pressure switch
26/04/2013	15:03	16:24	Maintenance	To re-check air compressor for the pneumatic valve fault - problem with contractor
26/04/2013	22:34	22:37	Equipment Breakdown	Main flare is not detected
27/04/2013	11:43	12:22	Maintenance	To replace contactor at air compressor for pneumatic valve. To replace ball valve at air compressor
09/05/2013	9:23	15:55	Maintenance	GE1/F1/F2 proper shutdown for Flare stack works - both flares. Replacement of flare stack roof for Flare 1 and Flare 2 by Chien Soon. Minor repaint flare stack
15/05/2013	10:48	10:58	Power Failure	Isolation transformer tripped (F4 closed). CH4 below danger set point
25/05/2013	20:58		Equipment Breakdown	Due to power failure, Flare 1 shutdown & pilot flame not detected when restart
26/05/2013		1:12		
30/05/2013	16:08		Power Failure	TNB power failure. Unable to restart immediately due to TT3 problem. Changed TT3 transmitter and TT3 thermocouple sensor - in house team
31/05/2013		17:35		
	18:11		Equipment Breakdown	Blower #1 failure. Unable to restart Flare 1
01/06/2013		11:12		
04/06/2013	19:04	19:11	Power Failure	TNB power surge
06/06/2013	10:14		Power Failure	TNB power failure at site. TNB maintenance works at PPU
07/06/2013		12:50		
11/06/2013	11:29	14:19	Power Failure	TNB Power failure
13/06/2013	9:01	9:03	Exceed Set Point Limit	O2 is above danger set point
04/07/2013	14:20	17:09	Power Failure	TNB Power failure at site
05/07/2013	12:11	14:34	Power Failure	TNB Power failure at site
05/07/2013	15:31	19:26	Maintenance	O2 above Danger set point, service condensate tank. Water pump problem. Wire cable damage
08/07/2013	9:04	16:59	Maintenance	Advance Phase-condensate tank to flare 1-major service. Remove sludge from condensate tank. Found pump problem. Condensate tank-replace with new submersible pump, major service

09/07/2013	14:52	15:44	Maintenance	Condensate tank (main pipe) - replace with new submersible pump service + check tank condition
13/07/2013	15:19	17:21	Power Failure	TNB Power failure at site
25/07/2013	13:31	15:21	Maintenance	Install TT3 with repaired probe sensor t new transmitter-Supplied by Nectar
04/08/2013	10:33	11:44	Power Failure	Flare 1 Shutdown due to TNB failure
16/08/2013	22:48	2:25	Others	Flare 1 shutdown due to O_2 High. Unable to restart - check analyser tubings/well heads/main gas
20/08/2013	8:44	8:58	Power Failure	Main power supply trip - Reset & Restart
22/08/2013	11:24	11:39	Others	Testing for advance phase gas (O_2) performance
23/08/2013	10:50	11:35	Others	Testing for advance phase gas (O_2) performance + check condensate tank
23/08/2013	15:23	15:26	Others	Testing for advance phase gas (O_2) performance

Appendix 2: Details on the downtime of Flare No.2

Date	Flaring stopped		Reason	Remarks
	From	To		
12/03/2013	8:33	9:05	Power Failure	Power surge - cause blower trip, Flare 2 shutdown
16/03/2013	9:53	10:07	Maintenance	F2 - to check blower lube oil level - leaking top-up lube oil for blower #2
20/03/2013	15:20	15:51	Exceed set point limit	F2 - CH4 below danger set point. PLC signal lost
28/03/2013	12:08	15:12	Maintenance	Scheduled maintenance - blower service, change oil seal - Hydrocare
03/04/2013	6:02	8:31	Equipment Breakdown	F2 - CH4 below danger set point. To check CH4 analyser - tubing/sensor. Found that PLC signal received from instruments - fail
04/04/2013	17:26	18:34	Equipment Breakdown	F2 - CH4 below danger set point. To check CH4 analyser - tubing/sensor. Found that PLC signal received from instrument - fail
04/04/2013	19:58	20:51	Equipment Breakdown	F2 - CH4 below danger set point. PLC signal received from instrument - fail
05/04/2013	0:04	0:11	Equipment Breakdown	F2 - CH4 below danger set point. PLC signal received from instrument. Fail. Restart F2 immediately to ensure LFG constant supply to GE1
05/04/2013	16:47	17:07	Maintenance	To check PLC & computer connection - signal communication
10/04/2013	22:45	22:51	Equipment Breakdown	Main flame not detected. Few seconds data loss. No signal from PLC

12/04/2013	2:24	2:56	Equipment Breakdown	Main flame not detected. TT3 below 50 degree Celcius
12/04/2013	4:25	4:37	Equipment Breakdown	Main flame not detected. Few seconds data loss
12/04/2013	7:02	7:08	Equipment Breakdown	Main flame not detected. Few seconds data loss
12/04/2013	7:38	7:55	Equipment Breakdown	Main flame not detected. Few seconds data loss
12/04/2013	16:01	16:31	Others (Main flame not detected)	Main flame not detected. Few seconds data loss
13/04/2013	5:25	5:28	Equipment Breakdown	Main flame not detected. Few seconds data loss
16/04/2013	9:10	10:07	Equipment Breakdown	To check PLC missing data problem. To change PLC network model as recommended by Fairyland
25/04/2013	10:33	14:19	Others	Annual Calibration - CDM equipment. 6 equipment- PT1/ PT2/ FT1/ FT2/ TT1/ TT3
09/05/2013	9:12	16:00	Maintenance	GE1/ F2/ F1 proper shutdown for Flare stack works. Both flares. Replacement of flare stack roof, for Flare 1 & Flare 2, by Chien Soon - Minor repaint flare stack
25/05/2013	20:54		Power Failure	Due to power failure on site, Flare 2 shutdown
26/05/2013		1:32		
30/05/2013	16:07		Power Failure	TNB power failure
31/05/2013		15:01		
04/06/2013	19:02	19:35	Power Failure	TNB power surge
06/06/2013	10:19		Others	TNB total shutdown for site area- BTSL. When TNB power restored back @ 07/06/13 (noon)- unable to restart the computer. Mr. Zhang (Fairyland) checked and found CPU computer- Flare 2 problem
11/06/2013		6:57		
25/06/2013	14:20	14:30	Exceed set point limit	PT1 above danger set point due to testing at Ph1 & Ph2A extraction wells- max flow rate
4/7/2013	14:18	17:15	Power Failure	TNB power failure at site
5/7/2013	12:08	14:46	Power Failure	TNB power failure at site
13/7/2013	15:17	17:29	Power Failure	TNB power failure at site
21/7/2013	16:32	18:14	Equipment Breakdown	Main Flame not detected. SCADA /computer system error
4/8/2013	10:31	11:28	Power Failure	Flare 2 Shutdown due to TNB failure
4/8/2013	18:05	18:17	Power Failure	Flare 2 Trip due to surge.
8/8/2013	20:09	21:17	Equipment Breakdown	Flare 2 Shutdown due to UPS failure.
9/8/2013	0:04	10:12	Equipment Breakdown	UPS Failure - Batteries problem Replaced by using GSS batteries.
15/8/2013	11:32	12:32	Maintenance	To change UPS batteries - new batteries for UPS backup power.
16/8/2013	8:14	9:25	Equipment Breakdown	UPS Fail to backup - computer & PLC system power failure.
25/8/2013	17:48	17:58	Maintenance	Due to Pneumatic Valve air leaking - change to new tube.

27/8/2013	17:19	18:21	Power Failure	F2 sudden shut down due to power failure for PLC & computer system. To check for possible cause

Appendix 3: Details on the downtime of Gas Engine No.1

Date	Gas Engine No.1 Stopped		Description Of Event
	From	To	
03/01/2013	22:40		GDU malfunction which caused gas temperature high
04/01/2013		09:40	
04/03/2013	23:54		Reverse VAR
05/03/2013		0:21	
12/04/2013	10:34		SPE/Enercon-modification works @ GCP to install baseload control knob - for operation GE 1
13/04/2013		5:36	
17/05/2013	11:15		GE1-Fault-Critical Fault SPE to check GE condition before restart. Major engine fault
31/05/2013		23:59	
01/06/2013	0:00		GE - Fault: Critical Fault - SPE to check GE conditions before restart. Major engine fault
30/06/2013		23:59	
01/07/2013	0:00		GE 1 restart after long down time for major engine overhaul By SPE
25/07/2013		11:49	
30/07/2013	15:55		SPE to check Jacket water Engine Outlet T206 - Alarm + Fault
31/07/2013		20:27	
04/08/2013	10:31		GE Shutdown due to power failure.
05/08/2013		11:58	
08/08/2013	20:09		Proper Shutdown due to Flare 2 problem with UPS batteries. Unable to restart.
09/08/2013		13:01	
25/08/2013	14:16		Reverse VAR. Unable to restart - engine problem. Just crank but no restart.
26/08/2013		13:05	

Appendix 4: Description on the calculation applied in ER Calculation Sheet for Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 2.0

Referring to the tools, for LFG temperatures below 60 ^{o}C, moisture could be neglected due to its very low influence on final results and thus, the measurement in wet or dry basis is not important (as reflected in the amendments to ACM 0001, version 9.1 onwards). In the case where the LFG temperature exceeds 60^{o}C, the same basis for both methane concentration and flow measurement will be considered according to the tools.

There are 6 measurement options as tabulated below:

Option	Flow of gaseous stream	Volumetric fraction
A	Volume flow – dry basis	dry or wet basis[3]
B	Volume flow – wet basis	dry basis
C	Volume flow – wet basis	wet basis
D	Mass flow – dry basis	dry or wet basis
E	Mass flow – wet basis	dry basis
F	Mass flow – wet basis	wet basis

During this monitoring period, for Flare No.1 with LFG temperature exceeding 60^{o}C, option B measurement was selected and was applied in the CER calculation.

<u>**Determination of the absolute humidity of the gaseous stream**</u>

The absolute humidity is a parameter required for Option B. It can be determined from the measurement of

moisture content (Option 1) or by assuming the gaseous stream is dry or saturated in a simplified conservative approach (Option 2).

Option 2 which assumes that the gaseous stream is dry or saturated in a simplified conservative approach was selected for the CER calculation.

Option 2: Simplified calculation without measurement of the moisture content

This option provides a simple and conservative approach to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. If it is conservative to assume that the gaseous stream is dry, then $m_{H2O,t,db}$ is assumed to equal to 0. If it is conservative to assume that the gaseous stream is saturated, then $m_{H2O,t,db}$ is assumed to be equal to the saturation absolute humidity ($m_{H2O,t,db,sat}$) and is calculated using the equation below:

$$m_{H2O,t,db,Sat} = \frac{p_{H2O,t,Sat} * MM_{H2O}}{(P_t - p_{H2O,t,Sat}) * MM_{t,db}}$$

Where:

$m_{H2O,t,db,sat}$	=	Saturation absolute humidity in time interval *t* on a dry basis (kg H_2O/kg dry gas)
$p_{H20,t,Sat}$	=	Saturation pressure of H_2O at temperature T_t in time interval t (Pa)
T_t	=	Temperature of the gaseous stream in time interval *t* (K)
P_t	=	Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_{H2O}	=	Molecular mass of H_2O (kg H_2O/kmol H_2O)
$MM_{t,db}$	=	Molecular mass of the gaseous stream in a time interval *t* on a dry basis (kg dry gas/kmol dry gas)

Parameter	Formula/ description
$p_{H20,t,Sat}$	1 / 2 / — ; Filonenko/ Ginzburg (1973) and Filonenko et al. (1971) / 0…100 / $p_S = \exp(6.416 + 17.3 \cdot t / (238+t))$, P_s – Saturation pressure of H_2O t – LFG Temperature
P_t	**Absolute Pressure** $P_a = P_g + P_{at}$ $P_a = P_g + 101325$ where, P_a = Absolute Pressure, P_g = Gauge Pressure, P_{at} = Atmospheric Pressure.
MM_{H2O}	18.0152 kg/kmol Default value from the tool

$MM_{t,db}$	$$MM_{t,db} = \sum_{k}(v_{k,t,db} * MM_k)$$ Where: $MM_{t,db}$ = Molecular mass of the gaseous stream in time interval *t* on a dry basis (kg dry gas/kmol dry gas) $v_{k,t,db}$ = Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis (m^3 gas k/m^3 dry gas) MM_k = Molecular mass of gas *k* (kg/kmol) k = All gases, except H_2O, contained in the gaseous stream (e.g. N_2, CO_2, O2, CO, H2, CH_4, N_2O, NO, NO2, SO_2, SF_6 and PFCs). See available simplification below Default value for $MM_{i,k}$, Gases involve in the calculation are CH_4, CO_2, and O_2

Data / Parameter:	MM_i		
Data unit:	kg/kmol		
Description:	Molecular mass of greenhouse gas *i*		
Value to be applied:	Compound	Structure	Molecular mass (kg / kmol)
	Carbon dioxide	CO_2	44.01
	Methane	CH_4	16.04
	Nitrous oxide	N_2O	44.02
	Sulfur hexafluoride	SF_6	146.06
	Perfluoromethane	CF_4	88.00
	Perfluoroethane	C_2F_6	138.01
	Perfluoropropane	C_3F_8	188.02
	Perfluorobutane	C_4F_{10}	238.03
	Perfluorocyclobutane	$c\text{-}C_4F_8$	200.03
	Perfluoropentane	C_5F_{12}	288.03
	Perfluorohexane	C_6F_{14}	338.04
Any comment:			

Data / Parameter:	MM_k		
Data unit:	kg/kmol		
Description:	Molecular mass of gas *k*		
Value to be applied:	For gases *k* that are greenhouse gases appy values for MM_i.		
	Compound	Structure	Molecular mass (kg / kmol)
	Nitrogen	N_2	28.01
	Oxygen	O_2	32.00
	Carbon monoxide	CO	28.01
	Hydrogen	H_2	2.02
	Nitric oxide	NO	30.01
	Nitrogen dioxide	NO_2	46.01
	Sulfur dioxide	SO_2	64.06
Any comment:			

Option B of measurement options

The volumetric flow of the gaseous stream in time interval *t* on a dry basis ($V_{t,db}$) is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

$$V_{t,tb} = V_{t,wb}/(1 + v_{H2O,t,db})$$

Where:

$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m³ dry gas/h)
$V_{t,wb}$	=	Volumetric flow of the gaseous stream in time interval *t* on a wet basis (m³ wet gas/h)
$v_{H2O,t,db}$	=	Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m³ H_2O/m³ dry gas)

The volumetric fraction of H_2O in time interval *t* on a dry basis ($v_{H2O,t,db}$) is estimated according to the equation below:

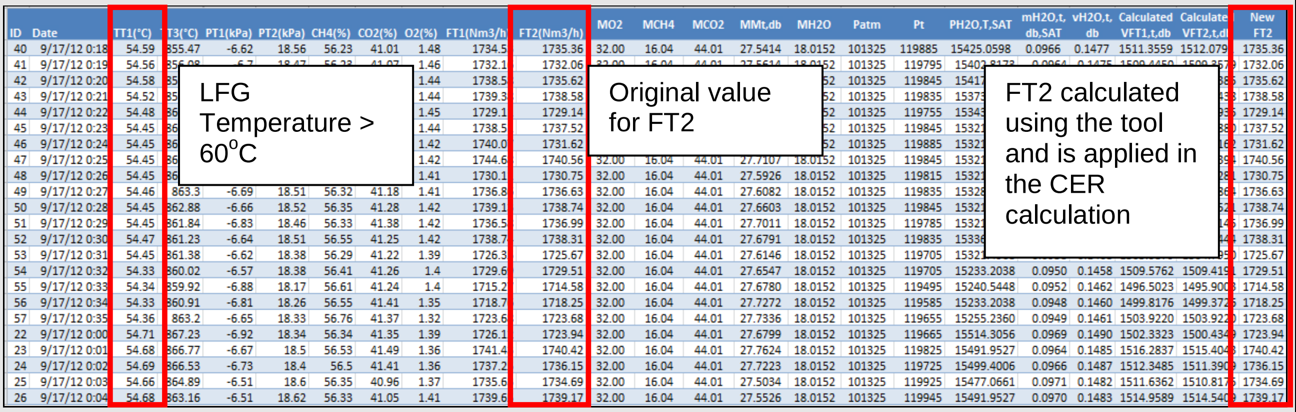
$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$

Where:

$v_{H2O,t,db}$	=	Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m³ H_2O/m³ dry gas)
$m_{H2O,t,db}$	=	Absolute humidity in the gaseous stream in time interval *t* on a dry basis (kg H_2O/kg dry gas)
$MM_{t,db}$	=	Molecular mass of the gaseous stream in time interval *t* on a dry basis (kg dry gas/kmol dry gas)
MM_{H2O}	=	Molecular mass of H_2O (kg H_2O/kmol H_2O)

The absolute humidity of the gaseous stream ($m_{H2O,t,db}$) is determined using Option 2 above ($MM_{t,db}$) which is as demonstrated above.

Example of the calculation using the *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*, version 2.0.



ID	Date	TT1(°C)	TT3(°C)	PT1(kPa)	PT2(kPa)	CH4(%)	CO2(%)	O2(%)	FT1(Nm3/h)	FT2(Nm3/h)
40	9/17/12 0:18	54.59	855.47	-6.62	18.56	56.23	41.01	1.48	1734.5	1735.36
41	9/17/12 0:19	54.56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.46	1732.1	1732.06
42	9/17/12 0:20	54.58	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.44	1738.5	1735.62
43	9/17/12 0:21	54.52	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.44	1739.3	1738.58
44	9/17/12 0:22	54.48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.45	1729.1	1729.14
45	9/17/12 0:23	54.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.44	1738.5	1737.52
46	9/17/12 0:24	54.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.42	1740.0	1731.62
47	9/17/12 0:25	54.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.42	1744.6	1740.56
48	9/17/12 0:26	54.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.41	1730.1	1730.75
49	9/17/12 0:27	54.46	863.3	-6.69	18.51	56.32	41.18	1.41	1736.8	1736.63
50	9/17/12 0:28	54.45	862.88	-6.66	18.52	56.35	41.28	1.42	1739.1	1738.74
51	9/17/12 0:29	54.45	861.84	-6.83	18.46	56.33	41.38	1.42	1736.5	1736.99
52	9/17/12 0:30	54.47	861.23	-6.64	18.51	56.55	41.25	1.42	1738.7	1738.31
53	9/17/12 0:31	54.45	861.38	-6.62	18.38	56.29	41.22	1.39	1726.3	1725.67
54	9/17/12 0:32	54.33	860.02	-6.57	18.38	56.41	41.26	1.4	1729.6	1729.51
55	9/17/12 0:33	54.34	859.92	-6.88	18.17	56.61	41.24	1.4	1715.2	1714.58
56	9/17/12 0:34	54.33	860.91	-6.81	18.26	56.55	41.41	1.35	1718.7	1718.25
57	9/17/12 0:35	54.36	863.2	-6.65	18.33	56.76	41.37	1.32	1723.6	1723.68
22	9/17/12 0:00	54.71	867.23	-6.92	18.34	56.34	41.35	1.39	1726.1	1723.94
23	9/17/12 0:01	54.68	866.77	-6.67	18.5	56.53	41.49	1.36	1741.4	1740.42
24	9/17/12 0:02	54.69	866.53	-6.73	18.4	56.5	41.41	1.36	1737.2	1736.15
25	9/17/12 0:03	54.66	864.89	-6.51	18.6	56.35	40.96	1.37	1735.6	1734.69
26	9/17/12 0:04	54.68	863.16	-6.51	18.62	56.33	41.05	1.41	1739.6	1739.17

ID	MO2	MCH4	MCO2	MMt,db	MH2O	Patm	Pt	PH2O,T,SAT	mH2O,t, db,SAT	vH2O,t, db	Calculated VFT1,t,db	Calculated VFT2,t,db	New FT2
40	32.00	16.04	44.01	27.5414	18.0152	101325	119885	15425.0598	0.0966	0.1477	1511.3559	1512.079	1735.36
41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101325	119795	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1732.06
42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101325	119845	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1735.62
43	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101325	119835	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1738.58
44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101325	119755	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1729.14
45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101325	119845	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1737.52
46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101325	119885	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1731.62
47	32.00	16.04	44.01	27.7107	18.0152	101325	119845	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1740.56
48	32.00	16.04	44.01	27.5926	18.0152	101325	119815	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1730.75
49	32.00	16.04	44.01	27.6082	18.0152	101325	119835	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1736.63
50	32.00	16.04	44.01	27.6603	18.0152	101325	119845	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1738.74
51	32.00	16.04	44.01	27.7011	18.0152	101325	119785	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1736.99
52	32.00	16.04	44.01	27.6791	18.0152	101325	119835	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1738.31
53	32.00	16.04	44.01	27.6146	18.0152	101325	119705	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1725.67
54	32.00	16.04	44.01	27.6547	18.0152	101325	119705	15233.2038	0.0950	0.1458	1509.5762	1509.419	1729.51
55	32.00	16.04	44.01	27.6780	18.0152	101325	119495	15240.5448	0.0952	0.1462	1496.5023	1495.900	1714.58
56	32.00	16.04	44.01	27.7272	18.0152	101325	119585	15233.2038	0.0948	0.1460	1499.8176	1499.372	1718.25
57	32.00	16.04	44.01	27.7336	18.0152	101325	119655	15255.2360	0.0949	0.1461	1503.9220	1503.922	1723.68
22	32.00	16.04	44.01	27.6799	18.0152	101325	119665	15514.3056	0.0969	0.1490	1502.3323	1500.434	1723.94
23	32.00	16.04	44.01	27.7624	18.0152	101325	119825	15491.9527	0.0964	0.1485	1516.2837	1515.404	1740.42
24	32.00	16.04	44.01	27.7223	18.0152	101325	119725	15499.4006	0.0966	0.1487	1512.3485	1511.390	1736.15
25	32.00	16.04	44.01	27.5034	18.0152	101325	119925	15477.0661	0.0971	0.1482	1511.6362	1510.817	1734.69
26	32.00	16.04	44.01	27.5526	18.0152	101325	119945	15491.9527	0.0970	0.1483	1514.9589	1514.540	1739.17

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Document information

Version	*Date*	*Description*
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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