Sindicatum carbon capital

Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project

Clean Development Mechanism (CDM)

CER Monitoring Report

Certified Emission Reductions

Monitoring Period: 21 January 2011 – 31 May 2011

CDM Registration No: 3462

Date: 24th June 2011
Version 1.0

A project designed to meet the baseline and monitoring requirements
of UN CDM Approved Consolidated Methodology

ACM0001 Version 11
"Consolidated baseline and monitoring
methodology for landfill gas project activities"

MONITORING REPORT FORM (CDM-MR)
Version 01 - in effect as of: 28/09/2010

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CDM – Executive Board

MONITORING REPORT
Version 1.0 – 24/06/2011

Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project
CDM Registration Number: 3462
Monitoring Period 1 – 21/01/2011 - 31/05/2011 (inclusive)

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project (hereinafter is referred as "The Project") extracts, captures and utilizes landfill gas (LFG) to generate electricity. The LFG is extracted and captured using Sindicatum Carbon Capital (ordered by Xentolar Holdings Limited, a project participant) proprietary LFG collection system and the electricity generated is exported to the Thailand electrical grid (Thai Grid).

Under the project activity, a fully integrated LFG collection system is installed and operated. When the yield of gas is insufficient to supply to the generators, or surplus LFG is available, due to engine maintenance or other site factors, LFG is sent to an enclosed ground flare where it is flared; thus minimising methane emissions and maximising carbon abatement. The annual emission reductions of the project activity indicated in the PDD are approximately 273,086 tCO_2e yearly over the first 7 year crediting period.

The construction of Landfill gas extraction pipe system commenced in August 2009. Landfill gas has been extracted and combusted by flare since February 2010, which is the project's first day of operation. The physical installation of the first four engines and construction of the grid connection was completed by the end of March 2010. Following commissioning the project exported electricity to the Thai Grid from April 2010. An additional 2 engines were installed during April 2011 and commissioned during May 2011.

Total emission reductions achieved in this monitoring period are **85,450tCO_2e.**

A.2. Project Participants

The project participants are:

PS Natural Energy Co., Ltd is a single purpose company registered in Thailand and is a host country Project Participant. PS Natural Energy Co., Ltd is privately owned by individual shareholders.

Bangkok Greenpower Co., Ltd.is a single purpose company established to build and operate the LFG to-energy project. Bangkok Greenpower Co., Ltd.is registered in Thailand and is a host country Project Participant.

Xentolar Holdings Limited is registered in Cyprus and is a non host Project Participant.

Sindicatum Carbon Capital Ltd. is a privately owned company registered in the UK and is a non host Project Participant.

A.3. Location of the project activity:

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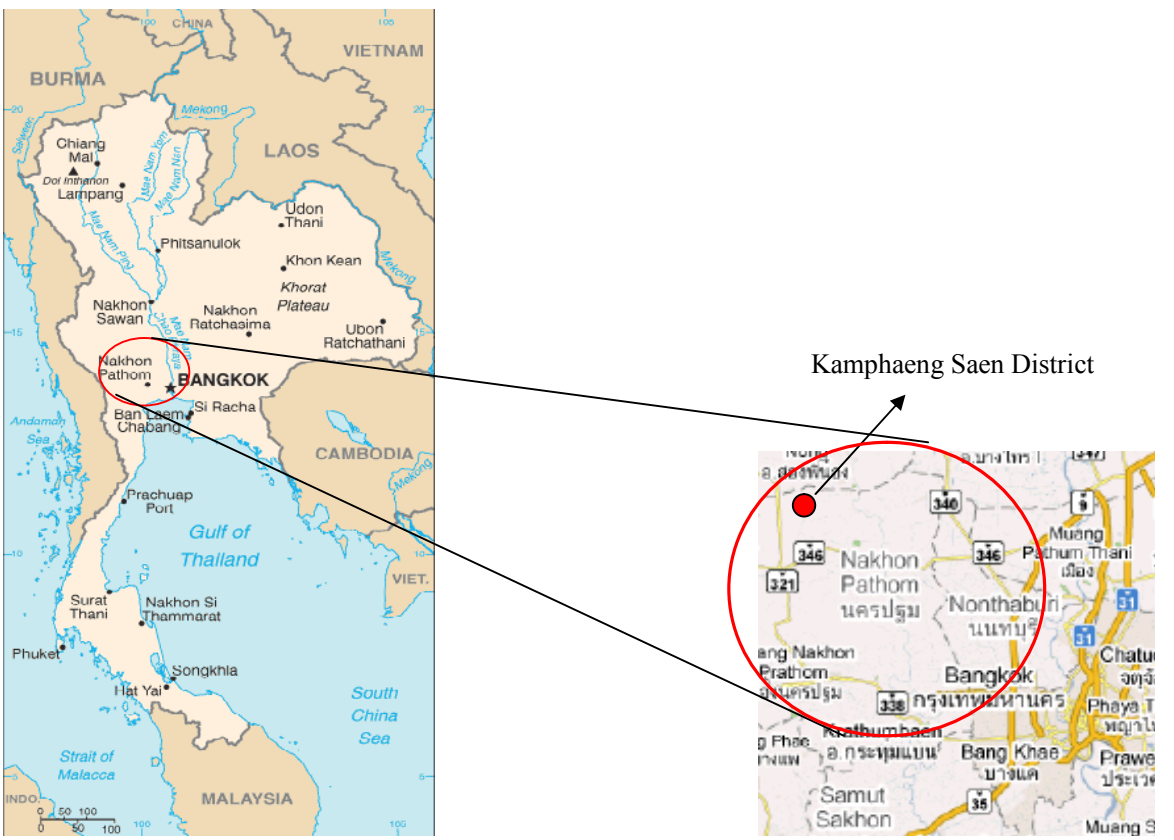
The Project is located at T. Sasimhum, A. Kamphaeng Saen, Nakhon Pathom, 73140. The geographic coordinates of the project are: longitude 14°3'50.62"N and latitude 99°56'50.96"E



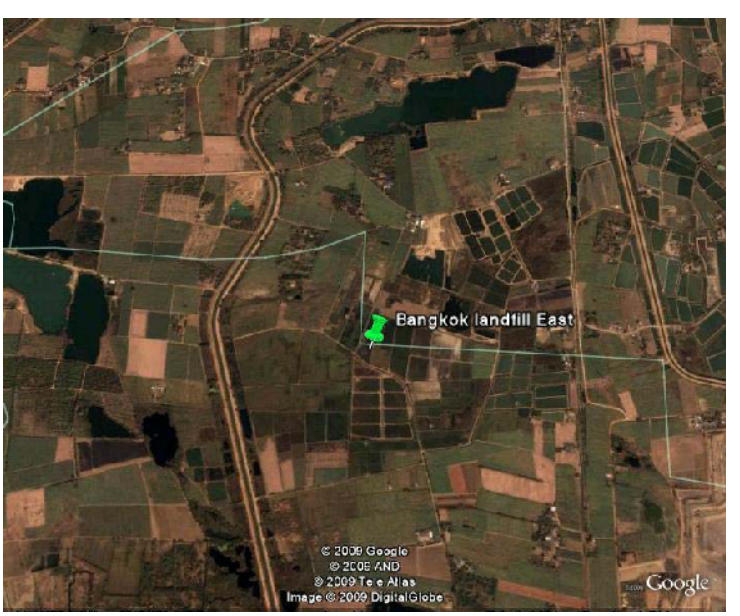


Figure A.3.1 Location of the project activity.

A.4. Technical description of the project

The project is extracting, capturing and utilizing landfill gas (LFG) from Kamphaeng Saen East Landfill to generate electricity. The electricity generated is exported to the Thai Grid. Whenever there is surplus LFG, due to engine maintenance or other site factors, LFG is sent to an enclosed ground flare where it is flared thus minimising methane emissions and maximising carbon abatement.

Landfill gas collection system:
High density polyethylene (HDPE) horizontal collection pipes have been installed in the waste as an integral part of the tipping operation. These collection wells are augmented by additional horizontal and vertical collection wells. The collection pipes are connected via main carrier pipes to the LFG extraction plant and a negative pressure applied. The LFG, comprising approximately 50% methane and 50% carbon dioxide is used for power generation with any surplus gas flared. The SCC proprietary LFG system has been designed to optimise LFG recovery and utilisation and optimise carbon abatement, and is designed to overcome inherent problems associated with LFG projects in similar conditions.

The recovered LFG passes through the pre-treatment plant where moisture and particulates are removed prior to the power generating engines. The pre treatment plant is designed to ensure that the gas quality reaching the engines is in line with the manufacturer's requirements. A schematic layout of the pre treatment and utilisation plant is shown in Figure A.4-1 below. Power generation units have been installed in line with electrical infrastructure capacity and also to match the LFG recovery profile. Sufficient flare capacity has been installed to ensure that any surplus LFG is flared if engine capacity is insufficient or during periods of maintenance or breakdown. The interface control and system management has been designed to allow real time adjustment of system performance thus optimising gas utilisation and carbon abatement.

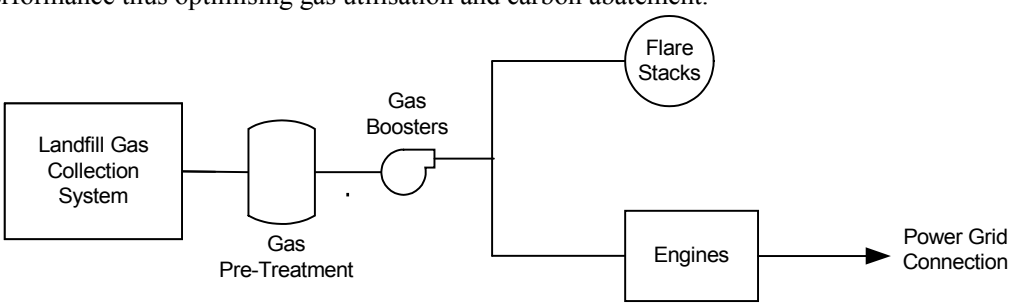


Figure A.4-1 Technical diagram of the project activity

LFG generator sets
After the LFG has passed through the pre treatment plant the gas is sent to spark ignition power generation units. The electricity produced is distributed to the Thailand Electric Grid. Currently the project activity consists of 6 generator sets manufactured by GE Jenbacher. The specification for the generator sets are shown below:

Parameters	Generator Sets
Quantity	6
Style	4 strokes
Rated rotating speed	1000r/minute
Rated power	1063kW
Rated voltage	400V
Rated frequency	50Hz

The generator sets used by this project are designed for power generation by utilizing landfill gas.

Flare system
The surplus gas is destroyed by a flare system. The combination of power generation and flare optimizes the destruction of landfill gas.

The flare installation used by this project meets all of the necessary conditions that are required by "Tool to determine project emissions from flaring gases containing methane" option a) for a default value of 90% for flare efficiency with continuous monitoring of compliance with the flare manufacture specifications. The flare system is equipped with a monitoring system to measure flow, the pressure, methane concentration and the temperature in order to comply with the tool.

Below is a summary of the technical specification of the flare:

Parameters	Flare
Type	Enclosed Flare
Quantity	3
Capacity	2,000 Nm^3/h
Flare Temperature (°C)	500-1200
Methane Combustion Efficiency	>98%
Manufacturer	Nanjing Carbon Recycle Biomass Technology Co., Ltd

Specification of the installed monitoring equipment is detailed in the tables included in section D.

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

- Baseline and monitoring methodology ACM0001 (Version 11) - "Consolidated baseline methodology and monitoring for landfill gas project activities";
- "Tool for the demonstration and assessment of additionality" - Version 05.2
- "Tool to determine project emissions from flaring gases containing methane"
- "Tool to calculate the emission factor for an electricity system" - Version 02 "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" - Version 04
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" -Version 1.

A.6. Registration date of the project activity:

21/01/2011

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

A renewable 7 years crediting period was chosen for the project activity. The start date of the crediting period was 21/01/2011.

A.8. Name of responsible person(s)/entity(ies):

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Mr. Gareth Phillips
Chief Climate Change Officer

Sven JP Starckx
Senior Technical Advisor Monitoring and Verification

Sindicatum Carbon Capital (SCC)
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London, UK
Tel: +44 (0) 20 7224 7555
Email: ccsecretariat@carbon-capital.com

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

Landfill gas has been extracted and combusted by flare since February 2010. The physical installation of the first 4*1063kW engines and construction of the grid connection was completed by late March 2010. Following commissioning of the grid connection the project started to export power to the Thai Grid on 8th April 2010. An additional 2*1063kW engines (No.s 5 & 6) were installed during April and commissioned during May 2011. The dates of commissioning completion for the engines were as follows:

Engine	Commissioning Handover Date	Engine	Commissioning Handover Date
1	18/05/2010	4	18/05/2010
2	17/06/2010	5	20/04/2011
3	18/05/2010	6	20/05/2011

The project activity started to export power on 8th April 2010 at a capacity of 0.8MW, which was subsequently increased to 3MW on June 3rd 2010. As of Oct 6th 2010, there was a further increase in electricity export to grid, as permission to export 4MW was granted by the Provincial Electricity Authority (PEA). Correspondingly, therefore a larger emission reduction was achieved from this time. PEA export approval for 6MW was achieved 27th May 2011.

Meanwhile, excessive landfill gas was also combusted by the flares in conjunction with power generation. At this stage, the combination of power generation and flaring optimizes the destruction of landfill gas. As waste tipping continues and additional LFG is generated, further generator sets will be installed.

Therefore, emission reductions of methane destroyed by both flare and power generation occurred within this monitoring period and emission reductions calculated for both types of LFG destruction are included in this monitoring report.

This is the first monitoring report. The monitoring period covered by this monitoring report is: **21/01/2011-31/05/2011 (inclusive)**.

The individual engine operational time is given in section D.2 – operation of energy plant. Information regarding replacement schedule of monitoring equipment can be referred to Annex E

Special events (overhaul times, downtimes of equipment, exchange,..) of the project activity during this monitoring period are detailed in Annex F.

During this monitoring period, no events or situations occurred, which impact the applicability of the methodology, as such no need to result any issues resulting from these events or situations.

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B.2. Revision of the monitoring plan

There have been no revisions to the monitoring plan as detailed in the registered PDD.

B.3. Request for deviation applied to this monitoring period

There have been no requests for deviation applied to this monitoring period.

B.4. Notification or request of approval of changes

There have been no notifications or requests of approval of change for the project activity as described in the CDM-PDD.

SECTION C. Description of the monitoring system

In order to guarantee the quality of the data and data collection system, a detailed monitoring manual has been developed and implemented. This detailed monitoring manual (available for verification by the DOE) is based upon requirements set out in the PDD and monitoring plan.

Management structure for the implementation of monitoring plan

A specific CDM department has been established by the project owner and a CDM manager has been appointed to oversee that activities are carried out according to the monitoring plan. The organizational structure for the CDM department is shown below.

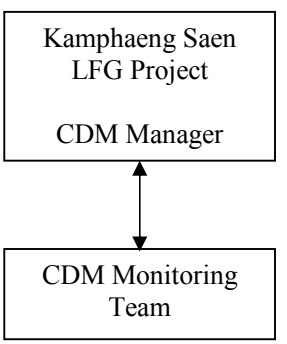

Figure C.1 Organisation Structure of the CDM Team

Responsibility and CDM management:

A CDM Manager is appointed with responsibility for monitoring all Project related activities and organizing training. The CDM Manager is responsible for overseeing the implementation of this procedure. Competency requirements for the position of CDM Manager are defined and applied to ensure that the CDM Manager is able to implement this procedure.

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All calculations are checked and signed off by the CDM Manager who is also be responsible for preparing and checking the documents required for verification.

A CDM Monitoring Team, that reports directly to the CDM Manager, has day to day responsibilities for checking instrumentation, record keeping, data handling and data processing, filing, reporting, organizing repair and maintenance of monitoring equipment and ensuring the monitoring plan is adhered to as indicated in the approved PDD. The monitoring staff have received technical training and refresher training as well as safety training to minimize exposure to workplace hazards.

A management level link has been established to ensure effective co-operation between landfill staff and CDM monitoring staff.

All relevant information, notes of meetings, data files, maintenance records, defect reports, hard copy and computerised records of monitoring are kept at a designated location and arranged in an orderly and transparent manner to facilitate auditing as and when required.

Responsibilities, procedures, methods, equipment types and specifications are described in detail in a site-specific CDM monitoring manual.

The parameters monitored and the monitoring procedure applied for determination of the emission reductions is described in detail in section B.7.1 of the Project Design Document Version 8, dated 13th August 2010, and available upon the UNFCCC website:
http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view

An overview of the parameters monitored is provided in **Section D**.

The location of measurement devices is presented in figure B.4-1 below:

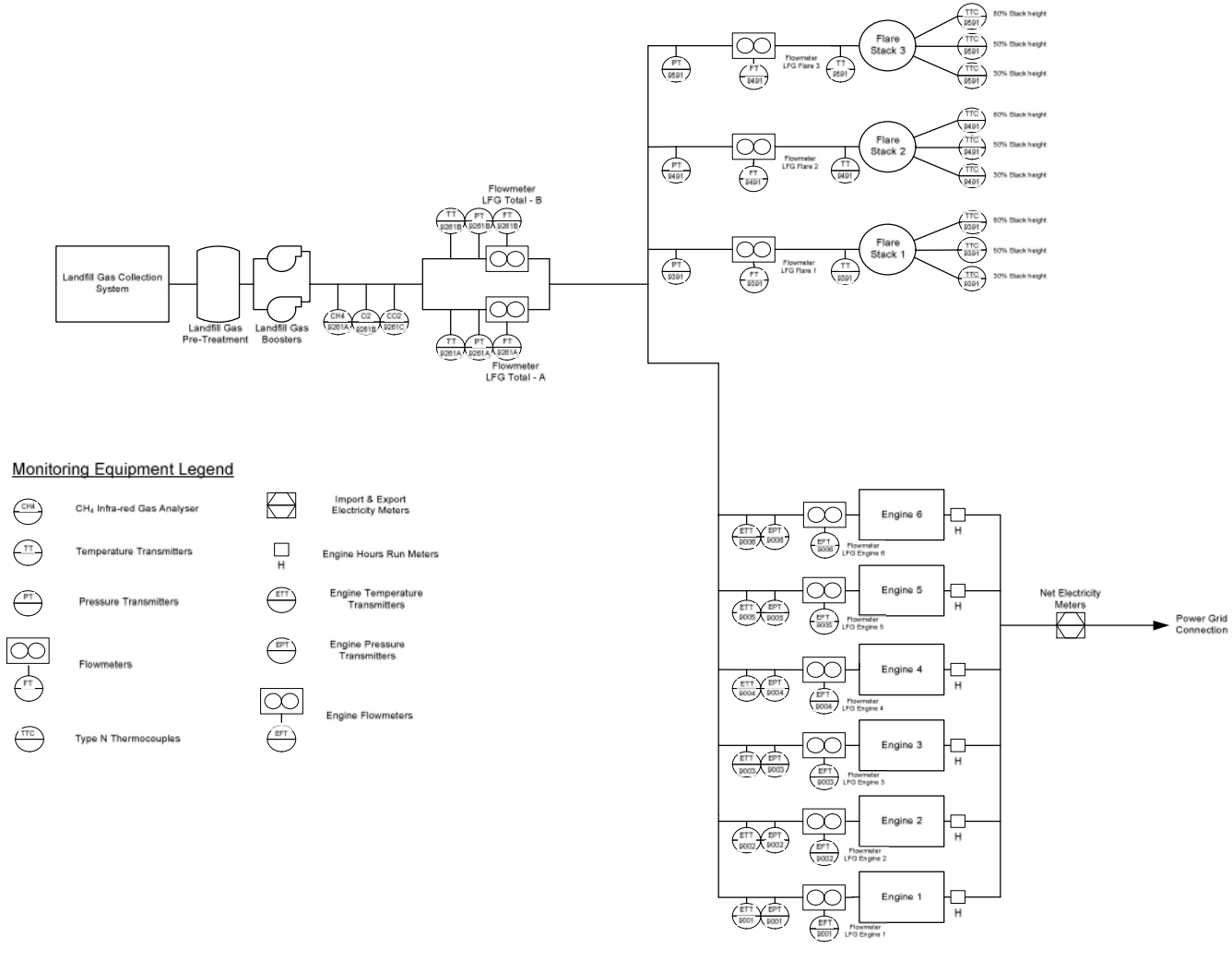

Figure B.4-1 - Location of the measurement devices

Data collection and management

- On-line monitoring

With the exception of the electricity meters, monitoring equipment required to determine GHG emissions and emission reductions are monitored on-line from a central control point which records meter readings at one minute intervals.

- Manual data recording system

A manual data recording system to act as a back-up for the on-line monitoring system is in place. This involves completion of a log sheet that records flow meter readings. Spot readings of other values (methane concentration, temperature and pressure) are also recorded periodically and at the times when flow meter readings are taken.

- Regulatory requirements related to landfill gas projects

Although the methodology only requires recording at the renewal of the crediting period, the information related to all relevant policies and circumstances are collected and recorded annually. Information will be kept during crediting period and two years after.

- Data archiving

The on-line monitoring system automatically and periodically archives data in a safe manner. Electronic documents are saved for backup, with written documents and back-ups safely kept. Calibration data is saved electronically. All information related to monitoring such as meeting minutes, data documents, maintenance records, accident reports, hard copies as well as computer records, are kept at designated locations to ensure that the examination process is transparent and effective. These data will be stored until 2 years after the end of the crediting period.

Maintenance and calibration of meters

All meters are maintained as specified in the CDM monitoring manual and according to manufacturer specifications. All key meters are subject to a quality control regime that includes regular maintenance and calibration. Calibrations are carried out by the manufacturer or a suitably qualified external company. A record is maintained showing the location and unique identification number of each meter, the calibration status of that meter (when last calibrated, when next due for calibration) and who performs the calibration service. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

Mass flow of methane supplied to the engines is corroborated by comparison with the sum of the gross engine power outputs, the relationship being a function of engine efficiency which can be considered a constant under the proposed maintenance regime.

Treatment of missing or corrupted data

When data in the on-line system are corrupted or missing whilst the generators are operating (as shown, for example, by electricity output) the missing data can be estimated by taking the lower value of the parameter one hour before the error and one hour after the system restart. If there is evidence that neither of these values is representative, use the average value of the parameter from the previous 24 hours.

Any error is recorded in the log sheet and the occurrence of the error will be investigated and rectified as soon as possible. If the on-line system is compromised for more than 24 hours, data will be manually recorded.

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Manually recorded data is backup data for methane destruction amount and other key parameters. Any deficiencies in methane flow monitoring data is rectified by calculation from power generation data.

Missing or corrupt data is detail in the special events schedule in Appendix F.

Non essential data
The on-line monitoring system will also record "non-essential" data. Such data is termed non-essential because it is not directly listed in the CDM Monitoring Methodology, but it will constitute a means of corroborating the on-line system. Non-essential data may include measurements of net and gross output from individual generators, certificated conversion efficiency, waste deposition and any other data considered relevant to the project activity.

Document Control
The CDM Manager has implemented a document control system that ensures that the current versions of necessary documents are available at the point of use.

Audit function and management review
The CDM Manager arranges for an independent internal audit of the management system periodically and at least once per year. The auditor is not be involved in the daily operation of the project and if necessary, may be sourced from a third party. The auditor will assess the implementation of the monitoring procedure and the preparation of the monitoring report. Audit findings and steps taken to address findings is recorded and reviewed in a Management Review meeting (convened at least annually) at which time the effectiveness of these procedures will be reviewed and necessary changes implemented. As the project was only registered in January 2011 the first annual Management Review meeting has not yet been convened and is scheduled following the outcome of the 1st verification audit, however an internal audit has been carried out and is available to the verifying DOE.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	Decisions under UNFCCC and the Kyoto Protocol
Value(s):	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline and project emission reduction calculations.
Additional comment:	Shall be updated according to any future COP/MOP decisions

Data / Parameter:	D_{CH4}
Data unit:	$tCH_4/ m^3 CH_4$
Description:	Methane density
Source of data used:	ACM0001 version 11
Value(s):	0.0007168 (at standard temperature and pressure: 0 degree Celsius and 1,013 bar)

	This data will be corrected for actual temperature and pressure according to the formula V1P1/T1 = V2P2/T2.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculations.
Additional comment:	

Data / Parameter:	$CEF_{elec,BL,y}$
Data unit:	tCO_2/MWh
Description:	Grid emission factor of electricity
Source of data used:	Thai grid emission factor calculation
Value(s):	0.57420
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculations.
Additional comment:	-

D.2. Data and parameters monitored	
Data / Parameter:	$LFG_{total,y}$
Data unit:	m^3
Description:	Total amount of landfill gas captured at Normal Temperature and Pressure
Measured /Calculated /Default:	Measured
Source of data:	Flow meter readings
Value(s) of monitored parameter:	Refer to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter. See specification details in Annex D. • Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/recorded every minute Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Data is backed up and archived, where it is stored for two years longer than the crediting period or two years after the last issuance of CERs. For internal cross checking purposes the consistency of flow measurements will be checked by examining the hourly flow balance. The conservative value is used for ER calculation.

	$(LFG_{flare,h} + LFG_{electricity,h}) = LFG_{total,h}$ Flow meter is calibrated according to the manufacturer's specifications. Calibrations are carried out by the manufacturer or a suitably qualified external company. Calibration and maintenance records are retained. On site staff have received training in CDM monitoring and the maintenance requirements of the flow meters.

Data / Parameter:	$LFG_{flare,y}$ (The same as $FV_{RG,h}$, different nomenclature for ACM0001 (version 11) and "Tool to determine project emissions from flaring gases containing methane".)
Data unit:	m^3
Description:	Amount of landfill gas flared at Normal Temperature and Pressure
Measured /Calculated /Default:	Measured
Source of data:	Flow meter on the inlet to each flare.
Value(s) of monitored parameter:	Refer to Section E4.Emission reductions calculation / table.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission and project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter. See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/reading every minute. Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Data is backed up and archived, where it is stored for two years longer than the crediting period or two years after the last issuance of CERs. For internal cross checking purposes the consistency of flow measurements will be checked by examining the hourly flow balance. The conservative value is used for ER calculation. $(LFG_{flare,h} + LFG_{electricity,h}) = LFG_{total,h}$ Flow meter is calibrated according to the manufacturer's specifications. Calibrations are carried out by the manufacturer or a suitably qualified external company. Calibration and maintenance records are retained. On site staff have received training in CDM monitoring and the maintenance requirements of the flow meters.

Data / Parameter:	$LFG_{electricity,y}$
Data unit:	m^3
Description:	Amount of landfill gas combusted in power plant at Normal Temperature and Pressure
Measured /Calculated	Measured

/Default:	
Source of data:	Flow meter on the inlet to each generator.
Value(s) of monitored parameter:	Refer to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter. See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/reading every minute. Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Data is backed up and archived, where it is stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. For internal cross checking purposes the consistency of flow measurements will be checked by examining the hourly flow balance. The conservative value is used for ER calculation. $(LFG_{flare,h} + LFG_{electricity,h}) = LFG_{total,h}$ Flow meter is calibrated according to the manufacturer's specifications. Calibrations are carried out by the manufacturer or a suitably qualified external company. Calibration and maintenance records are retained. On site staff have received training in CDM monitoring and the maintenance requirements of the flow meters.

Data / Parameter:	$PE_{flare,y}$
Data unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream in year *y*
Measured /Calculated /Default:	Calculated
Source of data:	Calculated
Value(s) of monitored parameter:	Referred to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A
Measuring/ Reading/	N.A

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Recording frequency:	
Calculation method (if applicable):	The parameter is calculated as per "Tool to determine project emissions from flaring gases containing Methane".
QA/QC procedures applied:	Regular maintenance should ensure optimal operation of flares. The enclosed flares are operated and maintained as per the specifications prescribed by the manufacturer.

Data / Parameter:	$\omega_{CH4,y}$ (The same parameter as $fv_{CH\ 4,RG,h}$ different nomenclature for ACM001(version 11) and "Tool to determine project emissions from flaring gases containing methane".)
Data unit:	m^3CH_4/m^3LFG
Description:	Methane fraction in the landfill gas
Measured /Calculated /Default:	Measured
Source of data:	Gas quality analyser reading
Value(s) of monitored parameter:	Referred to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• Infra-Red Gas Monitor. See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/reading every minute Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Routine checks are performed by the CDM Monitoring Team to ensure proper functioning of the equipment. Any faults are reported to the CDM Manager for action. Monthly zero check using atmospheric air or a certified nitrogen reference gas. Monthly site gas span undertaken using certified calibration gas. Gas analyser maintained and calibrated as per manufacturers recommendations Data is backed up and archived where it is stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.

Data / Parameter:	T
Data unit:	℃
Description:	Temperature of the landfill gas
Measured /Calculated /Default:	Measured
Source of data:	Temperature probe in LFG pipe work between the gas treatment package and the generator sets / flares.
Value(s) of monitored	Referred to E4.Emission reductions calculation / table

parameter:	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• Temperature Transmitter. • See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/reading every minute
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Routine checks are performed by CDM Monitoring Team to ensure proper functioning of the equipment. Any faults are reported to the CDM Manager for action. Temperature probe maintained and calibrated as per manufacturers recommendations. Data is backed up and archived where it is stored for the longer of two years longer than the crediting period or two years after the last issuance of CER's.

Data / Parameter:	*P*
Data unit:	Pa
Description:	Pressure of the landfill gas
Measured /Calculated /Default:	Measured
Source of data:	Pressure transmitter mounted in the LFG pipe work between the gas treatment package and the generator sets / flares.
Value(s) of monitored parameter:	Referred to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• Absolute Pressure Transmitter See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/reading every minute Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Routine checks are performed by CDM Monitoring Team to ensure proper functioning of the equipment. Any faults are reported to the CDM Manager for action. Pressure Transmitter maintained and calibrated as per manufacturers recommendations. Data is backed up and archived where it will be stored for the longer of

	two years longer than the crediting period or two years after the last issuance of CER's.

Data / Parameter:	EL_{LFG}
Data unit:	MWh
Description:	Net quantity of electricity produced / exported using LFG
Measured /Calculated /Default:	Measured
Source of data:	Electricity meter
Value(s) of monitored parameter:	Referred to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• Electricity Meter • See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuously measured. Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A
QA/QC procedures applied:	The electricity meters are maintained and calibrated according to manufacturer's instructions or the relevant regulations. Data will be archived for 2 years after the crediting period or two years after the last issuance of CERs. The data can be corroborated against financial data from the export of power to the grid.

Data / Parameter:	EL_{import} (The same parameter as $EC_{PJ,j,y}$)
Data unit:	MWh
Description:	Net amount of electricity imported from the grid for auxiliary use
Measured /Calculated /Default:	Measured
Source of data:	Electricity meter
Value(s) of monitored parameter:	Referred to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	• Electricity Meter • See specification details in Annex D. Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuously measured. Data is aggregated monthly and yearly

Calculation method (if applicable):	N.A
QA/QC procedures applied:	The electricity meters are maintained and calibrated according to manufacturer's instructions or the relevant regulations. Data will be archived for 2 years after the crediting period or two years after the last issuance of CERs. The data can be corroborated against financial data from the import of power from the grid

Data / Parameter:	Operation of the energy plant
Data unit:	Hours
Description:	Operation of the energy plant
Measured /Calculated /Default:	Measured
Source of data:	Measured with individual, software based, run meters on each generator set, readings taken from SCADA system
Value(s) of monitored parameter:	Engine #1: 2917 hours run Engine #2 : 3003 hours run Engine #3: 2926 hours run Engine #4 : 2679 hours run Engine #5 : 496 hours run Engine #6: 262 hours run
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For emission reductions calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N.A
Measuring/ Reading/ Recording frequency:	Continuously Measured
Calculation method (if applicable):	N.A
QA/QC procedures applied:	N.A

Data / Parameter:	T_{flare}
Data unit:	℃
Description:	Temperature of the exhaust gas of the flare
Measured /Calculated /Default:	Measured
Source of data:	Type N Temperature thermocouple mounted in flare stack
Value(s) of monitored parameter:	Refer to E4.Emission reductions calculation / table
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For project emission calculation
Monitoring equipment (type, accuracy class, serial	Type N Thermocouple • See specification details in Annex D.

number, calibration frequency, date of last calibration, validity)	Installation, date of calibration dates and validity are provided in Annex E.
Measuring/ Reading/ Recording frequency:	Continuous measuring/reading every minute
Calculation method (if applicable):	N.A
QA/QC procedures applied:	Routine checks are performed by Site Engineers to ensure proper functioning of the equipment. Any faults are reported to the CDM Manager for action. Thermocouple maintained and calibrated as per manufacturer's recommendations.

Data / Parameter:	$TDL_{j,y}$
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to Source *j*
Measured /Calculated /Default:	Measured
Source of data:	Electricity Annual Report by DEDE Department Ministry of Energy, Thailand. Most recent, accurate and reliable published data available within the host country is applied.
Value(s) of monitored parameter:	9.42%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	For project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N.A
QA/QC procedures applied:	-

Data / Parameter:	Regulatory requirements relating to landfill gas projects
Data unit:	-
Description:	Regulatory requirements relating to landfill gas projects may effect the value of AF or $MD_{reg,y}$
Measured /Calculated /Default:	Measurements by project participants
Source of data:	See details in Annex C.
Value(s) of monitored parameter:	N/A
Indicate what the data are used for (Baseline/ Project/ Leakage emission	For baseline emission calculation

calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N/A
QA/QC procedures applied:	-

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SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

The formulae used for determination of the baseline emissions are described in section B.6.1 of the registered PDD for the project activity.

$$BE_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} + EL_{LFG,,y} * CEF_{elec,BL,y} + ET_{LFG,y} * CEF_{ther,BL,y} \quad \textbf{(1)}$$

Where:

BE_y = Baseline emission in year y(tCO_2e)

$MD_{project,y}$ = The amount of methane that would have been destroyed/combusted during year y (tCH_4) in project scenario

$MD_{BL,y}$ = The amount of methane that would have been destroyed/combusted during year y in the absence of the project due to regulatory and/or contractual requirement (tCH_4) this is zero for this project

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 this project activity would have been produced by power plants connected to the Thai Grid during year y(MWh)

$CEF_{elec,BL,y}$ = CO_2 emission factor of the Thai Grid (tCO_2e/MWh)

$ET_{LFG,y}$ = The quantity of thermal energy produced utilizing the landfill gas, which in the absence of project activity would have been produced from onsite/offsite fossil fuel fried boiler, during the year y (TJ)

$CEF_{ther,BL,y}$ = CO_2 emission intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation (t CO_2/TJ)

$MD_{project,y}$ is determined via the measured quantities of methane captured and destroyed by the project, either by flaring or as fuel to the gas engines, as detailed in equation 2 below.

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} \quad \textbf{(2)}$$

Where:

$MD_{flared,y}$ = Quantity of methane destroyed by flaring during year y(tCH_4);

$MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity during year y(tCH_4).

In this project there will be no thermal energy utilization from LFG: $\mathbf{ET_{LFG,y} = 0}$. Similarly $\boldsymbol{MD_{BL,y} = 0}$ as there would have been no methane destruction due to regulatory and/or contractual requirements in the absence of this project.

The baseline emissions are calculated in the attached ER calculation excel spreadsheets, and summary of calculation results is provided in Tables 1 to 5 below.

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E.2. Project emissions calculation

$PE_y = PE_{EC,y} + PE_{FC,j,y}$ **(3)**

Where:

$PE_{EC,y}$ = Emission from consumption of electricity in project case
$PE_{FC,j,y}$ = Emission from consumption of heat in the project case

$PE_{FC,j,y}$ does not need to be accounted for as there is no thermal generation by the proposed project activity.

Project emissions arise from consumption of grid electricity ($PE_{EC,y}$) during periods when there is no on-site generation. $PE_{EC,y}$ is determined using the procedure described in Methodological "Tool to calculate baseline, project and/or leakage emissions from energy consumption" Version 1.

$$PE_{EC,y} = EC_{P,y} \times EF_{EL,y} \times (1 + TDL_y) \quad \textbf{(4)}$$

Where

$EC_{P,y}$ = Electricity imported from the grid and used in the project in year y (MWh/yr)
$EF_{EL,y}$ = CO_2 emission factor of the Thai Grid in year y (tCO_2e/MWh)
TDL_y = Average technical transmission and distribution losses for providing electricity to the project in year y (fraction)

The project emissions are calculated in the attached ER calculation excel spreadsheets, and summary of calculation results is given in Table 6.

E.3. Leakage calculation

No leakage effects need to be accounted under ACM0001 version 11.

E.4.

Emission reductions are calculated using ACM 0001 version 11, as follows:

$ER_y = BE_y - PE_y$ **(5)**

Where:

ER_y = Emission reductions in year y(tCO_2e/yr)
BE_y = Baseline emissions in year y(tCO_2e/yr)
PE_y = Project emissions in year y(tCO_2e/yr)

The value of D_{CH4} under standard temperature and air pressure (1.013bar and 0°C) is 0.0007168 tCH_4/m^3CH_4.

See registered PDD for detailed information.
http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view
Notes on ER Calculations:

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1. Table 1 – The Quantity of Methane Gas fed to the Generators 1 to 4 (Nm^3) for the period 21st January until 8th March, has been corrected as per EB52, Annex 60 "Guidelines for assessing compliance with the calibration frequency requirements" as the temperature transmitters calibration certificates are not available for this period.
2. Table 5 - The amount of electricity exported is taken from the official PEA Electric Meter Reading Statements for each complete month of operation, February to April inclusive. However as the initial commencement date of the monitoring period was 21st January, (CDM registration Date) no official export meter reading is available for that date. Therefore the meter readings used for the calculation of exported power between 21st January and 1st February are those taken internally by SCC staff from the Secondary Electric Meters. These secondary electric meters are installed and calibrated by the PEA and are used by them as a back-up in the event of Primary meter failure. SCC staff take daily readings of these meters for internal management purposes. Installation details and calibration certificates have been provided.
3. Table 6 - The amount of electricity imported is taken from the official PEA Electric Meter Reading Statements for each complete month of operation, February to April inclusive. However as the initial commencement date of the monitoring period was 21st January, (CDM registration Date) no official import meter reading is available for that date. Therefore the meter readings used for the calculation of imported power between 21st January and 1st February are those taken internally by SCC staff from the Secondary Electric Meters. These secondary electric meters are installed and calibrated by the PEA and are used by them as a back-up in the event of Primary meter failure. SCC staff take daily readings of these meters for internal management purposes. Installation details and calibration certificates have been provided.

The following table shows monthly total LFG collected by project and amount of LFG fed to each individual flare stack and each engine.

Table 1. Monthly net methane destruction attribute to the project activity

Date (inclusive)		Quantity of total Landfill gas captured measured in Nm^3	Quantity of Landfill gas fed to flare measured in Nm^3	Quantity of landfill gas fed to the power generators measured in Nm^3	Average value of concentration of methane in landfill gas m^3CH_4/m^3LFG	Quantity of Methane Gas fed to the flare measured in Nm^3	Quantity of Methane Gas fed to the power generators measured in Nm^3
		LFG total, month	LFG flare, month	LFG Electricity, month	$\omega CH_4,y$	CH_4 Flare, month	CH_4 Electricity, month
2011/01/21	2011/01/31	781,682	183,048	579,080	52%	93,710	299,112
2011/02/01	2011/02/28	2,184,520	664,801	1,454,969	50%	334,420	738,012
2011/03/01	2011/03/31	2,670,885	870,149	1,640,871	51%	449,509	866,356
2011/04/01	2011/04/30	2,547,797	877,212	1,649,160	52%	455,693	856,518
2011/05/01	2011/05/31	2,760,717	884,021	1,838,088	50%	436,430	925,348

Table 2. Methane destruction attributes to power generation

Date (inclusive)		Quantity of Methane Gas fed to the power generators measured in Nm^3	Methane density expressed in tonnes of methane per cubic meter of methane tCH_4/m^3CH_4	Quantity of methane destroyed by generator (tCH_4)*	Global warming potential of methane	Quantity of equivalent Carbon dioxide destroyed by power generation(tCO_2)
		CH_4 Electricity, month	D CH_4	MD electricity, month	GWP CH_4	tCO_2e, month
2011/01/21	2011/01/31	299,112	0.0007168	214	21	4,502
2011/02/01	2011/02/28	738,012	0.0007168	529	21	11,109
2011/03/01	2011/03/31	866,356	0.0007168	621	21	13,041
2011/04/01	2011/04/30	856,518	0.0007168	614	21	12,893
2011/05/01	2011/05/31	925,348	0.0007168	663	21	13,929

Table 3. Methane destruction attributes to LFG flaring

Flare 1

Date (inclusive)		Quantity of Methane Gas fed to the flare measured in Nm^3	Methane density expressed in tonnes of methane per cubic meter of methane tCH_4/m^3CH_4	Quantity of methane fed to flaring (tCH_4)*	Project emissions from flaring of the residual gas stream (tCH_4)*	Global warming potential of methane	Project emissions from flaring of the residual gas stream (tCO_2eq)*	Quantity of methane destroyed by flaring (tCH_4)*
		CH_4 total, month	D CH_4		PE flare CH_4, month	GWP CH_4	PE flare CO_2, month	MD flare, month
2011/01/21	2011/01/31	88,072	0.0007168	63.13	7.69	21	161.55	55.44
2011/02/01	2011/02/28	222,800	0.0007168	159.70	18.43	21	387.09	141.27
2011/03/01	2011/03/31	225,577	0.0007168	161.69	16.72	21	351.11	144.97
2011/04/01	2011/04/30	236,023	0.0007168	169.18	19.46	21	408.66	149.72
2011/05/01	2011/05/31	150,236	0.0007168	107.69	14.42	21	302.82	93.27

Flare 2

Date (inclusive)		Quantity of Methane Gas fed to the flare measured in Nm^3	Methane density expressed in tonnes of methane per cubic meter of methane tCH_4/m^3CH_4	Quantity of methane fed to flaring (tCH_4)*	Project emissions from flaring of the residual gas stream (tCH_4)*	Global warming potential of methane	Project emissions from flaring of the residual gas stream (tCO_2eq)*	Quantity of methane destroyed by flaring (tCH_4)*
		CH_4 total, month	D CH_4		PE flare CH_4, month	GWP CH_4	PE flare CO_2, month	MD flare, month
2011/01/21	2011/01/31	398	0.0007168	0.29	0.29	21	5.99	0.00
2011/02/01	2011/02/28	72	0.0007168	0.05	0.05	21	1.08	0.00
2011/03/01	2011/03/31	48	0.0007168	0.03	0.03	21	0.73	0.00
2011/04/01	2011/04/30	221	0.0007168	0.16	0.16	21	3.33	0.00
2011/05/01	2011/05/31	75,355	0.0007168	54.01	6.35	21	133.34	47.67

Flare 3

Date (inclusive)		Quantity of Methane Gas fed to the flare measured in Nm^3	Methane density expressed in tonnes of methane per cubic meter of methane tCH_4/m^3CH_4	Quantity of methane fed to flaring (tCH_4)*	Project emissions from flaring of the residual gas stream (tCH_4)*	Global warming potential of methane	Project emissions from flaring of the residual gas stream (tCO_2eq)*	Quantity of methane destroyed by flaring (tCH_4)*
		CH_4 total, month	D CH_4		PE flare CH_4, month	GWP CH_4	PE flare CO_2, month	MD flare, month
2011/01/21	2011/01/31	5,240	0.0007168	3.76	0.93	21	19.49	2.83
2011/02/01	2011/02/28	111,548	0.0007168	79.96	10.41	21	218.65	69.55
2011/03/01	2011/03/31	223,884	0.0007168	160.48	17.00	21	357.09	143.48
2011/04/01	2011/04/30	219,448	0.0007168	157.30	31.77	21	667.16	125.53
2011/05/01	2011/05/31	210,839	0.0007168	151.13	16.31	21	342.53	134.82

Remarks: Flare efficiency determination is referred to scenario a) of "tool to determine project emissions from flaring gases containing methane".

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The following table shows monthly net methane destruction attribute to the project activity and total emission reductions completed associated with project activity in this monitoring period.

Table 4. Monthly net methane destruction attribute to the project activity

Date (inclusive)		The amount of methane that have been destroyed in the project scenario (tCH_4)	The amount of methane that have been destroyed in the absence of the project (tCH_4)	Net methane destruction attributable to the project activity (tCH_4)	Net methane destruction attributable to the project activity (tCO_2)
		$MD_{project.\ month}$	$MD_{BL,\ month}$	$MD_{project,\ month} - MD_{BL,\ month}$	$=(MD_{project,\ month} - MD_{BL,\ month})*GWP_{CH4}$
2011/01/21	2011/01/31	272.67	0.00	272.67	5,726
2011/02/01	2011/02/28	739.82	0.00	739.82	15,536
2011/03/01	2011/03/31	909.45	0.00	909.45	19,099
2011/04/01	2011/04/30	889.20	0.00	889.20	18,673
2011/05/01	2011/05/31	939.04	0.00	939.04	19,720
Total 21/01/2011 – 31/05/2011 (inclusive)					**78,754**

Remarks: Data in this table is aggregated from the hourly results; calculation formulas are used in hourly and daily data level.
The sum of the LFG quantities fed to the flare and the power plant was compared hourly with the LFG_{total}. The lowest value would be used for calculation of $MD_{Project,y}$ at next step data process, according to QA/QC.

Table 5. The net amount of electricity exported to the grid

Date (inclusive)		Total amount of electricity exported (MWh)	CO_2 emissions intensity of the baseline source of electricity displaced (tCO_2e/MWh)	CO_2 emissions intensity (exported electricity) (tCO_2e)
		$EL_{LFG, month}$	$CEF_{elec, BL, month}$	
21/01/2011	31/05/2011	**11,670**	**0.5742**	**6,701**

Table 6. The net amount of electricity imported for the project purpose (project emissions)

Date (inclusive)		Total amount of electricity imported (MWh)	CO_2 emissions intensity of the baseline source of electricity displaced (tCO_2e/MWh)	Average technical transmission and distribution losses for providing electricity	CO_2 emissions intensity (imported electricity) (tCO_2e)
		$EL_{IM, month}$	$CEF_{elec, BL, month}$	$TDL_{,grid,month}$	
21/01/2011	31/05/2011	**6.96**	**0.5742**	**9.42%**	**4.37**

Table 7. Total Emission reductions of the monitoring period

Reporting Period	Net methane destruction attributable to the project activity (tCO2)	CO2 emissions intensity (imported electricity) (tCO2e)	CO2 emissions intensity (exported electricity) (tCO2e)	Total emission reductions (tCO2e)
Total 21/01/2011 – 31/05/2011 (inclusive)	**78,754**	**4.37**	**6,701**	**85,450**

Total baseline emissions: 88,815tCO_2e
Total project emissions: 3,365tCO_2e
Total leakage: 0tCO_2e
Total emission reductions: 85,450tCO_2e

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**= 315,502 x 131/365 = 113,235**	**85,450**

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

The ex-ante emission reduction calculation included in the PDD estimates a total of 113,235tCO_2e for the current monitoring period (calculation as per table section E.5). However only 85,450 CO_2e have actually been generated during the current monitoring period due to lower gas production/collection which has led to a lower number of engines being installed to date compared to that envisaged at this stage in the PDD. Further engines have now been installed, therefore it is expected that the emission reductions will be closer to the PDD estimates during the next monitoring period.

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Annex A. Emission Reductions Calculation Sheets

Separate emission reductions calculation spreadsheets have been provided for the purpose of verification.

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Annex B. Flare Efficiency

The determination of project emissions from flaring gases containing methane is described in the registered PDD page 25 onwards.

Determination of the hourly flare efficiency:

In case of enclosed flares and use of the default value for the flare efficiency, the flare efficiency in the hour h ($h_{flare,h}$) 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 assessment of the hourly flare efficiency using the above described criteria for the dataset covering the monitoring period will be verified by the DOE at the time of the site visit. The excel spreadsheet indicating flare efficiency for the reported period will be submitted to the DOE.

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Annex C. Monitored Laws and Regulations

Regulation	Impact	Date of application
Public Health Act 1992	Stated in PDD. Governs the operation of the landfill and provides a mechanism for regulation by local administrative body via the issuance of the license to the landfill. Ting Bua Sub-district Administrative Organisation has not currently set out and specific regulations relating to the license. No impact on parameters monitored during the current crediting period.	1992
Act of Cleanliness and Tidiness of the Nation 1992	Has no requirement for LFG control, extraction or utilisation. No impact on parameters monitored during the current crediting period.	1992

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Annex D. Specification of CDM Monitoring Equipment

Parameter	Instrument Type	Manufacturer	Instrument Model	Instrument Range	Accuracy	Calibration Requirements
LFG_{total}	V-Cone Flow Meter	Kingways	KVS14IIKC23FSN with Rosemount 3051 CD Differential Pressure Transmitter	750-7500m^3/hr	±0.5%	2 yearly
LFG_{flare}	V-Cone Flow Meter	Kingways	KVS08IIKC23FSN with Rosemount 3051 CD Differential Pressure Transmitter	300-2000m^3/hr	±0.5%	2 yearly
	V-Cone Flow Meter	KVS Lamway	RVM-VS08IIJF63N2 with Rosemount 3051 CD Differential Pressure Transmitter	300-2000m^3/hr	±0.5%	2 yearly
$LFG_{electricity,}$	V-Cone Flow Meter	Kingways	KVS06IIKC23FSN with Rosemount 3051 CD Differential Pressure Transmitter	100-1000m^3/hr	±0.5%	2 yearly
	V-Cone Flow Meter	KVS Lamway	RVM-VS06IIJF63N2 with Rosemount 3051 CD Differential Pressure Transmitter	100-1000m^3/hr	±0.5%	2 yearly
ω_{CH4}	Infra Red Gas Analsyer	Edinburgh Instruments Limited	Guardian Plus Infra-Red Gas Monitor	0-100%	± 2.0% Full Scale Deflection	Annually
T	Temperature Transmitter	Honeywell	STT830-171	-58 to 500˚C	(0.3+0.005|t|)°C	Annually
P	Absolute Pressure Transmitter	Rosemount	Model 3051TA	0 –207 kPa	± 0.065%	Annually
EL_{LFG}	Electric Meter	EDMI	EDMI-Mk6(Genius)	-	Class 0.5S	Annually
EL_{import}	Electric Meter	EDMI	EDMI-Mk6(Genius)	-	Class 0.5S	Annually
T_{flare}	Type N Thermocouple	Honeywell	STT830-173	0 to 1200˚C	Accuracy Class II (allowable deviation ±(0.0075|t|))	Annually
	Type N Thermocouple	Uniflare	32-N-LTS-176-6.0-21-TXLIN/EX1	0 to 1300˚C	Accuracy Class II (allowable deviation ±(0.0075|t|))	Annually

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Annex E. CDM Monitoring Equipment Installation & Calibration Dates

Name	Tag No.	Serial No.	Equipment Start Date	Equipment End Date	Calibration Certificate Validity Period	Certificate Reference	Monitoring period
LFG_{total}	FT 9261A	9061213	21/01/2011	01/06/2011	20090803-20110802	D09-770-JG-14	2011/01/21~2011/06/01
	FT 9261B	9061212	21/01/2011	01/06/2011	20090803-20110802	D09-770-JG-13	
LFG_{flare}	FT 9391	9061209	21/01/2011	13/03/2011	20090803-20110802	D09-770-JG-10	
		10071509*	13/03/2011	01/06/2011	20100824-20120823	D10-783-JG-11	
	FT 9491	9061210	21/01/2011	01/06/2011	20090803-20110802	D09-770-JG-11	
	FT 9591	9061205	21/01/2011	13/03/2011	20090803-20110802	D09-770-JG-06	
		10071510*	13/03/2011	01/06/2011	20100824-20120823	D10-783-JG-09	
$LFG_{electricity,}$	EFT9001	9062901	21/01/2011	13/03/2011	20090814-20110813	D09-800-JG-02	
		10071502*	13/03/2011	15/03/2011	20100820-20120819	D10-783-JG-01	
		9062901	15/03/2011	20/03/2011	20090814-20110813	D09-800-JG-02	
		10071502*	20/03/2011	01/06/2011	20100823-20120822	D10-783-JG-01	
	EFT9002	9062903	21/01/2011	13/03/2011	20090814-20110813	D09-800-JG-04	
		10071503*	13/03/2011	01/06/2011	20100823-20120822	D10-783-JG-04	
	EFT9003	9062907	21/01/2011	13/03/2011	20090813-20110812	D09-800-JG-08	
		10071504*	13/03/2011	01/06/2011	20100820-20120819	D10-783-JG-02	
	EFT9004	9062913	21/01/2011	13/03/2011	20090811-20110810	D09-800-JG-14	
		10071505*	13/03/2011	01/06/2011	20100823-20120822	D10-783-JG-07	
	EFT9005	10071506	05/04/2011	01/06/2011	20100823-20120822	D10-783-JG-03	
	EFT9006	9062914	27/04/2011	01/06/2011	20090812-20110811	D09-800-JG-15	
ω_{CH4}	CH4 9261A	31421	21/01/2011	01/06/2011	20100823-20110822	C2010-0018051	
T	TT 9261A	080625360	21/01/2011	01/06/2011	20100822-20110821	C1008-615	
	TT 9261B	080625355	21/01/2011	01/06/2011	20100822-20110821	C1008-619	
	TT 9391	080625397	21/01/2011	01/06/2011	20100822-20110821	C1008-618	
	TT 9491	080625432	21/01/2011	01/06/2011	20100822-20110821	C1008-617	
	TT 9591	080625347	21/01/2011	01/06/2011	20100822-20110821	C1008-616	
	ETT9001	090536658	21/01/2011	08/03/2011	-	-	
		100208514*	08/03/2011	01/06/2011	20100922-20110921	10/2366	
	ETT9002	090543121	21/01/2011	08/03/2011	-	-	
		100208537*	08/03/2011	01/06/2011	20100922-20110921	10/2371	
	ETT9003	090536683	21/01/2011	08/03/2011	-	-	
		100208540*	08/03/2011	01/06/2011	20100922-20110921	10/2369	
	ETT9004	090543120	21/01/2011	08/03/2011	-	-	
		100208541*	08/03/2011	01/06/2011	20100922-20110921	10/2370	
	ETT9005	100211940	04/05/2011	01/06/2011	20110329-20120328	11/0656	
	ETT9006	100098212	28/04/2011	01/06/2011	20110329-20120328	11/0657	
P	PT 9261A	5466002	21/01/2011	01/06/2011	20100630-20110629	L1007-092	
	PT 9261B	5466003	21/01/2011	01/06/2011	20100630-20110629	L1007-093	
	PT 9391	5466004	21/01/2011	01/06/2011	20100630-20110629	L1007-094	
	PT 9491	5466006	21/01/2011	01/06/2011	20100630-20110629	L1007-095	
	PT 9591	5466083	21/01/2011	01/06/2011	20100630-20110629	L1007-096	
	EPT9001	02166915	21/01/2011	01/06/2011	20101116-20111115	C1011-354	
	EPT9002	02300672	21/01/2011	01/06/2011	20101116-20111115	C1011-355	
	EPT9003	02300673	21/01/2011	01/06/2011	20101116-20111115	C1011-356	
	EPT9004	02300674	21/01/2011	01/06/2011	20101116-20111115	C1011-357	
	EPT9005	02150753	05/04/2001	01/06/2011	20101220-20111219	P02760	
	EPT9006	02150750	28/04/2001	01/06/2011	20101220-20111219	P02758	
EL_{LFG}	EPMP	201005194 PEA -15850695	21/01/2011	01/06/2011	20100719-20110718	-	
	EPMS	201007272 PEA -15852773	21/01/2011	01/06/2011	20100719-20110718	-	
EL_{import}	IPMP	201006718 PEA-15852219	21/01/2011	01/06/2011	20101115-20111114	-	
	IPMS	201005191 PEA -15850692	21/01/2011	01/06/2011	20100719-20110718	-	
T_{flare}	TTC 9393A	090326010	21/01/2011	01/06/2011	20100825-20110824	10/2051	
	TTC 9393B	090329544	21/01/2011	01/06/2011	20100906-20110905	H2010-0018860	
	TTC 9393C	080614290	21/01/2011	10/04/2011	20100816-20110815	10/1812	
		090326007*	10/04/2011	01/06/2011	20100825-20110824	10/2058	
	TTC 9493A	080614306	21/01/2011	18/05/2011	20100825-20110824	10/2054	
		22641C/1A*	18/05/2011	01/06/2011	20110105-20120104	18706-1A	
	TTC 9493B	080614289	21/01/2011	01/06/2011	20100825-20110824	10/2055	
	TTC 9493C	080614373	21/01/2011	01/06/2011	20100816-20110815	10/1815	
	TTC 9593A	090326013	21/01/2011	01/06/2011	20100816-20110815	10/1820	
	TTC 9593B	090326012	21/01/2011	01/06/2011	20100816-20110815	10/1819	
	TTC 9593C	090326009	21/01/2011	01/06/2011	20100816-20110815	10/1818	

Note: - * denotes that this equipment was installed during the monitoring period to replace an instrument that was due for calibration

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Annex F. Special Events Table and Missing CDM Data (more than 1 hour)

Start Time (UTC)	Finish Time (UTC)	Event/Cause	Impact on ER Calculation
2011-02-07 23:00:00	2011-02-08 05:00:00	Grid connection failure	No methane destruction by the project(MD project = 0)
2011-02-11 23:00:00	2011-02-12 02:00:00	Grid connection failure	No methane destruction by the project(MD project = 0)
2011-02-15 00:00:00	2011-02-15 06:00:00	Power Plant/Pre-treatment Maintenance	No methane destruction by the project(MD project = 0)
2011-03-13 01:00:00	2011-03-13 15:00:00	Pre-treatment maintenance/ Switch Gear Installation for Engine 5 and Engine 6	No methane destruction by the project(MD project = 0)
2011-3-13 15:54	2011-3-15 13:10	Missing Engine 1 Flow Readings	Flow back calculation for Engine 1 methane destruction
2011-03-15 16:00:00	2011-03-16 05:00:00	Grid connection failure	No methane destruction by the project(MD project = 0)
2011-03-20 13:45	2011-03-22:5:00	Missing Engine 1 Flow Readings	Flow back calculation for Engine 1 methane destruction
2011-04-13 16:00:00	2011-04-13 17:00:00	Pre-treatment Faults	No methane destruction by the project(MD project = 0)
2011-04-14 00:00:00	2011-04-14 01:00:00	Grid connection failure	No methane destruction by the project(MD project = 0)
2011-04-17 14:00:00	2011-04-17 15:00:00	Pre-treatment Faults	No methane destruction by the project(MD project = 0)
2011-04-23 13:00:00	2011-04-23 14:00:00	Pre-treatment Faults	No methane destruction by the project(MD project = 0)
2011-5-7 6:25	2011-5-7 13:14	Shut down for installation of switch gear for engine no 6.	No methane destruction by the project(MD project = 0)
2011-5-16 7:19	2011-5-16 9:49	Fault on engine CDM SCADA system caused Engine CDM data missing	Impact flow balance check and all missing data are default to zero which reduced methane destruction by power generation(MD electricity)
2011-5-16 11:29	2011-5-17 1:14	Fault on engine CDM SCADA system caused Engine CDM data missing	Impact flow balance check and all missing data are default to zero which reduced methane destruction by power generation(MD electricity)