Monitoring report form (Version 03.1)

Monitoring report

Title of the project activity	Bangkok Kamphaeng Saen East : Landfill Gas to Electricity Project
Reference number of the project activity	3462
Version number of the monitoring report	1
Completion date of the monitoring report	22/10/2013
Registration date of the project activity	21/01/2011
Monitoring period number and duration of this monitoring period	Monitoring period 4 Duration - 01/04/2012 - 30/09/2013 inclusive
Project participant(s)	Bangkok Greenpower Co., Ltd. Xentolar Holdings Limited Sindicatum Carbon Capital Ltd.
Host Party(ies)	The Kingdom of Thailand
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope 13 - Waste Handling and Disposal Baseline and monitoring methodology ACM0001 (Version 11) - "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	496,872 tCO_2e (Estimated data from 01 April 2012 – 30 September 2013)
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	563,609 tCO_2e,
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012	279,602 tCO_2e,
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013	284,007 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of 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 tCO2e yearly over the first 7-year crediting period.

The construction of landfill gas extraction pipe & gas collection system commenced in July 2009 and commissioning on February 2010. The Pre-treatment and three flares were installed from October 2009 to January 2010. Landfill gas has been extracted and combusted by flare since February 2010. 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. A further 2 engines were installed during December 2011 and commissioned during January 2012.

Total emission reductions achieved in this monitoring period are **563,609 tCO_2e**.

A.2. Location of project activity

The Project is located in the Kingdom of Thailand, 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.2.1 Location of the project activity.

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)
The Kingdom of Thailand (host)	Bangkok Greenpower Co., Ltd.	No
UK (Annex I)	Xentolar Holdings Limited	No
UK (Annex I)	Sindicatum Carbon Capital Ltd.	No

A.4. Reference of applied methodology

- Baseline and monitoring methodology ACM0001 (Version 11) - "Consolidated baseline and monitoring methodology 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" - Version 1
- "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
- "Tool to calculate project or leakage or CO2 emissions from fossil fuel combustion (Version 02)

Detailed information regarding these methodologies and tools please refer to UNFCCC methodology website.

A.5. Crediting period of project activity

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

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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 B.1-1 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.

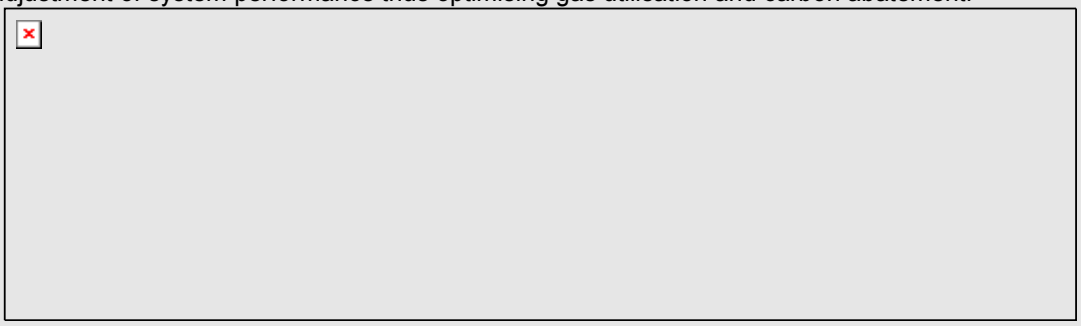

Figure B.1-1 Technical diagram of the project activity

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 8 generator sets manufactured by GE Jenbacher. The specification for the generator sets are shown below:

Parameters	Generator Sets
Quantity	8
Style	4 strokes
Rated rotating speed	1500 r/minute
Rated power	1063 kW
Rated voltage	400 V
Rated frequency	50 Hz

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, 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.

The three Flares were installed between October 2009 and January 2010. Landfill gas has been extracted and combusted by flares since February 2010, and the 3 Flares were completely commissioning on 25/06/2010. 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. 5 & 6) were installed during April and commissioned during May 2011. An additional 2*1063kW engines (No. 7 & 8) were install during December 2011 and commissioned during January 2012 The dates of commissioning completion for the engines were as follows:

Engine	Commissioning Handover Date	Engine	Commissioning Handover Date
1	18/05/2010	5	20/04/2011
2	17/06/2010	6	20/05/2011
3	18/05/2010	7	27/01/2012
4	18/05/2010	8	27/01/2012

The project activity started to export power on 08/04/2010 at a capacity of 0.8MW, which was subsequently increased to 3MW on 03/06/2010, 4MW on 06/10/2010, 6MW on 26/05/2010 and 6.3MW on 12/07/2011; as each phase of the power generation plant has been granted approval by the Provincial Electricity Authority (PEA) and PEA has approval for the increase from 6.3MW to 8MW export on 18/07/2012.

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 forth monitoring report. The monitoring period covered by this monitoring report is: **01/04/2012 – 30/09/2013 (inclusive)**.

The individual engine operational time for this monitoring period is provided in section D.2 – operation of energy plant. Information regarding replacement schedule of monitoring equipment is referred to in Annex E.

Special events which impact on the operation of the project activity such as downtime, major, overhaul, equipment failure, that exceed more than 24 hours during this monitoring period are detailed in Annex F.

No events or situations may which impact the applicability of the methodology occurred during this monitoring period.

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 were applied during this monitoring period.

B.2.2. Corrections

Not applicable.

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

There have been no permanent changes from registered monitoring plan or applied methodology submitted or approved during this monitoring period with this monitoring report.

Previously, there has been permanent changes from registered monitoring plan made to include parameters related to the monitoring of project emissions from temporary fossil fuel consumption as a result of a change to the project design. These changes were approved by the UN secretariat, reference PRC-3462-001, on 8th Feb, 2013.

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

There have been no changes to the project design of the project activity submitted or approved during this monitoring period with this monitoring report.

Previously, there has been changes to the project design during this monitoring period which consists of the use of a diesel generator when there is no on-site electricity and no availability of electricity from the grid (e.g. during the connection of new engines to the grid). This change was added to a revised project design document (PDD) and approved by the UN secretariat, reference PRC-3462-001, on 8th Feb 2013. The project boundary in the revised PDD was consequently modified to include project emissions and parameters for monitoring these project emissions were included in a revised monitoring plan as described in B.2.3.

B.2.5. Changes to start date of crediting period

There have been no changes to the start date of crediting period submitted or approved during this monitoring period with this monitoring report.

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

Not Applicable

SECTION C. Description of 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

The project owner has established a specific CDM department 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.

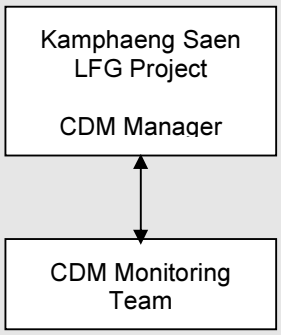

Figure C.1 Organisation Structure of the CDM Team

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.

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 staffs 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 computerized 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 9, dated 13/08/2010, 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 C.2 below:

Figure C.2 - 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 on daily basis. Spot readings of other values (methane concentration, temperature and pressure) are also recorded periodically and at the times when flow meter readings are taken on daily basis.

- 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 or higher value of the parameter one hour before the error or 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 is investigated and rectified as soon as possible. If the on-line system is compromised for more than 24 hours, data is manually recorded. Manually recorded data is backup data for methane destruction amount and other key parameters. Any deficiencies in methane flow monitoring data are rectified by calculation from power generation data.

Any treatment of missing or corrupt data is detailed and available for verification by DOE.

Non-essential data
The on-line monitoring system also records “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 assesses the implementation of the monitoring procedure and the preparation of the monitoring report. Audit findings and steps taken to address findings are 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. The audit reports and annual review meeting notes are available to the verifying DOE.

SECTION D. Data and parameters

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

Data / Parameter:	
Unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data:	IPCC and change from GWP of 21 to 25 according to decision 4/CMP7 and para 66, EB69
Value(s) applied):	21 for first commitment period (up to Dec 31st, 2012), 25 for second commitment period starting January 1st, 2013
Purpose of data:	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:	
Unit:	$tCH_4/ m^3 CH_4$
Description:	Methane density
Source of data:	ACM0001 version 11
Value(s) applied):	0.0007168 (at standard temperature and pressure: 0 degree Celsius and 1.013 bar)
Purpose of data:	This data is used for baseline emission calculations.
Additional comment:	N.A.

Data / Parameter:	$CEF_{elec,BL,y}$ (the same parameter as $EF_{EL,}$)
Unit:	tCO_2/MWh
Description:	Grid emission factor of electricity
Source of data:	Thai grid emission factor calculation
Value(s) applied):	0.57420
Purpose of data:	This data is used for baseline emission and project emission calculations.
Additional comment:	N.A.

D.2. Data and parameters monitored

Data / Parameter:	$LFG_{total,y}$
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 Emission Reductions spreadsheet
Monitoring equipment:	• V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter. • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/recorded every minute Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A.
QA/QC procedures:	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 is 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. Installation, calibration dates and validity periods are provided in Annex E. On site staffs have received training in CDM monitoring and the maintenance requirements of the flow meters.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

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".)
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 Emission Reductions spreadsheet
Monitoring equipment:	• V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter. • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/reading every minute. Data is aggregated monthly and yearly.

Calculation method (if applicable):	N.A.
QA/QC procedures:	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 is 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. Installation, calibration dates and validity periods are provided in Annex E. On site staff have received training in CDM monitoring and the maintenance requirements of the flow meters.
Purpose of data:	For baseline emission and project emission calculation
Additional comment:	N.A.

Data / Parameter:	$LFG_{electricity,y}$
Unit:	m^3
Description:	Amount of landfill gas combusted in power plant at Normal Temperature and Pressure
Measured/Calculated / Default:	Measured
Source of data:	Flow meter on the inlet to each generator.
Value(s) of monitored parameter:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	• V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter. See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/reading every minute. Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A.
QA/QC procedures:	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 is 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. Installation, calibration dates and validity periods are provided in Annex E. On site staff have received training in CDM monitoring and the maintenance requirements of the flow meters.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

Data / Parameter:	$PE_{flare,y}$
Unit:	tCO_2e
Description:	Project emissions from flaring of the residual gas stream in year *y*
Measured/Calculated / Default:	Calculated
Source of data:	Calculated
Value(s) of monitored parameter:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	N.A.
Calculation method (if applicable):	The parameter is calculated as per "Tool to determine project emissions from flaring gases containing Methane".
QA/QC procedures:	Regular maintenance should ensure optimal operation of flares. The enclosed flares are operated and maintained as per the specifications prescribed by the manufacturer.
Purpose of data:	For project emission calculation
Additional comment:	N.A.

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".)
Unit:	m^3CH_4/m^3LFG
Description:	Methane fraction in the landfill gas
Measured/Calculated / Default:	Measured
Source of data:	Gas quality analyzer reading
Value(s) of monitored parameter:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	• Infra-Red Gas Monitor. See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/reading every minute Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A.
QA/QC procedures:	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 checks 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. Installation, calibration dates and validity periods are provided in Annex E. 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.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

Data / Parameter:	*T*
Unit:	°C
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 parameter:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	• Temperature Transmitter. • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/reading every minute
Calculation method (if applicable):	N.A.
QA/QC procedures:	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. Installation, calibration dates and validity periods are provided in Annex E. 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.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

Data / Parameter:	*P*
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:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	• Absolute Pressure Transmitter • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/reading every minute Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A.

QA/QC procedures:	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. Installation, calibration dates and validity periods are provided in Annex E. 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.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

Data / Parameter:	EL_{LFG}
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:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	• Electricity Meter • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuously measured. Data is aggregated monthly and yearly.
Calculation method (if applicable):	N.A.
QA/QC procedures:	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.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

Data / Parameter:	EL_{import} (The same parameter as ECPJ,j,y)
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:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	• Electricity Meter • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuously measured. Data is aggregated monthly and yearly
Calculation method (if applicable):	N.A.

QA/QC procedures:	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
Purpose of data:	For project emission calculation
Additional comment:	N.A.

Data / Parameter:	Operation of the energy plant
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 : 10,782 hours run Engine # 2 : 11,458 hours run Engine # 3 : 11,425 hours run Engine # 4 : 11,733 hours run Engine # 5 : 11,995 hours run Engine # 6 : 11,481 hours run Engine # 7 : 12,801 hours run Engine # 8 : 12,769 hours run (Working run hour from 1 April 2012 to 30 September 2013)
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	Continuously Measured
Calculation method (if applicable):	N.A.
QA/QC procedures:	N.A.
Purpose of data:	For emission reductions calculation
Additional comment:	N.A.

Data / Parameter:	T_{flare}
Unit:	°C
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 Emission Reductions spreadsheet
Monitoring equipment:	• Type N Thermocouple • See specification details in Annex D.
Measuring/Reading/ Recording frequency:	Continuous measuring/reading every minute
Calculation method (if applicable):	N.A.

QA/QC procedures:	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. Installation, calibration dates and validity periods are provided in Annex E. 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.
Purpose of data:	For project emission calculation
Additional comment:	N.A.

Data / Parameter:	$TDL_{j,y}$
Unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to Source *j*
Measured/Calculated / Default:	Calculated
Source of data:	Annual Report Thailand Energy Statistics 2012 (Preliminary) 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:	8.58 %
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	Annually
Calculation method (if applicable):	<table><tr><th>Year</th><th>2012</th></tr><tr><td>Generation</td><td>168,471</td></tr><tr><td>Net Import</td><td>9,471</td></tr><tr><td>Station Service</td><td>5,492</td></tr><tr><td>Line Losses</td><td>9,782</td></tr><tr><td>Consumed</td><td>162,668</td></tr><tr><td>Distribution loss</td><td>8.58</td></tr></table> Total distribution loss = (Station Service + Line Losses) / (Electrical Supply Generation loss + Electrical Supply Net Import Loss)
QA/QC procedures:	N.A.
Purpose of data:	For project emission calculation
Additional comment:	N.A.

Data / Parameter:	Other flare operation parameters
Unit:	°C, m^3CH_4/m^3LFG, and m^3

Description:	The following parameters have been detailed earlier, however these parameters are also used to ensure that the flares are operating within their specifications and the flare efficiency default value is allocated accordingly: **Parameter** / Range for technical specifications: Temperature of landfill gas (T_{flare},) — 500-1,200 °C Methane fraction in landfill gas ($\omega_{CH4,y}$) — 25-65% Amount of landfill gas flared at Normal temperature and pressure (LFG_{flare}) — 300-2,000 Nm^3/h The flare efficiency is determined as set out in Annex A and B
Measured/Calculated / Default:	Measured
Source of data:	• Temperature transmitter • Infra-Red Gas Monitor V-Cone Flow Meter –with associated Rosemount 3051CD differential pressure transmitter
Value(s) of monitored parameter:	Refer to emission reduction spreadsheet
Monitoring equipment:	N.A..
Measuring/Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	N.A.
QA/QC procedures:	Refer to individual parameters
Purpose of data:	For determination of default flare efficiency for project emission calculation
Additional comment:	N.A.

Data / Parameter:	Regulatory requirements relating to landfill gas projects
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.
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	Annually
Calculation method (if applicable):	N.A.
QA/QC procedures:	N.A.
Purpose of data:	For baseline emission calculation
Additional comment:	N.A.

Data / Parameter:	$FC_{i,j,y}$
Unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type i combusted in process j during the year y
Measured/Calculated / Default:	Measured
Source of data:	Onsite measurements by project participants
Value(s) of monitored parameter:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed. It shall have a book or record sheet of control for fuel consumed recording (on a daily basis or per shift).
Calculation method (if applicable):	N.A.
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Purpose of data:	For project emission calculation
Additional comment:	N.A.

Data / Parameter:	$NCV_{i,y}$
Unit:	GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)
Description:	Weighted average net calorific value of fuel type i in year y
Measured/Calculated / Default:	Default value
Source of data:	The following data sources may be used if the relevant conditions apply:

Data source	Conditions for using the data source
a) Values provided by the fuel supplier in invoice	This is the preferred source
b) Measurements by the project participants	If a) is not available
c) Regional or national default values	If a) is not available
d) IPCC default values at the upper limit of the uncertainly at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG inventories	If a) is not available

Value(s) of monitored parameter:	Refer to Emission Reductions spreadsheet
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	N.A.
Calculation method (if applicable):	The parameter is calculated as per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
QA/QC procedures:	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standard
Purpose of data:	For project emission calculation
Additional comment:	Applicable where Option B is used

Data / Parameter:	$EF_{CO2,i,y}$
Unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor of fuel type i in year
Measured/Calculated / Default:	0.07480 tCO_2/GJ
Source of data:	IPCC default values at the upper limit of the uncertainly at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG inventories
Value(s) of monitored parameter:	N.A.
Monitoring equipment:	N.A.
Measuring/Reading/ Recording frequency:	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Calculation method (if applicable):	N.A.
QA/QC procedures:	N.A.
Purpose of data:	For project emission calculation
Additional comment:	Applicable where option B is used

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

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

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
[redacted]	=	Global Warming Potential value for methane for the first commitment period until 31st December 2012 is 21(tCO2e/tCH4). Global Warming Potential value for methane for the second commitment period starting 1st January 2013 is 25 (tCO2e/tCH4).
[redacted]	=	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)
[redacted]	=	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 (tCO_2e/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.

[redacted] ***(2)***

Where:

$MD_{flared,y}$ = measured quantity of methane destruction in flares during the year y;

$MD_{electricity,y}$ = measured quantity of methane destruction in power plant during the year y;

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4} \quad (3)$$

Where:

$LFG_{electricity,y}$ = quantity of LFG destroyed by the generators in m^3

$w_{CH4,y}$ = average concentration of methane in LFG (m^3CH_4/m^3LFG)

D_{CH4} = density of methane (tCH_4/m^3)

Including it in this equation takes account of the fact that $LFG_{electricity,y}$ is measured at the inlet to the generator.

$$MD_{flared,y} = (LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare\ y} / GWP_{CH4}) \quad (4)$$

Where:

$LFG_{flared,y}$ = quantity of landfill gas fed to the flare during the year measured in cubic meters (m^3),

$w_{CH4,y}$ = the average methane fraction of the landfill gas as measured during the year and expressed as a fraction (m^3CH_4/m^3LFG);

D_{CH4} = methane density, (tCH_4/m^3 CH_4)

$PE_{flare,y}$ = the project emissions from flaring of the residual gas stream in year y (tCO_2e)

$PE_{flare,y}$ = [redacted] (5)

Where:

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in year y (tCO_2e);
$TM_{RG,h}$	=	Mass flow rate of methane in the residual gas in the hour h($kgCH_4/h$);

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad (6)$$

Where:

[redacted]	=	Flare efficiency in hour h(%), IPCC default value 90% is taken;
GWP_{CH4}	=	Global Warming Potential value for methane for the first commitment period until 31st December 2012 is 21(tCO2e/tCH4). Global Warming Potential value for methane for the second commitment period starting 1st January 2013 is 25 (tCO2e/tCH4).

In the above formula, $LFG_{flare,y}$, $LFG_{flared,h}$, $\omega_{CH4,y}$, $\omega_{CH4,h}$ and $\eta_{flare,h}$ has been confirmed ex-post during project implementation.
The value of D_{CH4} under standard temperature and air pressure (1.013bar and 0°C) is 0.0007168 tCH_4/m^3CH_4.

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

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

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

$$PE_y = PE_{EC,y} + PE_{FC,j.y} \quad (7)$$

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

Although $PE_{FC,i,y}$ does not normally need to be accounted for as there is no thermal generation by the project activity. In the case where fossil fuel is used in the project activity, CO_2 emission from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels,

$$PE_{FC.i.v} = \sum_i FC_{i.i.v} \times COEF_{i.v} \quad (8)$$

Where:

$PE_{FC,j,y}$	=	Are the CO2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type i combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO2 emission coefficient $COEF_{i,y}$ can be calculated using Option B due to the availability of data on the fossil fuel type *i*, as follows:

Option B: The CO2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO2 emission factor of the fuel type *i*, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad (9)$$

Where:

$COEF_{i,y}$ = Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)

$NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = Is the weighted average CO2 emission factor of fuel type *i* in year *y* (tCO2/GJ)

i = Are the fuel types combusted in process *j* during the year *y*

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

(10)

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 Thailand 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)

E.3. Calculation of leakage

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

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

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

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

$$ER_y = BE_y - PE_y \quad (11)$$

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 emissions reductions are calculated in the attached ER calculation excel spreadsheets, and a summary of the calculation results is provided in Table 7.
See registered PDD for detailed information.
http://cdm.unfccc.int/UserManagement/FileStorage/R28ZCYKV731O6DHP9GSQ0LTUWJXF5N

Calculation sheets are provided below.

Notes on ER Calculations:

1. The flow of $LFG_{total,y}$, $LFG_{flare,y}$ and $LFG_{electricity,y}$ are measured using V-Cone pressure differential flow meters at each location as detailed in section D.2 above. At each V-cone flow measuring location an independent temperature transmitter and pressure transmitter is also installed to measure the LFG at this location. These working conditions are then used to convert the flow of LFG to NTP. The CH_4 volume flow is then converted to mass flow using the NTP methane density, a constant provided in the ACM0001 methodology.

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 Nm³	Quantity of Landfill gas fed to flare measured in Nm³	Quantity of landfill gas fed to the power generators measured in Nm³	Average value of concentration of methane in landfill gas m^3CH_4/m^3LFG	Quantity of Methane Gas fed to the flare measured in Nm³	Quantity of Methane Gas fed to the power generators measured in Nm³
		LFG total, month	LFG flare, month	LFG Electricity, month	$\omega CH_4,y$	CH_4 Flare, month	CH_4 Electricity, month
01/04/2012	30/04/2012	3,817,682	1,165,978	2,612,036	52%	607,318	1,357,613
01/05/2012	31/05/2012	3,792,978	1,001,157	2,724,881	51%	511,654	1,386,364
01/06/2012	30/06/2012	3,898,210	934,713	2,927,685	49%	457,986	1,431,950
01/07/2012	31/07/2012	3,850,750	508,490	3,295,144	51%	263,820	1,679,884
01/08/2012	31/08/2012	4,100,674	559,779	3,492,475	49%	275,466	1,709,211
01/09/2012	30/09/2012	3,804,972	833,124	2,918,719	51%	435,144	1,472,692
01/10/2012	31/10/2012	4,304,372	606,987	3,655,113	50%	304,762	1,835,133
01/11/2012	30/11/2012	3,864,450	219,160	3,589,778	49%	108,880	1,760,164
01/12/2012	31/12/2012	3,623,316	44,356	3,512,362	47%	22,232	1,662,286
01/01/2013	31/01/2013	3,921,088	40,141	3,833,400	44%	19,450	1,677,960
01/02/2013	28/02/2013	3,531,380	59,579	3,420,685	47%	29,780	1,585,475
01/03/2013	31/03/2013	3,492,115	24,840	3,217,130	47%	12,457	1,505,057
01/04/2013	30/04/2013	3,342,674	8,604	3,218,897	46%	4,534	1,479,908
01/05/2013	31/05/2013	3,515,614	3,647	3,424,127	44%	1,944	1,507,382
01/06/2013	30/06/2013	3,444,298	3,882	3,399,369	46%	2,160	1,569,050
01/07/2013	31/07/2013	4,053,291	21	3,838,513	45%	10	1,704,487
01/08/2013	31/08/2013	3,736,557	12	3,526,444	46%	6	1,620,842
01/09/2013	30/09/2013	3,549,871	21,199	3,297,562	53%	12,640	1,723,878

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
01/04/2012	30/04/2012	1,357,613	0.0007168	973	21	20,436
01/05/2012	31/05/2012	1,386,364	0.0007168	994	21	20,869
01/06/2012	30/06/2012	1,431,950	0.0007168	1026	21	21,555
01/07/2012	31/07/2012	1,679,884	0.0007168	1204	21	25,287
01/08/2012	31/08/2012	1,709,211	0.0007168	1225	21	25,728
01/09/2012	30/09/2012	1,472,692	0.0007168	1056	21	22,168
01/10/2012	31/10/2012	1,835,133	0.0007168	1315	21	27,624
01/11/2012	30/11/2012	1,760,164	0.0007168	1262	21	26,495
01/12/2012	31/12/2012	1,662,286	0.0007168	1192	21	25,022
01/01/2013	31/01/2013	1,677,960	0.0007168	1203	25	30,069
01/02/2013	28/02/2013	1,585,475	0.0007168	1136	25	28,412
01/03/2013	31/03/2013	1,505,057	0.0007168	1079	25	26,971
01/04/2013	30/04/2013	1,479,908	0.0007168	1061	25	26,520
01/05/2013	31/05/2013	1,507,382	0.0007168	1080	25	27,012
01/06/2013	30/06/2013	1,569,050	0.0007168	1125	25	28,117
01/07/2013	31/07/2013	1,704,487	0.0007168	1222	25	30,544
01/08/2013	31/08/2013	1,620,842	0.0007168	1162	25	29,045
01/09/2013	30/09/2013	1,723,878	0.0007168	1236	25	30,892

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
01/04/2012	30/04/2012	74,432	0.0007168	53.35	7.51	21	157.68	45.84
01/05/2012	31/05/2012	131,542	0.0007168	94.29	12.10	21	254.01	82.19
01/06/2012	30/06/2012	103,695	0.0007168	74.33	9.00	21	189.04	65.33
01/07/2012	31/07/2012	110,334	0.0007168	79.09	9.70	21	203.68	69.39
01/08/2012	31/08/2012	244,418	0.0007168	175.20	19.61	21	411.75	155.59
01/09/2012	30/09/2012	244,402	0.0007168	175.19	18.83	21	395.39	156.36
01/10/2012	31/10/2012	277,458	0.0007168	198.88	20.23	21	424.90	178.65
01/11/2012	30/11/2012	275,002	0.0007168	197.12	20.12	21	422.44	177.01
01/12/2012	31/12/2012	280,867	0.0007168	201.33	20.99	21	440.85	180.33
01/01/2013	31/01/2013	100,436	0.0007168	71.99	7.84	25	195.91	64.16
01/02/2013	28/02/2013	33,941	0.0007168	24.33	4.06	25	101.58	20.27
01/03/2013	31/03/2013	28,695	0.0007168	20.57	2.68	25	67.01	17.89
01/04/2013	30/04/2013	29,497	0.0007168	21.14	4.01	25	100.18	17.14
01/05/2013	31/05/2013	43,749	0.0007168	31.36	4.29	25	107.31	27.07
01/06/2013	30/06/2013	34,648	0.0007168	24.84	3.41	25	85.28	21.42
01/07/2013	31/07/2013	149,504	0.0007168	107.16	11.56	25	288.99	95.60
01/08/2013	31/08/2013	54,219	0.0007168	38.86	5.76	25	143.97	33.11
01/09/2013	30/09/2013	95,080	0.0007168	68.15	7.87	25	196.72	60.28

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
01/04/2012	30/04/2012	199,574	0.0007168	143.05	15.45	21	324.43	127.61
01/05/2012	31/05/2012	172,960	0.0007168	123.98	13.75	21	288.74	110.23
01/06/2012	30/06/2012	78,311	0.0007168	56.13	5.83	21	122.33	50.31
01/07/2012	31/07/2012	71,774	0.0007168	51.45	6.66	21	139.92	44.79
01/08/2012	31/08/2012	81,979	0.0007168	58.76	7.23	21	151.81	51.53
01/09/2012	30/09/2012	177,608	0.0007168	127.31	13.45	21	282.49	113.86
01/10/2012	31/10/2012	54,840	0.0007168	39.31	4.98	21	104.63	34.33
01/11/2012	30/11/2012	12,070	0.0007168	8.65	1.30	21	27.33	7.35
01/12/2012	31/12/2012	10,355	0.0007168	7.42	1.75	21	36.75	5.67
01/01/2013	31/01/2013	19,063	0.0007168	13.66	2.14	25	53.41	11.53
01/02/2013	28/02/2013	14,566	0.0007168	10.44	1.69	25	42.25	8.75
01/03/2013	31/03/2013	6,537	0.0007168	4.69	0.97	25	24.13	3.72
01/04/2013	30/04/2013	423	0.0007168	0.30	0.15	25	3.66	0.16
01/05/2013	31/05/2013	731	0.0007168	0.52	0.41	25	10.14	0.12
01/06/2013	30/06/2013	1,275	0.0007168	0.91	0.43	25	10.64	0.49
01/07/2013	31/07/2013	0	0.0007168	0.00	0.00	25	0.00	0.00
01/08/2013	31/08/2013	0	0.0007168	0.00	0.00	25	0.00	0.00
01/09/2013	30/09/2013	763	0.0007168	0.55	0.16	25	4.01	0.39

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
01/04/2012	30/04/2012	240,283	0.0007168	172.24	18.05	21	379.10	154.18
01/05/2012	31/05/2012	218,860	0.0007168	156.88	16.89	21	354.66	139.99
01/06/2012	30/06/2012	255,265	0.0007168	182.97	18.80	21	394.75	164.18
01/07/2012	31/07/2012	95	0.0007168	0.07	0.07	21	1.43	0.00
01/08/2012	31/08/2012	1	0.0007168	0.00	0.00	21	0.02	0.00
01/09/2012	30/09/2012	571	0.0007168	0.41	0.12	21	2.53	0.29
01/10/2012	31/10/2012	0	0.0007168	0.00	0.00	21	0.00	0.00
01/11/2012	30/11/2012	2	0.0007168	0.00	0.00	21	0.03	0.00
01/12/2012	31/12/2012	2	0.0007168	0.00	0.00	21	0.03	0.00
01/01/2013	31/01/2013	78	0.0007168	0.06	0.06	25	1.40	0.00
01/02/2013	28/02/2013	0	0.0007168	0.00	0.00	25	0.00	0.00
01/03/2013	31/03/2013	1	0.0007168	0.00	0.00	25	0.01	0.00
01/04/2013	30/04/2013	70	0.0007168	0.05	0.05	25	1.25	0.00
01/05/2013	31/05/2013	5	0.0007168	0.00	0.00	25	0.09	0.00
01/06/2013	30/06/2013	0	0.0007168	0.00	0.00	25	0.00	0.00
01/07/2013	31/07/2013	0	0.0007168	0.00	0.00	25	0.00	0.00
01/08/2013	31/08/2013	0	0.0007168	0.00	0.00	25	0.00	0.00
01/09/2013	30/09/2013	0	0.0007168	0.00	0.00	25	0.00	0.00

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

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

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

Date (inclusive)		The amount of methane that has been destroyed in the project scenario (tCH_4)	The amount of methane that would 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)
		$MD_{project.\ month}$	$MD_{BL,\ month}$	$MD_{project.\ month} - MD_{BL,\ month}$	$=(MD_{project.\ month} - MD_{BL,\ month})*GWP_{CH4}$
01/04/2012	**30/04/2012**	388.98	973.14	0.00	1,362.12
01/05/2012	**31/05/2012**	326.64	993.75	0.00	1,320.39
01/06/2012	**30/06/2012**	294.30	1,026.42	0.00	1,320.72
01/07/2012	**31/07/2012**	167.46	1,204.14	0.00	1,371.60
01/08/2012	**31/08/2012**	174.71	1,225.16	0.00	1,399.87
01/09/2012	**30/09/2012**	278.53	1,055.63	0.00	1,334.16
01/10/2012	**31/10/2012**	194.87	1,315.42	0.00	1,510.29
01/11/2012	**30/11/2012**	68.17	1,261.69	0.00	1,329.85
01/12/2012	**31/12/2012**	12.57	1,191.53	0.00	1,204.10
01/01/2013	**31/01/2013**	11.53	1,202.76	0.00	1,214.29
01/02/2013	**28/02/2013**	17.84	1,136.47	0.00	1,154.31
01/03/2013	**31/03/2013**	6.87	1,078.83	0.00	1,085.69
01/04/2013	**30/04/2013**	2.18	1,060.80	0.00	1,062.98
01/05/2013	**31/05/2013**	0.43	1,080.49	0.00	1,080.92
01/06/2013	**30/06/2013**	0.81	1,124.70	0.00	1,125.51
01/07/2013	**31/07/2013**	0.00	1,221.78	0.00	1,221.78
01/08/2013	**31/08/2013**	0.00	1,161.82	0.00	1,161.82
01/09/2013	**30/09/2013**	6.35	1,235.68	0.00	1,242.03
Total 01/04/2012 – 30/09/2013 (inclusive)					**22,502.43**

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 is be used for calculation of $MD_{Project,y}$ in the next data processing step, according to QA/QC.

Table 5. Project emission from Diesel Generator

Date (inclusive)		Quantity of fossil fuel combustion (Diesel) (liters)	CO2 emission coefficient of Diesel (tCO2/liter)	PE fc,j,y emission of heat (from fossil fuel combustion) to meet project requirement (tCO2e)
		$\sum FC_{i,j,y}$	$COEF_{i,y}$	
11/07/2012	12/07/2012	3,600	0.0027	10

Table 6. 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 (exported electricity) (tCO_2e)
		$EL_{LFG, month}$	$CEF_{elec, BL, month}$	
01/04/2012	30/09/2013	86,517.43	0.5742	49,678

Table 7. 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 (imported electricity) (tCO_2e)
		$EL_{IM, month}$	$CEF_{elec, BL, month}$	$TDL_{,grid,month}$	
01/04/2012	30/09/2013	12.72	0.5742	8.58%	7.930

Table 8. Total GHG 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 (fossil fuel combustion) (tCO2e)	CO2 emissions intensity (exported electricity) (tCO2e)	Total emission reductions (tCO2e)
Total 01/04/2012 – 30/09/2013 (inclusive)	513,948	8	10	49,678	563,609

Table 9. Summary of GHG Emission reductions for the monitoring period

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)
Total	568,899	5,290	0	563,609

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)	2012 = 326,881 x 275 / 366 = 245,607 2013 = 335,940 x 273 / 365 = 251,265 Total Monitoring Period = 496,872	563,609

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

The ex-ante emission reduction calculation included in the PDD estimates a total of 496,872 tCO_2e for the current monitoring period (calculation as per table section E.5). **563,609** tCO_2e have actually been generated during the current monitoring period which is higher than the estimated value. Any increase is due to the higher GWP (25) of methane used from 1st Jan 2013 compared to the registered PDD, higher waste amounts tipped , and operation performance to date compared to that envisaged at this stage in the PDD.

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)	279,602	284,007

Annex A. Emission Reductions Calculation Sheets

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

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.

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. Thung 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
Public Health Act (Issue 2) 2007	Repealed section 18 of Public Health Act 1992 and enforce section 9 of this act. Governs the operation of the landfill provides a mechanism for regulation by local administrative body via the issuance of the license to the landfill and not apply this amended law to the disposal of hazardous waste as defined by the factory laws. Currently, Thung Bua Sub-district Admistrative Organisation has not set out and announced the specific regulations relating to the license. No impact on parameters monitored during the current crediting period.	2007

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	KVS14IIKD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	750 - 7500 $m.^3$/hr.	±0.5%	2 yearly
		Shanghai Kent	KVCFF-350-AON/2 (PN10) with Rosemount 3051 CD Differential Pressure Transmitter	750 - 7500 $m.^3$/hr.	±0.5%	2 yearly
LFG_{flare}	V-Cone Flow Meter	Kingways	KVS08IIKC23FSN with Rosemount 3051 CD Differential Pressure Transmitter	250 - 2500 $m.^3$/hr.	±0.5%	2 yearly
		KVS Lamways	RVM-VS08IIJF63N2 with Rosemount 3051 CD Differential Pressure Transmitter	250 - 2500 $m.^3$/hr.	±0.5%	2 yearly
$LFG_{electricity,}$	V-Cone Flow Meter	Kingways	KVS06IIKC23FSN with Rosemount 3051 CD Differential Pressure Transmitter	200 - 2000 $m.^3$/hr.	±0.5%	2 yearly
		Kingways	KVS06IIKC23FSN with Rosemount 3051 CD Differential Pressure Transmitter	100 - 1000 $m.^3$/hr.		
		KVS Lamways	RVM-VS06JF63N2 with Rosemount 3051 CD Differential Pressure Transmitter			
		Shanghai Kent	KVCFF150CD1N/6 with Rosemount 3051 CD Differential Pressure Transmitter			
ω_{CH4}	Infra Red Gas Analyser	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	± 0.075 % of span	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 - 1200˚C	Accuracy Class II (allowable deviation ±(0.0075|t|))	Annually
		Uniflare	32-N-LTS-176-6.0-2I-TXLIN/EXI	0 - 1300˚C	Accuracy Class II (allowable deviation ±(0.0075|t|))	Annually

Annex E. CDM Monitoring Equipment Installation & Calibration Dates

Name	Tag No.	Serial No.	Equipment Start Date	Equipment End Date	Calibration Certification Validity Period	Certificate Reference
LFG_{Total}	FT 9261 A	9061213	20120401	20121231	20111201-20131130	D11-1128-JG
	FT 9261 B	9061212	20120401	20130705	20110729-20130728	D11-733-JG-01
		KT13050301399	20130705	20130930	20130605-20150604	D13-415-JG
LFG_{Flare}	FT 9391	9061210	20120401	20130705	20110914-20130913	LC1109-046
		9062916	20130705	20130930	20130625-20150624	LC1306-087
	FT 9491	9062916	20120401	20130604	20110621-20130620	LC1106-080
		10071510	20130604	20130930	20130419-20150418	L1304-375
	FT 9591	9061205	20120401	20130604	20110618-20130617	LC1106-075
		10071509	20130604	20130930	20130419-20150418	L1304-374
LFG_{Engine}	EFT 9001	9062903	20120401	20130604	20110613-20130612	LC1106-025
		10071503	20130604	20130930	20121001-20140903	L1210-028
	EFT 9002	10071503	20120401	20120805	20100823-20120822	D10-783-JG-04
		10071504	20120805	20130930	20111107-20131106	LC1111-081
	EFT 9003	9062907	20120401	20130604	20110613-20130612	LC1106-026
		10071505	20130604	20130930	20130419-20150418	L1304-376
	EFT 9004	9062913	20120401	20130604	20110613-20130612	LC1106-027
		10071506	20130604	20130930	20130419-20150418	L1304-377
	EFT 9005	1104-0160	20120401	20130705	20110714-20130713	LC1106-082
		9062907	20130705	20130930	20130624-20150623	LC1306-090
	EFT 9006	1104-0159	20120401	20130705	20110720-20130719	LC1106-081
		9062903	20130705	20130930	20130624-20150623	LC1306-089
	EFT 9007	9062901	20120401	20130604	20110613-20130612	LC1106-024
		10071502	20130604	20130930	20130419-20150418	L1304-372
	EFT 9008	9062914	20120401	20130705	20110913-20130912	LC1109-045
		9062901	20130705	20130930	20130624-20150623	LC1306-088
ω_{CH4}	CH4 9261 A	31426	20120401	20120518	20110603-20120602	L1106-104
		31421	20120518	20120829	20110902-20120901	L1109-038
		29692	20120829	20120829	20120618-20130617	L1206-165
		31421	20120829	20120829	20110902-20120901	L1109-038
		29690	20120829	20130124	20120125-20130124	1299
		29690	20130124	20130930	20130124-20140123	C1301-1053

Annex E. CDM Monitoring Equipment Installation & Calibration Dates (Cont.)

Name	Tag No.	Serial No.	Equipment Start Date	Equipment End Date	Calibration Certification Validity Period	Certificate Reference
T	TT 9261 A	080625355	20120401	20120806	20110808-20120807	11/1867
		080638016	20120806	20130726	20120731-20130730	12/1539
		080625360	20130726	20130930	20130716-20140715	13/1864
	TT 9261 B	080625360	20120401	20120806	20110809-20120808	11/1870
		100208514	20120806	20130726	20120731-20130730	12/1543
		080625355	20130726	20130930	20130716-20140715	13/1863
	TT 9391	100208523	20120401	20120806	20110808-20120807	11/1875
		080625347	20120806	20130726	20120731-20130730	12/1541
		100208523	20130726	20130930	20130716-20140715	13/1865
	TT 9491	080625400	20120401	20120806	20110808-20120807	11/1868
		080625397	20120806	20130726	20120731-20130730	12/1540
		090536657	20130726	20130930	20130716-20140715	13/1867
	TT 9591	090536657	20120401	20120806	20110808-20120807	11/1876
		080625432	20120806	20130726	20120731-20130730	12/1544
		080625400	20130726	20130930	20130716-20140715	13/1866
	ETT 9001	100208540	20120401	20120806	20110809-20120808	11/1871
		100208541	20120806	20130718	20120806-20130805	12/1669
		090536658	20130718	20130930	20130322-20140321	13/0388
	ETT 9002	100208515	20120401	20120608	20110809-20120808	12/0401
		100211940	20120608	20130220	20120301-20130228	12/0336
		080638031	20130220	20130930	20121105-20131104	12/2383
	ETT 9003	090536658	20120401	20130220	20120301-20130228	12/0333
		080638042	20130220	20130930	20121105-20131104	12/2384
	ETT 9004	090543121	20120401	20130220	20120301-20130228	12/0334
		080638069	20130220	20130930	20121105-20131104	12/2385
	ETT 9005	090536683	20120401	20130220	20120301-20130228	12/0332
		100208537	20130220	20130718	20120806-20130805	12/1668
		090543121	20130718	20130930	20130322-20140321	13/0393
	ETT 9006	090543120	20120401	20130220	20120301-20130228	12/0335
		100208540	20130220	20130718	20120808-20130807	12/1675
		090536683	20130718	20130930	20130322-20140321	13/0391
	ETT 9007	100208541	20120401	20120806	20110809-20120808	11/1872
		100208515	20120806	20130718	20120731-20130730	12/1542
		090543120	20130718	20130930	20130322-20140321	13/0390

Annex E. CDM Monitoring Equipment Installation & Calibration Dates (Cont.)

Name	Tag No.	Serial No.	Equipment Start Date	Equipment End Date	Calibration Certification Validity Period	Certificate Reference
T	ETT 9008	100208537	20120401	20120806	20110809-20120808	11/1873
		100098212	20120806	20130222	20120301-20130228	12/0337
		100211940	20130222	20130930	20130222-20140221	13/039
P	PT 9261 A	5466080	20120401	20120611	20110614-20120613	L1106-158
		5466002	20120611	20130605	20120611-20130610	C1206-273
		5466080	20130605	20130930	20130605-20140604	C1306-250
	PT 9261 B	5466089	20120401	20120611	20110614-20120613	L1106-159
		5466003	20120611	20130605	20120611-20130610	C1206-274
		5466089	20130605	20130930	20130605-20140604	C1306-251
	PT 9391	5466010	20120401	20120611	20110614-20120613	L1106-155
		5466004	20120611	20130605	20120611-20130610	C1206-278
		5466010	20130605	20130930	20130605-20140604	C1306-254
	PT 9491	5466007	20120401	20120611	20110614-20120613	L1106-156
		5466006	20120611	20130605	20120611-20130610	C1206-279
		5466007	20130605	20130930	20130605-20140604	C1306-255
	PT 9591	5466015	20120401	20120611	20110614-20120613	L1106-157
		5466083	20120611	20130605	20120611-20130610	C1206-280
		5466015	20130605	20130930	20130605-20140604	C1306-256
	EPT 9001	02443480	20120401	20120611	20110614-20120613	C1106-160
		02166916	20120611	20121102	20111110-20121109	C1111-012
		02443480	20121102	20130605	20120611-20130610	C1206-281
		02300672	20130605	20130930	20121105-20131104	C1211-111
	EPT 9002	02443481	20120401	20120611	20110614-20120613	C1106-161
		02150750	20120611	20121102	20111110-20121109	C1111-013
		02443481	20121102	20130605	20120611-20130610	C1206-282
		02300674	20130605	20130930	20121105-20131104	C1211-113
	EPT 9003	02166915	20120401	20121102	20111110-20121109	C1111-014
		02715553	20121102	20130605	20120807-20130806	C1208-032
		02150753	20130605	20130930	20121105-20131104	C1211-106
	EPT 9004	02300672	20120401	20121105	20111110-20121109	C1111-015
		02150751	20121105	20130930	20121105-20131104	C1211-107
	EPT 9005	02150751	20120401	20121105	20111110-20121109	C1111-011
		02300673	20121105	20130930	20121105-20131104	C1211-112
	EPT 9006	02300674	20120401	20121105	20111110-20121109	C1111-017
		02150750	20121105	20130930	20121105-20131104	C1211-109

Annex E. CDM Monitoring Equipment Installation & Calibration Dates (Cont.)

Name	Tag No.	Serial No.	Equipment Start Date	Equipment End Date	Calibration Certification Validity Period	Certificate Reference
P	EPT 9007	02150753	20120401	20121105	20111110-20121109	C1111-010
		02166915	20121105	20130930	20121105-20131104	C1211-110
	EPT 9008	02300673	20120401	20121105	20111110-20121109	C1111-016
		02166916	20121105	20130930	20121105-20131104	C1211-108
EL_{export}	Primary	15850695	20120401	20120704	20110712-20120711	-
		19936922	20120704	20120704	20110808-20120807	-
		15850695	20120704	20130703	20120704-20130703	-
		19936983	20130703	20130703	20120910-20130909	-
		15850695	20130703	20130930	20130703-20140702	-
	Back-up	15852773	20120401	20120704	20110713-20120712	-
		19936922	20120704	20120704	20110808-20120807	-
		15852773	20120704	20130703	20120704-20130703	-
		19936983	20130703	20130703	20120910-20130909	-
		212607309	20130703	20130930	20130703-20140702	-
EL_{import}	Primary	15852219	20120401	20120704	20110712-20120711	-
		19936924	20120704	20120704	20110808-20120807	-
		15852219	20120704	20130703	20120704-20130703	-
		19936924	20130703	20130703	20120809-20130808	-
		15852219	20130703	20130930	20130703-20140702	-
	Back-up [C]	15850692	20120401	20120704	20110713-20120712	-
		19936924	20120704	20120704	20110808-20120807	-
		15850692	20120704	20121003	20120704-20130703	-
		210422526	20121003	20130703	20121001-20130930	-
		19936924	20130703	20130703	20120809-2013808	-
		210422526	20130703	20130930	20130703-20140702	-
T_{Flare}	TTC 9393 A	22641 C/1	20120401	20120726	20120207-20130206	12/0203
		080614298	20120726	20130206	20120322-20130321	12/0491
		080614289	20130206	20130726	20121012-20131011	12/2186
		080614373	20130726	20130930	20130716-20140715	13/1860
	TTC 9393 B	22641 C/3	20120401	20120726	20120207-20130206	12/0205
		080614290	20120726	20130206	20120322-20130321	12/0492
		090326009	20130206	20130726	20121005-20131004	12/2140
		090326012	20130726	20130930	20130716-20140715	13/1861

Annex E. CDM Monitoring Equipment Installation & Calibration Dates (Cont.)

Name	Tag No.	Serial No.	Equipment Start Date	Equipment End Date	Calibration Certification Validity Period	Certificate Reference
T Flare	TTC 9393 C	090329527	20120401	20120726	20110809-20120808	11/1861
		090326006	20120726	20130206	20120322-20130321	12/0490
		090326007	20130206	20130726	20121012-20131011	12/2187
		090326013	20130726	20130930	20130716-20140715	13/1862
	TTC 9493 A	080614379	20120401	20120726	20110907-20120906	11/2183
		080614320	20120805	20130726	20120801-20130731	12/1547
		080614290	20130726	20130930	20130221-20140220	13/0381
	TTC 9493 B	080614305	20120401	20120726	20110907-20120906	11/2185
		080614305	20120805	20130726	20120801-20130731	12/1546
		080614323	20130726	20130930	20130306-20140305	13/0511
	TTC 9493 C	080614306	20120401	20120726	20110907-20120906	11/2184
		080614379	20120805	20130726	20120801-20130731	12/1545
		080614298	20130726	20130930	20130221-20140220	13/0382
	TTC 9593 A	080614323	20120401	20120726	20110809-20120808	11/1896
		090329527	20120919	20130726	20120802-20130801	12/1550
		090326006	20130726	20130930	20130221-20140220	13/0380
	TTC 9593 B	080614321	20120401	20120726	20110809-20120808	11/2072
		080614306	20120919	20130726	20120802-20130801	12/1548
		090326010	20130726	20130930	20130306-20140305	13/0512
	TTC 9593 C	080614320	20120401	20120726	20110809-20120808	11/1897
		080614297	20120919	20130726	20120802-20130801	12/1549
		080614321	20130726	20130930	20130306-20140305	13/0510

Annex F. Special Events Table

Start Time (UTC)	Finish Time (UTC)	Downtime (hr:mm)	DESCRIPTION OF EVENT	Impact on ER Calculation
01/04/2012 07:00	02/04/2012 11:04	28:05	Stopped for Engine 4 due to change intercooler	No methane destruction by the Engine 4
01/04/2012 12:29	04/04/2012 10:05	69:37	Stopped for Engine 2 due to Maintenance 14,000 hrs and change intercooler	No methane destruction by the Engine 2
02/04/2012 14:29	04/04/2012 08:35	42:07	Stopped for Engine 3 due to Start new engine	No methane destruction by the Engine 3
05/04/2012 15:50	07/04/2012 09:26	41:37	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
06/04/2012 15:11	08/04/2012 10:33	43:23	Stopped for Engine 3 due to Start new engine	No methane destruction by the Engine 3
08/04/2012 18:02	22/04/2012 15:40	333:39	Stopped for Engine 3 due to Knocking failure and change cylinder head #20 / Waiting spare part 7 cylinder head/ Maintenance (clean cylinder head)Test and start up after maintenance (clean cylinder head)	No methane destruction by the Engine 3
08/04/2012 19:02	19/04/2012 15:31	260:30	Stopped for Engine 4 due to Waiting & Change turbo charger and intercooler	No methane destruction by the Engine 4
21/04/2012 03:04	24/04/2012 10:18	79:15	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
24/04/2012 17:51	26/04/2012 14:11	44:21	Stopped for Engine 1 due to Start new engine	No methane destruction by the Engine 1
26/04/2012 09:44	29/04/2012 23:57	86:14	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
26/04/2012 15:07	30/04/2012 10:30	91:24	Stopped for Engine 1 due to Start new engine	No methane destruction by the Engine 1
03/05/2012 11:01	04/05/2012 15:22	28:22	Stopped for Engine 1 due to PEA change VT	No methane destruction by the Engine 1
03/05/2012 11:01	04/05/2012 15:22	28:22	Stopped for Engine 2 due to PEA change VT and test run 8 MW	No methane destruction by the Engine 2
05/05/2012 13:21	06/05/2012 16:12	26:52	Stopped for Engine 4 due to Start new engine and change lube oil	No methane destruction by the Engine 4
05/05/2012 17:27	08/05/2012 14:55	69:29	Stopped for Engine 3 due to Start new engine	No methane destruction by the Engine 3
06/05/2012 16:28	08/05/2012 09:19	40:52	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
08/05/2012 09:24	11/05/2012 15:18	77:55	Stopped for Engine 1 due to Start new engine	No methane destruction by the Engine 1
11/05/2012 15:26	13/05/2012 09:54	42:29	Stopped for Engine 4 due to Start new engine	No methane destruction by the Engine 4
11/05/2012 17:41	15/05/2012 11:12	89:32	Stopped for Engine 3 due to Generator reverse power and start new engine	No methane destruction by the Engine 3
13/05/2012 10:03	18/05/2012 13:53	123:51	Stopped for Engine 1 due to Start new engine / Change turbo charger	No methane destruction by the Engine 1
16/05/2012 02:49	22/05/2012 14:59	156:11	Stopped for Engine 2 due to Knocking failure/Waiting & change cylinder head 1,4,14,18 & 20 / Regap & Clean all spark plug	No methane destruction by the Engine 2
19/05/2012 16:11	22/05/2012 14:21	70:11	Stopped for Engine 1 due to Start new engine	No methane destruction by the Engine 1

Annex F. Special Events Table (Cont.)

Start Time (UTC)	Finish Time (UTC)	Downtime (hr:mm)	DESCRIPTION OF EVENT	Impact on ER Calculation
22/05/2012 16:49	26/05/2012 10:17	89:29	Stopped for Engine 1 due to Start new engine	No methane destruction by the Engine 1
24/05/2012 09:43	25/05/2012 10:21	24:39	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
25/05/2012 10:37	30/05/2012 14:04	123:28	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
27/05/2012 15:49	05/06/2012 09:56	210:08	Stopped for Engine 1 due to Start new engine / Waiting & Change circuit board	No methane destruction by the Engine 1
30/05/2012 11:50	07/06/2012 16:17	196:28	Stopped for Engine 3 due to Exhaust gas temperature deviation high cylinder #15 and start new engine / Clean spark plug cylinder #14 and change spark plug cylinder #14, 15, 18, 8	No methane destruction by the Engine 3
07/06/2012 13:45	13/06/2012 17:46	148:02	Stopped for Engine 6 due to Waiting & intercooler	No methane destruction by the Engine 6
13/06/2012 17:53	15/06/2012 14:49	44:57	Stopped for Engine 1 due to Clean spark plug cylinder #14 / Waiting and Change intercooler	No methane destruction by the Engine 1
16/06/2012 16:32	19/06/2012 16:35	72:04	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
19/06/2012 15:45	20/06/2012 16:35	24:51	Stopped for Engine 1 due to Leanox cont. deviation high	No methane destruction by the Engine 1
20/06/2012 16:41	09/07/2012 18:32	457:52	Stopped for Engine 1 due to Waiting / Change turbo charger	No methane destruction by the Engine 1
24/06/2012 14:45	27/06/2012 11:43	68:59	Stopped for Engine 2 due to Exhaust gas temperature high cylinder # 6 / Waiting and change cylinder head # 6	No methane destruction by the Engine 2
07/07/2012 06:23	09/07/2012 21:28	63:06	Stopped for Engine 4 due to Waiting & Change cylinder head #18	No methane destruction by the Engine 4
09/07/2012 00:19	10/07/2012 21:05	44:47	Stopped for Engine 2 due to Waiting and change cylinder head # 7,8,12 / Change compensator	No methane destruction by the Engine 2
13/07/2012 22:35	15/07/2012 15:07	40:33	Stopped for Engine 6 due to Start new engine	No methane destruction by the Engine 6
05/08/2012 11:12	06/08/2012 19:01	31:50	Stopped for Engine 4 due to Exhaust gas temperature deviation high cylinder # 8 and change cylinder head	No methane destruction by the Engine 4
07/08/2012 08:23	11/08/2012 16:15	103:53	Stopped for Engine 5 due to DE-COKE and maintenance 10,000 hrs. running service	No methane destruction by the Engine 5
13/08/2012 09:50	14/08/2012 17:35	31:46	Stopped for Engine 4 due to Waiting & change cylinder head cylinder #16	No methane destruction by the Engine 4
17/08/2012 04:32	22/08/2012 20:53	136:22	Stopped for Engine 4 due to Knocking failure and change cylinder head cylinder #4	No methane destruction by the Engine 4

Annex F. Special Events Table (Cont.)

Start Time (UTC)	Finish Time (UTC)	Downtime (hr:mm)	DESCRIPTION OF EVENT	Impact on ER Calculation
21/08/2012 08:46	05/09/2012 11:51	363:06	Stopped for Engine 6 due to DE-COKE and maintenance 10,000 hrs. running service	No methane destruction by the Engine 6
11/09/2012 07:49	13/09/2012 16:37	56:49	Stopped for Engine 3 due to Change intercooler	No methane destruction by the Engine 3
14/09/2012 20:36	03/10/2012 16:00	451:25	Stopped for Engine 6 due to Engine oil temperature high / Check piston and liner and waiting for service piston and liner / Service and install piston cylinder #8 and liner cylinder #8, 11 and change lube oil	No methane destruction by the Engine 6
15/09/2012 16:41	17/09/2012 11:32	42:52	Stopped for Engine 2 due to Valve no.13 broken & Change head cylinder # 13,15,19	No methane destruction by the Engine 2
15/09/2012 20:51	18/09/2012 12:19	63:29	Stopped for Engine 1 due to Waiting for service generator / service generator	No methane destruction by the Engine 1
18/09/2012 15:36	29/09/2012 00:53	249:18	Stopped for Engine 1 due to Waiting for generator repairing / Service generator and change lube oil	No methane destruction by the Engine 1
09/11/2012 04:56	10/11/2012 15:51	34:56	Stopped for Engine 3 due to Fuel mixture temperature high and change cylinder head cylinder #3,10,11,19 and change cylinder head gasket cylinder #17,18	No methane destruction by the Engine 3
14/11/2012 12:40	15/11/2012 16:34	27:55	Stopped for Engine 1 due to Leanox cont. deviation high and change turbo charger and PLC guard	No methane destruction by the Engine 1
06/12/2012 08:22	07/12/2012 17:37	33:16	Stopped for Engine 4 due to Change inter cooler	No methane destruction by the Engine 4
10/12/2012 17:27	15/12/2012 11:37	114:11	Stopped for Engine 6 due to Waiting part and change inter cooler	No methane destruction by the Engine 6
04/01/2013 15:54	07/01/2013 15:43	71:50	Stopped for Engine 4 due to Stop engine from suction swing	No methane destruction by the Engine 4
08/01/2013 13:30	09/01/2013 13:34	24:05	Stopped for Engine 2 due to Leanox cont. deviation high	No methane destruction by the Engine 2
09/01/2013 23:41	12/01/2013 13:45	62:05	Stopped for Engine 2 due to Start new engine	No methane destruction by the Engine 2
13/01/2013 13:28	19/01/2013 18:18	148:51	Stopped for Engine 4 due to Maintenance 20,000 hrs. running service	No methane destruction by the Engine 4
27/01/2013 15:09	01/02/2013 17:36	122:28	Stopped for Engine 3 due to Maintenance 20,000 hrs. running service	No methane destruction by the Engine 3
04/02/2013 09:13	05/02/2013 12:14	27:02	Stopped for Engine 4 due to Change inter cooler	No methane destruction by the Engine 4
10/02/2013 03:13	12/02/2013 12:45	57:33	Stopped for Engine 6 due to Change inter cooler	No methane destruction by the Engine 6
04/03/2013 06:59	09/03/2013 11:45	124:47	Stopped for Engine 2 due to Maintenance 20,000 hrs. running service	No methane destruction by the Engine 2
04/03/2013 11:28	05/03/2013 12:09	24:42	Stopped for Engine 5 due to Change cylinder # 5, 12, 17	No methane destruction by the Engine 5

Annex F. Special Events Table (Cont.)

Start Time (UTC)	Finish Time (UTC)	Downtime (hr:mm)	DESCRIPTION OF EVENT	Impact on ER Calculation
31/03/2013 11:05	06/04/2013 12:55	145:51	Stopped for Engine 1 due to Maintenance 20,000 Hrs. running service	No methane destruction by the Engine 1
22/04/2013 01:08	25/04/2013 07:16	78:09	Stopped for Engine 7 due to DE-COKE and maintenance 10,000 hrs. running service	No methane destruction by the Engine 7
29/04/2013 02:02	02/05/2013 04:27	74:26	Stopped for Engine 8 due to DE-COKE and maintenance 10,000 hrs. running service	No methane destruction by the Engine 8
13/05/2013 10:52	03/06/2013 11:38	504:47	Stopped for Engine 5 due to Waiting part and change inter cooler	No methane destruction by the Engine 5
14/05/2013 07:50	15/05/2013 10:17	26:28	Stopped for Engine 3 due to Replace generator	No methane destruction by the Engine 3
08/06/2013 05:40	10/06/2013 02:23	44:44	Stopped for Engine 5 due to Engine oil temperature high	No methane destruction by the Engine 5
10/06/2013 08:44	13/06/2013 10:59	74:16	Stopped for Engine 3 due to DE-COKE and maintenance 10,000 hrs. running service	No methane destruction by the Engine 3
16/07/2013 03:57	18/07/2013 04:06	48:10	Stopped for Engine 6 due to Change cylinder # 4, 11, 14, 15, 17, 18 and Compensator 2 units	No methane destruction by the Engine 6

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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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