Project design document form for CDM project activities

(Version 07.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	LFG flaring project at Dubai, UAE
Version number of the PDD	8
Completion date of the PDD	18/07/2016
Project participant(s)	**Green Energy Solutions & Sustainability LLC** **Dubai Municipality** **First Climate(India) Private Limited**
Host Party	**United Arab Emirates (UAE)**
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	Applied Methodology: ACM0001 (Version 12)- **Flaring or use of landfill gas**. Applied Standardized Baseline(s): **Not Applicable**
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral Scope linked to the applied methodology (ies): **13: Waste Handling & Disposal**
Estimated amount of annual average GHG emission reductions	268,622 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

General Description of the Project Activity

Green energy Solutions & Sustainability LLC is in the process of installation of a landfill gas (LFG) recovery system at the Al Qusais Landfill site in Dubai. The active Al Qusais Landfill site has been in operation since 1989. The Al Qusais landfill site has total surface area of approximately 53 hectares. The dumping of solid waste in the Al Qusais landfill is expected to be continued till 2013. However, depending on the availability of other landfill sites, the dumping of waste in Al Qusais landfill may be continued beyond 2013. Currently, daily around 10261[1] tonnes of municipal solid waste are being dumped at the Al Qusais landfill site under Dubai Municipality. No hazardous waste is deposited at the Al Qusais landfill site.

Purpose of the Project Activity

The purpose of the project activity is to replace the existing passive venting system (where the landfill gas is released into the atmosphere without any collection, recovery or combustion) with a landfill gas recovery system in order to collect and destroy the landfill gas generated at the Al Qusais Landfill site. The captured landfill gas will be completely flared by closed type flaring systems. The purpose of landfill gas flaring is to safely dispose of the flammable constituents (particularly methane) and to control odour nuisance, health risks and adverse environmental impacts. This will involve installation of an efficient gas collection system and requisite flaring equipment. The electricity requirement of the proposed project activity would be met by DG sets installed at the project site. Post project PP installed a 1 MW power generation system on Landfill gas and the power is used onsite for the running the blower and flare systems of Unit I and II. The Project also has a standby DG set for emergency power during outage of the gas based power generating system.

The major milestones for the project include:

- Site construction: From Jan 2012 to September 2012
- Setting up the flare unit and start of flare by November 2012

Setting up the Gas Based generation by January 2013.

In the absence of the project the landfill site would continue receiving Municipal Solid Waste (MSW) from the Dubai municipality area and the gas generated therein due to decomposition of the organic content of waste material would be released to the atmosphere. The project activity therefore would result in reduction of greenhouse gas (GHG) emissions associated with uncontrolled release of methane into the atmosphere

Contribution of the project activity to sustainable development:

- *The project contributes to the general well-being of the region and is in line with the sustainable development policies of the host country.*

Social well-being:

- *The installed landfill gas collection and flaring system will prevent potentially explosive situations associated with the subsurface gas migration, as it represents an effective control system which minimises migration off-site. Many constituents of landfill gas are hazardous and pose potentially significant risks to human health. The objective of LFG flaring is to safely dispose of the perilous constituents, particularly methane, and to control and reduce odour nuisance and health risks.*

---

[1] *Average daily figure has been obtained based on annual figure provided by Dubai Municipality*

Economic well-being:

- *The project would help in employment generation at landfill site and would act as a demonstration project that could be replicated to other landfill sites of similar nature.*
- *The project activity promotes the landfill gas recovery technology in the region. With CDM revenues the project activity has potential to encourage other landfill sites in the region to adopt similar technology.*
- *The project activity has the potential to earn significant CDM revenue which would contribute to the Gross Domestic Product (GDP) of the country.*

Environmental well-being:

- *Contribution to mitigation of global warming due to avoidance of methane emission.*
- *The project would result in avoidance of methane emissions and hence result in improvement of air quality in and around the landfill site. The avoidance of landfill gas emissions also prevents the escape of volatile organic compounds (VOC) from the gas. Introduction of managed landfill mechanism prevents incidence of fire and explosions which are common to unmanaged landfill site*

A.2. Location of project activity

A.2.1. Host Party

>>
United Arab Emirates

A.2.2. Region/State/Province etc.

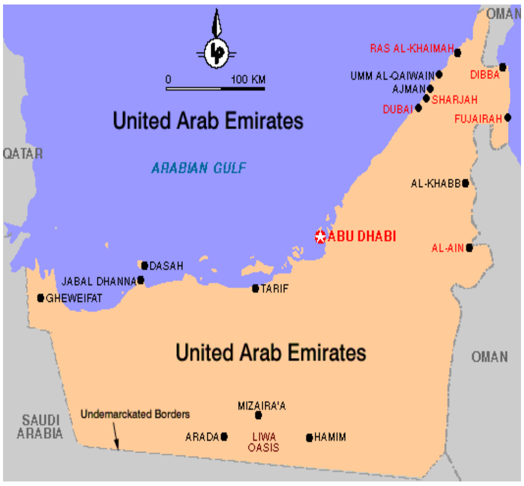
>>
Emirate: Dubai

A.2.3. City/Town/Community etc.

>>
City: Al Qusais

A.2.4. Physical/Geographical location

>>
The landfill site is known as Al Qusais landfill. It is located close to the Sharjah border of Dubai. The geographical co-ordinates for the project activity are mentioned below:
Longitude: 55˚26’14” East
Latitude: 25˚16’47” North
Arial view of the landfill and an indicative map of the landfill site are provided below:



Map of the United Arab Emirates, highlighting the location of Dubai

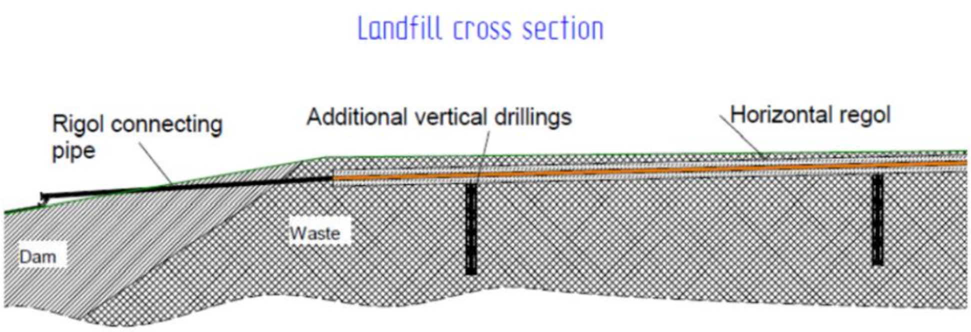
A.3. Technologies and/or measures

>>

The purpose of the project activity is to replace the existing passive venting system (where the landfill gas is released into the atmosphere without any collection, recovery or combustion) with a landfill gas recovery system in order to collect and destroy the landfill gas generated at the Al Qusais Landfill site. The captured landfill gas will be completely flared using closed type flares. The purpose of landfill gas flaring is to safely dispose of the flammable constituents (particularly methane) and to control odour nuisance, health risks and adverse environmental impacts. This will involve installation of an efficient gas collection system and requisite flaring equipment. The gas collection and flaring equipment is being supplied by Hofstetter Umwelttechnik AG which is one of the world's leading companies in flaring technology and degassing systems.

The project activity therefore would result in reduction of greenhouse gas (GHG) emissions associated with uncontrolled release of methane into the atmosphere.

The gas collection network would be combination of horizontal and vertical wells. The Horizontal gas collection system in combination with the vertical gas wells consists of gas trenches and implemented with a defined gradient from the centre of the landfill towards the sides. Vertical wells are drilled at adequate distance. The vertical gas wells are directly interconnected with the gas trenches and are underground and not piercing the surface in order to facilitate movement of waste dumping machinery on the landfill. The pictorial depiction of the setup is given below.

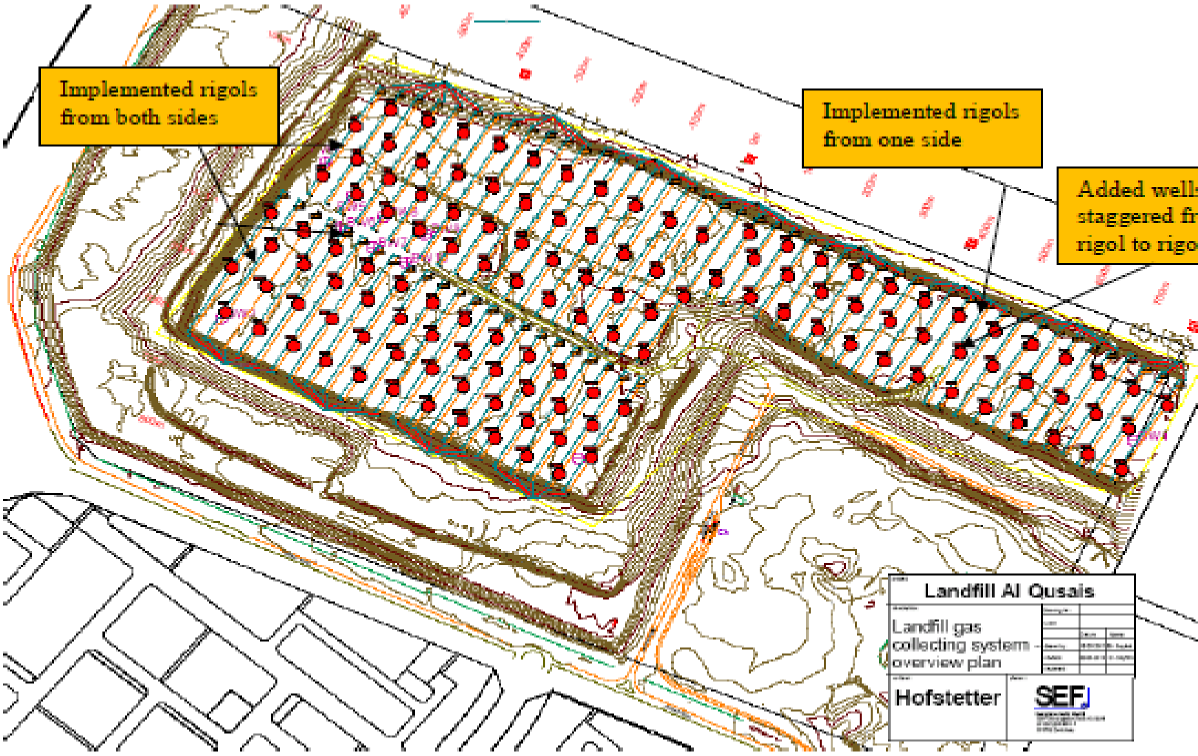


The project activity involves installation of a compact degassing plant and an efficient high temperature flare.

Compact Degassing plant (HOFGAS):

The project activity involves the installation of an active landfill-gas collection system using a combination of horizontal and vertical gas wells drilled into the waste to extract the LFG. The gas collection network consists of pipes that connect groups of gas wells to manifolds. These manifolds

are connected to a main pipe and then to the main header pipe, which delivers the gas to the extraction plant and the flare. The system operates at pressure slightly lower than atmospheric, as blowers will draw the gas from the wells through the collection system and deliver it to the flare. The schematic diagram of the gas collection system has been presented below.



The details of the major components are given below. :

Blower units[2]:

Gas flow rate of blowers (Nm^3/hr.)	Max:1500 Min:300
Number of blowers	2
Rating of motors (KW)	2 x 30
No of Skids	02

High temperature Flare[3]:
The extracted landfill gas is flared in the efficient high temperature flare.

Type	Closed
Number of flares	2
Gas flow rate of flare (Nm^3 /hr.)	Max: 3000 Min: 300
Flare temperature (^{o}C)	1000-1200
Residence time (seconds)	0.3

Pre-dewatering unit:

[2] *Hofstetter PO dated 31/10/2011*

[3] *Hofstetter PO dated 31/10/2011*

The LFG from the landfill is hot and saturated with moisture. A pre-dewatering unit capable of separating larger quantities of "splash water" would be installed at the entry of the gas pumping stations.

Gas filter unit:

During De-gassing small amount of sand, pieces of plastics and debris get transported through the piping into the gas pumping unit. These impurities might get in to the gas blowers and thus detrimental to the project. Gas filter units of around 200Um would be installed at the inlet of gas pumping station to prevent the same.

Electrical load of flaring[4]:

Electrical load	**Unit**	**Value**
2 gas blowers	kW	60
Flare	kW	1
Container	kW	10
Cooling unit	kW	180
Ancillaries (water pump, air conditioner)	kW	9
Total electrical load for 1 flare unit	kW	260
Total electrical load for 2 flare units	kW	520
Electrical load of office, lighting	kW	20
Total load for the project activity	kW	540

Onsite Gas Based power generation system:

The project has installed an onsite 1 MW power generation unit which includes installation of a 1 MW GE- Jenbacher (JFC-320-GS-B. I) whose technical parameters are given below.:

		Full Load	Part Load (50%)
Energy Input	KW	2655	1436
Gas volume	NM3/hr	279	151
Electrical output	KW	1063	529
Electrical efficiency		40%	36.8%

The other major components of the project would include.

- Suction piping and discharge piping for blower system.
- Gas collection stations
- High temperature flare unit.
- Blower skid for conveying gas from landfill to flare
- Dewatering unit
- Electrical control cabinet
- Instrumentation systems for blower and flare operations.
- Monitoring equipment for landfill gas capture and utilization systems.
- Onsite DG for auxiliary power 2x370 kVA with a connected load 540kW (will be used in case of failure of the LFG based power generation unit)
-
- Onsite landfill gas based power generation unit, 1 MW capacity.

[4] *Obtained from electrical load details provided by Hofstetter through mail dated 27th May 2012*

A.4. Parties and project participants

Party involved (host) indicates 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)
United Arab Emirates (host)	**Private entity:** First Climate (India) Private Limited **Private entity:** Green Energy Solutions & Sustainability LLC. **Public entity:** Dubai Municipality	No

A.5. Public funding of project activity

>>
There has been no public involved in the project activity

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

>>
Reference of selected approved baseline and monitoring methodology

ACM0001 - *Consolidated baseline and monitoring methodology for landfill gas project activities*[5]
Version – *12.0.0, EB 65*
Valid from 25th November 2011

The methodology also makes reference to the below mentioned tools.

- *Tool to determine project emissions from flaring gases containing methane, version 1, EB 28 annex 13*[6]
- *Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 1, EB 39 annex 7*[7]
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, version 2, EB 41 annex 11*[8]
- *Combined tool to identify the baseline scenario and demonstrate additionality, version 4.0.0, EB 66 annex 48*[9]
- *Emissions from solid waste disposal sites, version 06.0.1, EB 66 annex 46*[10]
- *Tool to determine the remaining lifetime of equipment, version 1, EB 50 annex 15*[11]

[5] http://cdm.unfccc.int/methodologies/DB/RNAKK7JRFWIKCFT3YSNKGPC1FR2DVA
[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf
[7] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf
[9] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v4.0.0.pdf
[10] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf
[11] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf/history_view

- *Tool to determine the baseline efficiency of thermal or electric energy generation systems, version 1, EB 48 annex 12*[12]
- *Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 02.0.0, EB 61 annex 11*[13]

Reference to standardized baseline

This is not applicable to the aforesaid project activity

B.2. Applicability of methodology and standardized baseline

>>

Applicability of Methodology

In the project activity large scale methodology ACM0001, Version 12.0.0 has been applied and application of the methodology is justified below:

Applicability Criteria	Justification
This methodology is applicable to project activities which: *(a) Install a new LFG capture system in a new or existing SWDS; or* *(b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:* *(i) The captured LFG was only vented or flared and not used prior to the implementation of the project activity; and* *(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.* *(c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:* *(i) Generating electricity;* *(ii) Generating heat in a boiler, air heater or kiln (brick firing only);*[14] *and/or* *(iii) Supplying the LFG to consumers*	Applicable and fulfilled: (a) The proposed project activity involves installation of a new LFG capture system in an existing Solid waste disposal site (SWDS). (b) Not applicable as there was no existing LFG capture system in the pre-project scenario. (c) The gas captured in the project activity would be flared and partly used for generation of power onsite for captive use as auxiliary (d) The project activity involves installation of a LFG capture and flaring system it does not result in any reduction of waste that would be recycled in absence of the project activity.[15] Hence this criterion is fulfilled.

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf

[13] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v2.0.0.pdf

[14] *For claiming emission reductions for other heat generation equipment (including other products in kilns), project participants may submit a revision to this methodology.*

[15] *This has been provided in Declaration from Dubai Municipality dated 30/10/2012 Ref: 812/02/02/1/1213694*

through a natural gas distribution network. *(d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.*	
The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is *(a) Partial or total release of the LFG from the SWDS; and* *(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heat or kiln;* *(i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or* *(ii) For heat generation: that heat would be generated using fossil fuels in on-site equipment.*	Applicable and fulfilled: (a) As explained in section B.4 and B.5 below the most plausible baseline scenario identified for the project activity is total release of the LFG from the landfill. (b) The project involves use of LFG onsite for generation of power which is used to power the unit itself. In the baseline scenario the methane would have been vented from the landfill site and thus no power demand would have been there. in the absence of the project the power would have been generated in a fossil fuel based (diesel based) system.. Hence this criterion is fulfilled.
This methodology is not applicable: *(a) In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln, where the purpose of the CDM project activity is to implement energy efficiency measures at the kiln;* *(b) If the management of the SWDS in the project activity is deliberately changed in order to increase methane generation compared to the situation prior to the implementation of the project activity (e.g. other to meet a technical or regulatory requirement). For example, this may apply to the addition of liquids to a SWDS, pre-treating waste to seed it with bacteria for the purpose of increasing the anaerobic degradation environment of the SWDS or changing the shape of the SWDS to increase the Methane Correction Factor.*	Applicable and fulfilled: (a) The project activity does not involve use of any other methodology apart from ACM 0001. (b) There is no change in the management of the SWDS apart from the installation of the LFG recovery system. Prior to the project activity the solid wastes are dumped in the selected area and then the wastes are mechanically compacted. After the entire waste in that area is compacted intermediate layer of sand is put on the waste and the same procedure is followed layer after layer. The waste will be dumped in similar manner in the future as well. There will be no such deliberate change in the management of the SWDS which will increase the methane generation compared to the situation prior to the implementation of the project activity.[16] Hence the criterion is fulfilled.

In addition the applicability conditions mentioned in the following tools are to be fulfilled.

[16] This has been provided in Declaration from Dubai Municipality dated 30/10/2012 Ref: 812/02/02/1/1213694.

The "Tool to determine project emissions from flaring gases containing methane" version 1, EB 28 annex 13 is applicable under the following conditions:

Applicability Criteria	Justification
The residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen	Applicable and fulfilled: The residual gas stream to be flared (landfill gas) does not contain any combustible gases other than methane, carbon monoxide and inert gases such as nitrogen.
The residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others) or from gases vented in coal mines (coal mine methane and coal bed methane)	Applicable and fulfilled: The residual gas stream to be flared (landfill gas) is obtained from decomposition of organic material in landfills.

The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 1, EB 39 annex 7" is only applicable if one out of the following three scenarios applies to the sources of electricity consumption:

Applicability Criteria	Justification
Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only.	Not applicable: The electricity consumed in the project activity is not sourced from the grid.
Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).	Applicable and fulfilled: The electricity consumed in the project activity would be sourced from the diesel generator set located at the site.
Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s).	Not applicable: The electricity consumed in the project activity is sourced only from the diesel generator set located at the site.

The "Emissions from solid waste disposal sites", version 6.0.1, EB 66, Annex 46 is applicable under the following conditions:

Applicability Criteria	Justification
The tool is applicable in cases where the solid waste disposal site where the waste would be dumped can be clearly identified. The tool is not applicable to stockpiles. The tool is not applicable to hazardous wastes.	Applicable and fulfilled: The waste disposal site can be clearly identified as the active Al Qusais landfill site. The Al Qusais landfill is not a stockpile nor is it used for the disposal of hazardous wastes.

Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 02.0.0, EB 61 annex 11

Applicability Criteria	Justification
Typical applications of this tool are methodologies where the flow and composition of residual or flared	Applicable and fulfilled: The flow and the composition of residual or flared gases or exhaust will be monitored in

gases or exhaust gases are measured for the determination of baseline or project emissions.	this project for the determination of the baseline and project emission and thus the Applicability Criteria is satisfied.
Methodologies where CO_2 is the particular and only gas of interest should continue to adopt material balances as the means of flow determination and may not adopt this tool as material balances are the cost effective way of monitoring flow of CO_2.	Not Applicable: There is no CO_2 emission involved particularly and is not applicable.

Other tools in linked to the methodology are not applicable for the project. Thus the project activity fulfils all the relevant criteria of the methodology and the corresponding tools.

Applicability of Standardized Baseline
This is not applicable for the aforesaid project activity.

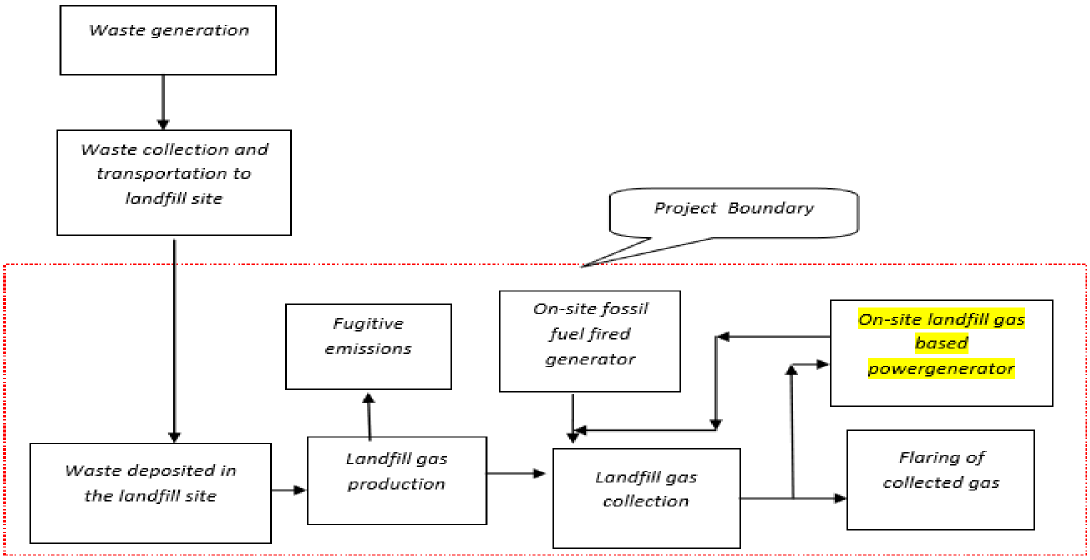
B.3. Project boundary

As per the relevant guidance provided in the methodology, "*The project boundary of the project activity shall include the site where the LFG is captured and, as applicable:*

- *Sites where the LFG is flared or used (e.g. flare, power plant, boiler, air heater, kiln or natural gas distribution network);*
- *Captive power plant(s) or power generation sources connected to the grid, which are supplying electricity to the project activity;*
- *Captive power plant(s) or power generation sources connected to the grid, which are supplying electricity in the baseline that is displaced by electricity generated by captured LFG in the project activity; and*
- *Heat generation equipment or sources which are supplying heat in the baseline that is displaced by heat generated by captured LFG in the project activity.*

The project boundary is therefore the site at the Al Qusais Landfill where landfill gas would be captured and flared. The project boundary also includes the diesel generator along with a new 1 MW landfill gas fired generation unit for generation of power for meeting the power requirement of the project activity.

The following diagram illustrates the project boundary:


Waste generation
Waste collection and transportation to landfill site
Project Boundary
Fugitive emissions
On-site fossil fuel fired generator
On-site landfill gas based powergenerator
Waste deposited in the landfill site
Landfill gas production
Landfill gas collection
Flaring of collected gas

The activities and emission sources considered within the project boundaries are listed in the table below:

Source		**GHGs**	**Included?**	**Justification/Explanation**
Baseline scenario	*Emissions from decomposition of waste at the SWDS site*	CO_2	No	*CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity*
		CH_4	Yes	*The major source of emissions in the baseline*
		N_2O	No	*N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative*
	Emissions from electricity generation	CO_2	No	*~~Since there is no electrical energy generation in the project activity~~ Power generated onsite using the landfill gas is for consumption by the project equipment, the absence of the same the power would have been generated from onsite fossil fuel based (diesel based) system. The baseline emissions for the same are not accounted for conservativeness.*
		CH_4	No	*~~Since there is no electrical energy generation in the project activity~~ as above*
		N_2O	No	*~~Since there is no electrical energy generation in the project activity~~ as above*
	Emissions from heat generation	CO_2	No	*Since there is no thermal energy generation in the project activity*
		CH_4	No	*Since there is no thermal energy generation in the project activity*
		N_2O	No	*Since there is no thermal energy generation in the project activity*
	Emissions from the use of natural gas	CO_2	No	*Since the project activity does not involve supply of LFG through a natural gas distribution network*
		CH_4	No	*Since the project activity does not involve supply of LFG through a natural gas distribution network*
		N_2O	No	*Excluded for simplification. This is conservative*
Project scenario	*Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity*	CO_2	No	*The project activity is not expected to combust any fossil fuel.*
		CH_4	No	*The project activity is not expected to combust any fossil fuel.*
		N_2O	No	*The project activity is not expected to combust any fossil fuel.*
	Emissions from electricity consumption due to the project activity	CO_2	Yes	*May be an important emission source due to fossil fuel based energy generation onsite for use in the project plant*
		CH_4	No	*Excluded for simplification. This emission source is assumed to be very small*
		N_2O	No	*Excluded for simplification. This emission source is assumed to be very small*

B.4. Establishment and description of baseline scenario

>>

In accordance with ACM0001, version 12.0.0, the baseline scenario is identified as follows:

Step 1: Identification of alternative scenarios

As per ACM0001, version 12.0.0, Step 1 of the "Combined tool to identify the baseline scenario and demonstrate additionality" all realistic and credible alternatives have been identified below:

Step 1a: Define alternatives scenarios to the proposed CDM project activity:

As per ACM0001, version 12.0.0 baseline alternatives for the destruction of LFG, shall take into consideration, inter alia, the following alternatives:

Scenario	Scenario description	Justification	Baseline
Waste treatment			
LFG1	The project activity implemented without being registered as a CDM project activity (i.e. capture and flaring or use of LFG)	The proposed project activity undertaken without being registered as a CDM project activity is a plausible scenario.	Yes
LFG2	Atmospheric release of the LFG or partial capture of LFG and destruction to comply with regulations or contractual requirements, or to address safety and odour concerns	The pre-project scenario is total release of the LFG to the atmosphere and hence continuation of prevailing practice is a plausible scenario.	Yes
LFG3	LFG is partially not generated because part of the organic fraction of the solid waste is recycled and not disposed in the SWDS	In the pre-project scenario the waste dumped at the site was not recycled and the entire waste was disposed in the SWDS. Hence this not a plausible scenario.	No
LFG4	LFG is partially not generated because part of the organic fraction of the solid waste is treated aerobically and not disposed in the SWDS	In the pre-project scenario no aerobic treatment of solid waste was in place and the entire waste was disposed in the SWDS. Hence this not a plausible scenario.	No
LFG5	LFG is partially not generated because part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS	In the pre-project scenario no incineration of solid waste was in place and the entire waste was disposed in the SWDS. Hence this not a plausible scenario.	No

~~As LFG captured in the project activity is flared hence the baseline scenarios for use of LFG have not been identified for the project activity.~~

ACM0001 requires baseline assessment if LFG is used for generation of electric or heat energy for export to a grid and/or to a nearby industry or used on-site.

Realistic and credible alternatives should be separately determined for: Power generation in the absence of the project activity which is use of LFG for generation of power for use onsite.

Power generation in the absence of the project activity Potential alternatives may include:

• *E1: Electricity generation from LFG, undertaken without being registered as CDM project activity;*
• *E2: Electricity generation in existing or new on-site or off-site renewable based captive power plant(s);*
• *E3: Electricity generation in existing and/or new grid-connected power plants.*

With regard to renewable energy sources, there are numerous renewable power generations options, but many resources (such as hydro, wave, marine currents, etc.) are not available at a landfill site. A landfill that is receiving solid waste on a daily basis is not a suitable location for locating windmills or solar power stations. Even after the landfill is closed, LFG continues to leak

out, the ground subsidizes, making landfills unsuitable for any constructions. Therefore, renewable power generation options at the landfill site do not comprise realistic nor credible baseline scenarios.

There is no heat demand onsite and thus same is not considered in baseline determination.

Hence Option E2 is discounted and the realistic and credible options are E1 and E3.

Outcome of Sub-step 1a:

The following are defined as credible alternatives to the project activity:

LFG1: The project activity (i.e. capture of landfill gas and its flaring) undertaken without being registered as a CDM project activity.

LFG2: Atmospheric release of the landfill gas (continuation of pre-project scenario).

The alternatives for the power generation portions are

- *E1: Electricity generation from LFG, undertaken without being registered as CDM project activity;*
- *E3: Electricity generation in existing and/or new grid-connected power plants.*

Sub-step 1b: Consistency with mandatory laws and regulations:

Both the scenarios LFG1and LFG2 complies with all the applicable laws and regulations of the country. There are no laws in UAE which mandates any recovery of methane from the land fill site.[17]

As for the electrical part, both E1 and E3 comply with all the applicable laws and regulations of the country. In UAE (Duabi) all electrical installations come under the purview of DEWA.There is no substation of DEWA (Dubai Electrical and Water Authorities) near the landfill project and the possibility of DEWA coming up with as substation for a demand of only around 500 kW is very remotely possible. The alternative E3 (Electricity generation in existing and/or new grid-connected power plants) is therefore ruled out and the only plausible scenario is E1 (Electricity generation from LFG, undertaken without being registered as CDM project activity).

Outcome of Step 1b:
The following are defined as credible alternatives to the project activity:

LFG1: The project activity (i.e. capture of landfill gas and its flaring) undertaken without being registered as a CDM project activity.
LFG2: Atmospheric release of the landfill gas (continuation of pre-project scenario).

E1: Electricity generation from LFG, undertaken without being registered as CDM project activity;

Step 2: Barrier analysis:

This step has not been applied to demonstrate additionality.

Step 3: Investment analysis

This step has been used to identify the baseline scenario and to demonstrate the additionality of the proposed project. This step has been elaborated in the following section (Section B.5).

[17] Based on the list of laws and regulations available in the website http://moew.gov.ae/portal/en/laws-and-legislations.aspx#page=1 (please select category as environment)

B.5. Demonstration of additionality

>>

In continuation to the steps discussed in section B.4 the additionality has been demonstrated as per the following steps of the "Combined tool to identify the baseline scenario and demonstrate additionality", version 4.0.0,

Step 3: Investment analysis

Identification of financial indicator:

As per the "Combined tool to identify the baseline scenario and demonstrate additionality" alternative scenario S3 corresponds to:

"Where applicable, the continuation of the current situation, not requiring any investment or expenses to maintain the current situation, such as, inter alia:

- *The continued venting of methane from a landfill;*
- *The continued release of N2O from adipic or nitric acid production"*

The identified baseline alternative LFG2 refers to atmospheric release of the landfill gas which is a continuation of the pre-project scenario and it does not require any investment or expenses to continue the venting of landfill gas. Hence baseline alternative LFG2 corresponds to alternative scenario S3 of the above mentioned tool.

Again as per the "Combined tool to identify the baseline scenario and demonstrate additionality", NPV or IRR should be used as financial indicator for project activities with baseline scenario S3 (The continued venting of methane from a landfill) which correspond to the continued venting of methane from a landfill.

Since there is no revenue from the project activity apart from the revenue from sale of carbon credits, using IRR as financial is not practical. Thus in the project activity NPV has been chosen as financial indicator. Considering the lifetime of the equipment as 15 years[18], the assessment period for the calculation of NPV has been chosen as 15 years.

As per the "Combined tool to identify the baseline scenario and demonstrate additionality" the NPV for the scenario of continuation of prevailing practice of release of methane to atmosphere from the landfill site LFG2 or S3 is '0'.

NPV of the project activity without CDM i.e. Scenario LFG1 + E1:

Particulars	Unit	Value	Remarks / source
Financial			
Project Cost[19]	Million Euro	1.42	Techno-commercial offer from Hofstetter dated 18/09/2011[20]
Operation & Maintenance Cost	Million Euro	0	The O&M cost of the project could not be estimated with any amount of certainty at the project decision making time. In the absence of any evidence to

[18] Letter dated 14/02/2012 from Hofstetter mentioning the life time of the equipment

[19] The project cost does not include the cost of landfill covering and profiling, cost of well installation, working capital and other associated costs; it includes the cost of degassing and flaring unit only.

[20] The cost of onsite LFG power project is not included for conservativeness

			support the O&M cost, the same was hence conservatively considered as zero while presenting the investment analysis. [21]
Salvage value	%	10	Obtained from information provided by independent Management consultants- Ideal Management Consultants dated 20/09/2011 (ref no. 1220/RMSO).
Discount rate	%	10.1	Discount rate is the rate of return that could be earned on an investment in the financial markets with similar risk. Hence, the default value for expected return on equity for group 1 project (i.e. Waste handling and disposal) in United Arab Emirates as provided in the Appendix A of the "Guidelines on the assessment of investment analysis" has been taken as discount rate
Source of Funds			
Debt	Million Euro	0	The project is entirely equity financed.
Equity	Million Euro	1.42	The project is 100% equity financed.
CDM related parameters			
Price of CER	Euro	8	For the month of September Obtained from http://bluenext.org/

The cost of the landfill gas capture and flaring system has been estimated to be € 1.42 million based on the techno-commercial offer provided by Hofstetter for the degassing unit which was available at the time of decision making (25/09/2011) which is in line with the guidance 6 of the "Guidelines on the assessment of investment analysis", version 5, EB 62 annex 5. Since the project activity involves installation and operation of a LFG capture and flaring system and installation of 1 MW LFG fired power generation unit for meeting captive power demand, there is no revenue stream for the project activity apart from CDM revenue.

The results of the NPV analysis are presented below:

Parameters	Values (Million Euro)
NPV of scenario LFG 1 + E1	-1.26
NPV of scenario LFG 2	0
NPV of scenario LFG 1 + E1 (with CDM revenue)	12.41

<u>Sensitivity analysis:</u>

The purpose of sensitivity analysis is to establish that the result of the financial analysis is robust to reasonable variations in the critical assumptions. The **"Guidance on the Assessment of Investment Analysis, Version 05, EB 62 annex 5"** provides that
"*Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation"* **and** "*As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%"*

[21] The cost of operations of a onsite LFG power generation system is not known with surety and so not included for conservativeness.

As per the above guidance sensitivity analysis has been carried out covering a range of ± 10 % for the following parameters to check the robustness of the outcome of financial computations:

- Project cost

Table: Variation in NPV (in INR million) due to reasonable variation of sensitive parameters

Sensitive parameters	+10%	0	-10%
Project Cost	-1.47	-1.26	-1.20

The sensitivity analysis establishes that in all conditions accommodating suitable variation in the sensitive parameter, the NPV of the project activity remains negative. Furthermore, the actual cost of project activity is same as the offer price which has been considered for the investment analysis.

Thus it is evident from the above discussion that the scenario LFG2 (continuation of prevailing practice of venting of methane to atmosphere) is financially more attractive than the scenario LFG1 (gas capture and flaring without CDM revenue) and E1. Also the revenue from sale of carbon credits makes the project financially viable.

Outcome of Step 3:
As demonstrated above there is only one remaining baseline alternative:

LFG2: Atmospheric release of the landfill gas (continuation of pre-project scenario).

Step 4: Common Practice Analysis

Since the proposed CDM project activity applies measure that is listed in the definition sections of the "Combined tool to identify the baseline scenario and demonstrate additionality", version 4.0.0, Step 4a is applicable for common practice analysis. However, in the 69th EB meeting the "Guidelines on common practice" has been revised and as per para 75 of the 69th EB meeting report the revisions in the common practice guidance would be incorporated in the next revision of "Combined tool to identify the baseline scenario and demonstrate additionality". Hence the latest "Guidelines on common practice", EB 69, annex 8 has been referred for carrying out common practice analysis.

Applicable geographical area: Although waste management policies differ between the various emirates, the host country i.e. UAE has been considered as the default geographical area.

Measure: The project activity involves installation of a landfill gas capture and flaring system. Thus the measure for the project activity is (c) Methane destruction (example: landfill gas flaring).

Output: Since the project activity involves landfill gas recovery and flaring, quantity of methane destructed is the output for the project activity.

Step 1: calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

Since the project activity involves destruction of methane, the capacity of the project activity can determined in terms of quantity of methane destructed i.e. 13994 tCH_4. Thus the output range of the project activity is between 6997 tCH_4 and 20991 tCH_4 i.e. +/-50% of the design output.

Step 2: identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

(a) The projects are located in the applicable geographical area;

The applicable geographical area i.e. United Arab Emirates consists of 7 separate states (Emirates): Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al Qaiwain, Fujairah and Ras Al Khaimah. MSW landfills in all major cities in the host country have been listed below:

Landfill Name[22]	**Emirate**	**Current Status**
Al Jebel- Ali	Al Jebel-Ali, Dubai	No gas collection system
Al Dhafra landfill	Al Dhafra, Abu Dhabi	No gas collection system
Sharjah old and new landfills	Sharjah	No gas collection system, aerobic treatment system being implemented under CDM. New methodology was submitted.[23]
Ras Al-Khaimah landfill	Ras Al-Khaimah	Landfill gas capture and utilisation project (Registered CDM project activity with reference no. 2496)
Al Ain landfill	Abu Dhabi	No gas collection system
Al Hail landfill	Al Hail, Fujairah	No gas collection system
Umm Al Quwain	Umm Al Quwain	No gas collection system

(b) The projects apply the same measure as the proposed project activity;

As demonstrated in the above table, the landfill with the same measure as that of project activity (i.e. landfill gas capture and flaring) is Ras Al-Khaimah landfill site[24] which involves landfill gas capture and utilization measure.

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

This criterion is not relevant for the project activity as the project activity involves landfill gas capture and flaring project.

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

This criterion is not relevant for the project activity as the project activity involves landfill gas capture and flaring project.

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

The capacity of the Ras Al-Khaimah[25] landfill gas capture and utilisation project is 13,390 tCH_4 and thus within the range of the output of the project activity.

---

[22] *Based on data provided by Ministry of Environment, UAE*

[23] *http://cdm.unfccc.int/methodologies/PAmethodologies/pnm/byref/NM0283*

[24] *Registered CDM project with reference no 2496*

[25] *Registered CDM project with reference no 2496*

(f) *The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity*

The Ras Al-Khaimah[26] landfill gas capture and utilisation project was commissioned in February 2008[27] i.e. before the start date of the proposed CDM project activity.

Step 3: within the projects identified in Step 2, identify those that are neither CDM registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

Since the Ras Al-Khaimah landfill gas capture and utilisation project is a registered CDM project activity[28], therefore $N_{all} = 0$.

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

Since $N_{all} = 0$, therefore $N_{diff} = 0$

Step 5: calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

This criterion is not relevant for the project activity as both N_{all} and N_{diff} are '0'.

As per para 10 of "Guidelines on common practice", EB 69, annex 8, *"The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3."*

Since $N_{all} - N_{diff} = 0$, the project activity is not a common practice in the region, it can be concluded that the project activity is additional in itself.

<u>Demonstration of prior CDM consideration</u>:

The project proponents have considered CDM revenues right at the planning stage of the project activity. "Guidelines on the demonstration and assessment of prior consideration of the CDM", version 4, EB 62 annex 13

"*for project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date*"

The start date of the project activity is 26th October 2011 i.e. the date of signing contract with the equipment supplier. In line with the above guidance the project proponent has intimated both the host Party DNA (CDM- DNA of UAE) and UNFCCC secretariat through email and received the acknowledgement from both the parties. The important dates are presented here below:

---

[26] *Registered CDM project with reference no 2496*

[27] *http://cdm.unfccc.int/filestorage/D/1/9/D190TO4ASLJCE8BHMGFKVYZI5P3XU6/PDD.pdf?t=Y298bWJxYzljfDBPy6ffpElHEjIU0bxHuSKW*

[28] *Registered CDM project with reference no 2496*

Date	CDM related Milestone
01/11/2011	Notification to UNFCCC about the CDM project activity
01/11/2011	Acknowledgement of the receipt of notification of the CDM project activity by UNFCCC
07/11/2011	Notification to DNA (UAE) about the CDM project activity
14/02/2012	Acknowledgement of the receipt of notification of the CDM project activity by DNA (UAE) & UNFCCC

B.6. Emission reductions

B.6.1. Explanation of methodological choices

>>

Baseline Emissions:

As per the steps and guidance provided in the approved methodology ACM0001 version 12.0.0, the baseline emission reductions have been calculated as follows:

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year *y*	tCO_2e
$BE_{CH4,y}$	Baseline emissions of methane from the SWDS in year *y*	tCO_2e
$BE_{EC,y}$	Baseline emissions associated with electricity generation in year *y*	tCO_2e
$BE_{HG,y}$	Baseline emissions associated with heat generation in year *y*	tCO_2e
$BE_{NG,y}$	Baseline emissions associated with natural gas use in year *y*	tCO_2e

Step (A): Baseline emissions of methane from the SWDS ($BE_{CH4,y}$)

$$BE_{CH4,y} = \left(1 - OX_{top\_layer}\right)\left(F_{CH4,PJ,y} - F_{CH4,BL,y}\right) GWP_{CH4} \quad \textbf{(2)}$$

Where:

$BE_{CH4,y}$	Baseline emissions of LFG from the SWDS in year *y*	tCO_2e
OX_{top_layer}	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline	dimensionless
$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year *y*[29]	tCH_4
$F_{CH4,BL,y}$	Amount of methane in the LFG that would be flared in the baseline in year *y*	tCH_4
GWP_{CH4}	Global warming potential of CH_4	tCO_2e/tCH_4

Step A.1: Ex post determination of $F_{CH4,PJ,y}$

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y} \quad \textbf{(3)}$$

Where:

[29] Although 1 MW landfill gas based power project is installed onsite no claims against the amount of methane destroyed by way of energy generation is there in the project. Claims are solely based on amount of methane flared. This is for conservative estimates.

$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year *y*	tCH_4
$F_{CH4,flared,y}$	Amount of methane in the LFG which is destroyed by flaring in year *y*	tCH_4
$F_{CH4,EL,y}$	Amount of methane in the LFG which is used for electricity generation in year *y*	tCH_4
$F_{CH4,HG,y}$	Amount of methane in the LFG which is used for heat generation in year *y*	tCH_4
$F_{CH4,NG,y}$	Amount of methane in the LFG which is sent to the natural gas distribution network in year *y*	tCH_4

As per the methodology ACM 0001, version 12.0.0, *"$F_{CH4,EL,y}$, $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ are determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". The following requirements apply:*

- *The gaseous stream the tool shall be applied to is the LFG delivery pipeline to each item of electricity generation or heat generation equipment j, or the natural gas distribution system. $F_{CH4,EL,y}$ and $F_{CH4,HG,y}$ y are then calculated as the sum of mass flows to each item of electricity generation or heat generation equipment j;*
- *CH_4 is the greenhouse gases for which the mass flow should be determined;*
- *The flow of the gaseous stream should be measured on continuous basis;*
- *The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 or 17 in the tool); and*
- *The mass flow should be summed to a yearly unit basis (t CH_4/yr)"*

Since in the project activity the LFG captured would be flared $F_{CH4,EL,y}$, $F_{CH4,HG,y}$ and $F_{CH4,NG,y}$ are all zero.

Amount of methane destroyed by flaring ($F_{CH4,flared,y}$)

$$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}} \quad \textbf{(4)}$$

Where:

$F_{CH4,flared,y}$	Amount of methane in the LFG which is destroyed by flaring in year *y*	$t\ CH_4$
$F_{CH4,sent\_flare,y}$	Amount of methane in the LFG which is sent to the flare in year *y*	$t\ CH_4$
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year *y*	$t\ CO_2e$
GWP_{CH4}	Global warming potential of CH_4	$t\ CO_2e/t\ CH_4$

As per the methodology ACM 0001, version 12.0.0, "*$F_{CH4,sent\_flare,y}$ is determined directly using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", applying the requirements described above where the gaseous stream the tool shall be applied to is the LFG delivery pipeline to the flare(s)".*

The mass flow of gas stream i.e. LFG delivery pipeline to the flare has been determined as per Option C of Option 2 in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 2, EB 61 Annex 11.

Here $F_{CH4,sent\_flare,y}$ is the cumulative mass flow of gas stream over the year.

$$F_{i,t} = V_{t,wb,n} \times v_{i,t,wb} \times \rho_{i,n}$$

with

$$\rho_{i,n} = \frac{P_n \times MM_i}{R_u \times T_u}$$

(5)

Where:

$F_{i,t}$	Mass flow of greenhouse gas i in the gaseous stream per hour	kg gas/h
$V_{t,wb,n}$	Volumetric flow of the gaseous stream per hour on a wet basis at normal conditions	m^3 wet gas/h
$v_{i,t,wb}$	Volumetric fraction of greenhouse gas i (CH_4 in this case) in the gaseous stream per hour on a wet basis	m^3 gas i/m^3 wet gas
$\rho_{i,n}$	Density of greenhouse gas i (CH_4) in the gaseous stream at normal conditions	kg gas i/m^3 wet gas i
P_n	Absolute pressure at normal conditions	Pa
T_n	Temperature at normal conditions	K
MM_i	Molecular mass of greenhouse gas i (CH_4)	kg/kmol
R_u	Universal ideal gases constant	Pa.m^3/kmol.K

$$V_{t,wb,n} = V_{t,wb} * [(T_n/T_t) * (P_n/P_t)]$$ **(6)**

Where:

$V_{t,wb,n}$	Volumetric flow of the gaseous stream per hour on a wet basis at normal conditions	m^3 wet gas/h
$V_{t,wb}$	Volumetric flow of the gaseous stream per hour on a wet basis	m^3 wet gas/h
P_t	Pressure of the gaseous stream in time interval t	Pa
T_t	Temperature of the gaseous stream in time interval t	K
P_n	Absolute pressure at normal conditions	Pa
T_n	Temperature at normal conditions	K

In the proposed CDM project activity the volumetric flow rate of the gaseous stream is directly available from the flow meter at normal conditions[30] and hence the equation (6) mentioned above has not been used for the determination of $V_{t,wb,n}$. Thus the parameter $V_{t,wb}$ becomes redundant as $V_{t,wb,n}$ is directly measured from the gas flow meter.

Project Emissions from Flaring ($PE_{flare,y}$):

As per methodology ACM0001, version 12.0.0, $PE_{flare,y}$ is determined using the procedure described in the *"Tool to determine project emissions from flaring gases containing methane."* If methane is flared through more than one flare, the $PE_{flare,y}$ shall be determined for each flare using the tool.

As per the tool, *project emissions from flaring of the residual gas stream are calculated based on the flare efficiency and the mass flow rate of methane in the residual gas stream that is flared. The flare efficiency depends on both the actual efficiency of combustion in the flare and the time that the flare is operating.*
For enclosed flares, the temperature in the exhaust gas of the flare is measured to determine whether the flare is operating or not.

For enclosed flares, either of the following two options can be used to determine the flare efficiency:

- *To use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If*

---
30 The same can be verified from the details of monitoring equipment provided by Hofstetter i.e. "H10979 Al Qusais LF CDM Monitoring Concept"

in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.

➢ *Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).*

In the project activity continuous monitoring of the methane destruction efficiency of the flare will be followed as enclosed flares are being used.

Step 1: Determination of the mass flow rate of the residual gas that is flared

$$FM_{RG,h} = \rho_{RG,n,h} \times FV_{RG,h} \quad \textbf{(7)}$$

Where:

$FM_{RG,h}$	Mass flow rate of the residual gas in hour h	kg/h
$\rho_{RG,n,h}$	Density of the residual gas at normal conditions in hour h	Kg/Nm^3
$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*	Nm^3/h

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \times T_n} \quad \textbf{(8)}$$

Where:

$\rho_{RG,n,h}$	Density of the residual gas at normal conditions in hour h	Kg/Nm^3
P_n	Atmospheric pressure at normal conditions	Pa
R_u	Universal ideal gas constant	$Pa.Nm^3/ kmol.K$
$MM_{RG,h}$	Molecular mass of the residual gas in hour h	Kg/kmol
T_n	Temperature at normal conditions	K

$$MM_{RG,h} = \sum_i (fv_{i,h} \times MM_i) \quad \textbf{(9)}$$

Where:

$MM_{RG,h}$	Molecular mass of the residual gas in hour h	Kg/kmol
$fv_{i,h}$	Volumetric fraction of component i in the residual gas in the hour h	-
MM_i	Molecular mass of residual gas component i	Kg/kmol
i	The components CH_4, CO, CO_2, O_2,H_2, N_2	-

As per the guidance provided in the "Tool to determine project emissions from flaring gases containing methane", "*As a simplified approach, project participants may only measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N_2).*"

In the project activity, the provision for monitoring volumetric fraction of CH_4, CO_2 and O_2 in the residual gas is in place. Hence, as a simplified approach, the volumetric fraction of methane, carbon dioxide and oxygen will be measured and the difference to be considered 100% as nitrogen (N_2) in the project activity.

Step 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

$$fm_{j,h} = \frac{\sum_i fv_{i,h} \times AM_j \times NA_{j,i}}{MM_{RG,h}}$$ **(10)**

Where:

$fm_{j,h}$	Mass fraction of element j in the residual gas in hour h	-
$fv_{i,h}$	Volumetric fraction of component i in the residual gas in the hour h	-
AM_j	Atomic mass of element j	kg/kmol
$NA_{j,i}$	Number of atoms of element j in component i	
$MM_{RG,h}$	Molecular mass of the residual gas in hour h	Kg/kmol
j	The elements carbon, hydrogen, oxygen and nitrogen	-
i	The components CH_4, CO, CO_2, O_2,H_2, N_2	-

As explained in Step 1, only the volumetric fraction of methane, carbon dioxide and oxygen will be measured and the difference to be considered 100% as nitrogen (N_2) in the project activity.

STEP 3. Determination of the volumetric flow rate of the exhaust gas on a dry basis

$$TV_{n,FG,h} = V_{n,FG,h} \times FM_{RG,h}$$ **(11)**

Where:

$TV_{n,FG,h}$	Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour h	Nm^3/h
$V_{n,FG,h}$	Volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in hour h	Nm^3/kg residual gas
$FM_{RG,h}$	Mass flow rate of the residual gas at normal conditions in the hour *h*	kg residual gas /h

$$V_{n,FG,h} = V_{n,CO2,h} + V_{n,O2,h} + V_{n,N2,h}$$ **(12)**

Where:

$V_{n,FG,h}$	Volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas
$V_{n,CO2,h}$	Quantity of CO_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas
$V_{n,N2,h}$	Quantity of N_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas
$V_{n,O2,h}$	Quantity of O_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas

$$V_{n,O2,h} = n_{O2,h} \times MV_n$$ **(13)**

Where:

$V_{n,O2,h}$	Quantity of O_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas
$n_{O2,h}$	Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour h	kmol/kg residual gas
MV_n	Volume of one mole of any ideal gas at normal temperature and pressure	Nm^3/kmol

$$V_{n,N2,h} = MV_n * \left\{\frac{fm_{N,h}}{200AM_N} + \left(\frac{1-MF_{O2}}{MF_{O2}}\right) * [F_h + n_{O2}]\right\} \quad (14)$$

Where:

$V_{n,N2,h}$	Quantity of N_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas
MV_n	Volume of one mole of any ideal gas at normal temperature and pressure	Nm^3/kmol
$fm_{N,h}$	Mass fraction of nitrogen in the residual gas in the hour h	-
AM_n	Atomic mass of nitrogen	kg/kmol
MF_{O2}	O_2 volumetric fraction of air	-
F_h	Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour h	kmol/kg residual gas
$n_{O2,h}$	Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour h	kmol/kg residual gas

$$V_{n,CO2,h} = \frac{fm_{C,h}}{AM_C} \times MV_n \quad (15)$$

Where:

$V_{n,CO2,h}$	Quantity of CO_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h	Nm^3/kg residual gas
$fm_{C,h}$	Mass fraction of carbon in the residual gas in the hour h	-
AM_C	Atomic mass of carbon	kg/kmol
MV_n	Volume of one mole of any ideal gas at normal temperature and pressure	Nm^3/kmol

$$n_{O2,h} = \frac{t_{O2,h}}{\left(1-\left(t_{O2,h}/MF_{O2}\right)\right)} \times \left[\frac{fm_{C,h}}{AM_C} + \frac{fm_{N,h}}{2AM_N} + \left(\frac{1-MF_{O2}}{MF_{O2}}\right) \times F_h\right] \quad (16)$$

Where:

$n_{O2,h}$	Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour h	kmol/kg residual gas
$t_{O2,h}$	Volumetric fraction of O_2 in the exhaust gas in the hour h	-
MF_{O2}	Volumetric fraction of O_2 in the air	-
F_h	Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour h	kmol/kg residual gas
$fm_{j,h}$	Mass fraction of element j in the residual gas in hour h	-
AM_j	Atomic mass of carbon	kg/kmol
j	The elements carbon (index C) and nitrogen (index N)	=

$$F_h = \frac{fm_{C,h}}{AM_C} + \frac{fm_{H,h}}{4AM_H} - \frac{fm_{O,h}}{2AM_O} \quad (17)$$

Where:

F_h	Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour h	kmol/kg residual gas
$fm_{j,h}$	Mass fraction of element j in the residual gas in hour h	-
AM_j	Atomic mass of element j	kg/kmol
j	The elements carbon (index C), hydrogen (index H) and oxygen (index O)	=

STEP 4. Determination of methane mass flow rate in the exhaust gas on a dry basis

$$TM_{FG,h} = \frac{TV_{n,FG,h} * fv_{CH4,FG,h}}{1000000} \quad (18)$$

Where:

$TM_{FG,h}$	Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h	kg/h
$TV_{n,FG,h}$	Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour h	Nm^3/h exhaust gas
$fv_{CH4,FG,h}$	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour h	mg/Nm^3

Step 5. Determination of methane mass flow rate in the residual gas on a dry basis

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad (19)$$

Where:

$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h	kg/h
$FV_{RG,h}$	Volumetric flow rate of the residual gas at normal conditions in the hour *h*	Nm^3/h
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas in the hour *h*	-
$\rho_{CH4,n}$	Density of methane at normal conditions	kg/ Nm^3

As per the tool, both the volumetric flow rate of the residual gas and the volumetric fraction of methane in the residual gas shall be measured on the same reference condition that may be dry or wet basis, or be converted to the same basis when the temperature of the gas exceeds 60°C.

Step 6: Determination of the hourly flare efficiency

The project activity shall employ an enclosed flare and the flare efficiency will be continuously monitored.
Therefore, as per the tool the flare efficiency in the hour *h* ($\eta_{flare,h}$) is:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C for more than 20 minutes during hour *h*
- determined as follows in cases where the temperature of the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h :

$$\eta_{flare,h} = 1 - \frac{TM_{FG,h}}{TM_{RG,h}} \quad (20)$$

Where:

$\eta_{flare,h}$	Flare efficiency in the hour h	-
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h	kg/h
$TM_{FG,h}$	Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h	kg/h

STEP 7. Calculation of annual project emissions from flaring

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times \left(1 - \eta_{flare,h}\right) \times \frac{GWP_{CH4}}{1000} \quad (21)$$

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	kg/h
$\eta_{flare,h}$	Flare efficiency in hour *h*	%
GWP_{CH4}	Global Warming Potential value for methane	tCO_2e/tCH_4

Step A.1.1: Ex ante estimation of $F_{CH4,PJ,y}$

In line with the guidance provided in methodology ACM0001, version 12.0.0, the *ex ante* estimation of the amount of LFG which is flared in the year ($F_{CH4,PJ,y}$) will be done with the latest version of the approved “Emissions from solid waste disposal sites”, version 06.0.1, considering the following additional equation:

$$F_{CH4,PJ,y} = \eta_{PJ} \cdot BE_{CH4,SWDS,y} / GWP_{CH4} \quad \textbf{(22)}$$

Where:

$F_{CH4,PJ,y}$	Amount of methane in the LFG which is flared and/or used in the project activity in year *y*	tCH_4
$BE_{CH4,SWDS,y}$	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y*	tCO_2e
η_{PJ}	Efficiency of the LFG capture system that will be installed in the project activity	%
GWP_{CH4}	Global warming potential of CH_4	tCO_2e/tCH_4

As per the methodology ACM0001, version 12.0.0, $BE_{CH4,SWDS,y}$ is determined using the methodological tool “Emissions from solid waste disposal sites”, version 06.0.1. The following guidance should be taken into account when applying the tool:

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

As per the tool “Emissions from solid waste disposal sites”, the amount of methane produced in the year *y* ($BE_{CH4,SWDS,y}$) is calculated as follows:

$$BE_{CH4,SWDS,y} = \varphi_y \cdot (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j}) \quad \textbf{(23)}$$

Where:

$BE_{CH4,SWDS,y}$	Baseline methane emissions occurring in year *y* generated from waste disposal at a SWDS during a time period ending in year *y*	tCO_2e
φ_y	Model correction factor to account for model uncertainties for year y	-
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y	-
GWP_{CH4}	Global Warming Potential of methane	tCO_2e/tCH_4

OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)	-
F	Fraction of methane in the SWDS gas (volume fraction)	-
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y*	-
MCF_y	Methane correction factor for year y	-
$W_{j,x}$	Amount of organic solid waste type j disposed or prevented from disposal in the SWDS in the year x	Tonnes
DOC_j	Fraction of degradable organic carbon in the waste type *j* (weight fraction)	-
k_j	Decay rate for waste type *j*	1/yr
j	Type of residual waste or types of waste in the MSW	-
x	Years in the time during the crediting period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)	-
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)	-

Step A.2: Determination of $F_{CH4,BL,y}$

Since in the pre-project scenario the methane from the landfill was released to the atmosphere and there is no regulatory or contractual requirements to destroy the methane generated from the landfill, the proposed project activity fits to Case 1 of the methodology ACM 0001, version 12.0.0.

Case 1: No requirement to destroy methane exists and no existing LFG capture system

In this situation:

$$F_{CH4,BL,y} = 0 \quad \textbf{(24)}$$

Project Emissions:

Project Emissions from consumption of electricity:

$$PE_y = PE_{EC,y} + PE_{FC,y} \quad \textbf{(25)}$$

Where:

PE_y	Project emissions in year y	tCO_2e
$PE_{EC,y}$	Emissions from consumption of electricity due to the project activity in year *y*	tCO_2e
$PE_{FC,y}$	Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y*	tCO_2e

In line with the guidance provided in methodology ACM0001, version 12.0.0, emissions in the project activity due to consumption of electricity has been determined as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.

Since the project activity consumes electricity from diesel generator sets (i.e. off-grid captive power plant), the project emission due to electricity consumption has been calculated based on “Scenario B” of the above tool.

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times \left(1 + TDL_{j,y}\right) \quad \textbf{(26)}$$

Where:

$PE_{EC,y}$	Emissions from consumption of electricity in the project case.	tCO_2e

$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source *j* in year *y*	MWh
$EF_{EL,j,y}$	Emission factor for electricity generation for source *j* in year *y*	tCO_2/MWh
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*	-
j	Sources of electricity consumption in the project	-

Determination of emission factor for electricity generation ($EF_{EL,j,y}$**)**

The emission factor for electricity generation has been determined by Option B1mentioned in "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".
As per the tool,
Option B2: Use the following conservative default values:

- *A value of 1.3* tCO_2*/MWh if*
  (a) *The electricity consumption source is a project or leakage electricity consumption source; or*
  (b) *The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).*

Since in the project activity the electricity consumption source is a project electricity consumption source the default value of 1.3tCO_2/MWh has been applied in the project activity.

Leakage Emissions:

No leakage effects need to be accounted for under methodology ACM0001, version 12.0.0.

Emission Reduction:

$$ER_y = BE_y - PE_y \quad (27)$$

Where:

ER_y	Emission reductions in year y	tCO_2e
BE_y	Baseline emissions in year y	tCO_2e
PE_y	Project emissions in year y	tCO_2e

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Data / Parameter	OX_{top_layer}
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	*Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites"*
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	Default value as per the tool, "Emissions from solid waste disposal sites"
Purpose of data	*Calculation of Baseline Emissions*
Additional comment	*Applicable to Step A.*

Data / Parameter	GWP_{CH4}
Unit	$tCO_2e/tCH4$
Description	Global warming potential of CH_4
Source of data	IPCC
Value(s) applied	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions
Choice of data or Measurement methods and procedures	The value has been obtained from authentic source.
Purpose of data	*Calculations of baseline Emissions*
Additional comment	-

Data / Parameter	$\rho_{i,n}$
Unit	kg /Nm³
Description	Density of greenhouse gas i (i.e. CH_4) in the gaseous stream at normal conditions
Source of data	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Value(s) applied	0.716
Choice of data or Measurement methods and procedures	Methane density at normal temperature and pressure (273.15 K and 101325 Pa)
Purpose of data	*Calculation of Baseline Emissions*
Additional comment	-

Data / Parameter	$BE_{CH4,SWDS,y}$
Unit	tCO_2e
Description	Methane generation from the landfill in the absence of the project activity at year *y*
Source of data	Calculated as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value(s) applied	2012: 587765 2013: 600425 2014: 612505 2015: 577457 2016: 544651 2017: 513931 2018: 485151 2019: 458178
Choice of data or Measurement methods and procedures	As per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site". The efficiency of degassing system has been already taken into account while estimating $BE_{CH4,SWDS,y}$.
Purpose of data	Calculation of Baseline Emissions

Additional comment	Used for *ex ante* estimation of the amount of methane that would have been destroyed/combusted during the year

Data / Parameter	$EF_{EL,j,y}$
Unit	t CO_2/MWh
Description	Emission factor for electricity generation for source j in year y
Source of data	"Tool to calculate baseline, project and/or leakage emission from electricity consumption", version 1
Value(s) applied	1.3
Choice of data or Measurement methods and procedures	Default value as per Option B2 of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1.
Purpose of data	Calculation of Project Emissions
Additional comment	Fixed ex ante

Data and parameters required solely for the *ex-ante* calculation of methane generation from the landfill in the absence of the project activity at year *y* ($BE_{CH4,SWDS,y}$):

Data / Parameter	φ_y
Unit	-
Description	Model correction factor to account for model uncertainties for year y
Source of data	As per the tool "Emissions from solid waste disposal sites" version 06.0.1
Value(s) applied	0.75
Choice of data or Measurement methods and procedures	The value has been determined as per option 1 of tool. As per the Table 3 of the tool "Emissions from solid waste disposal sites", the methane correction factor for Application A under dry conditions is 0.75.
Purpose of data	Calculation of Baseline Emissions.
Additional comment	-

Data / Parameter	f_y
Unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
Source of data	ACM0001 ver.12.0.0
Value(s) applied	0
Choice of data or Measurement methods and procedures	As per ACM0001 ver.12.0.0, as this is already accounted for in the equation 2 of the methodology, a value of 0 shall be assigned.
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	OX

Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
Source of data	IPCC 2006 guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	Default value as per the tool “Emissions from solid waste disposal sites”, version 06.0.1
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	F
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	Default value determined by the tool “Emissions from solid waste disposal sites”, version 06.0.1
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	$DOC_{f,y}$
Unit	-
Description	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y*
Source of data	IPCC 2006 guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	Default value determined for Application A (as methane emissions are mitigated by capturing and flaring or combusting the methane) by the tool “Emissions from solid waste disposal sites”, version 06.0.1
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	MCF_y
Unit	-
Description	Methane correction factor for year y
Source of data	IPCC 2006 guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.8
Choice of data or Measurement methods and procedures	The Al Qusais Landfill is an **unmanaged solid waste disposal site,** with depth of the landfill being more than 5 meters (around 25 mtrs). As per the tool “Emissions from solid waste disposal sites”, version 06.0.1, for unmanaged solid waste disposal site, a default value of 0.8 shall be applied.

Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	DOC_j
Unit	-
Description	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
Source of data	IPCC 2006 guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Values have been obtained from tool "Emissions from solid waste disposal sites", version 06.0.1 for wet wastes are applied, due to the fact that the data for waste quantities and composition are available on a wet basis.
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

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

Data / Parameter	k_j
Unit	1/yr
Description	Decay rate for the waste type *j*
Source of data	IPCC 2006 guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 3.3)
Value(s) applied	(see table below)

Waste type *j*	**k_j**
Pulp, paper and cardboard (other than sludge), textiles	0.045
Wood, wood products and straw	0.025
Other (non-food) organic putrescible garden and park waste	0.065
Food, food waste, sewage sludge, beverages and tobacco	0.085

Choice of data or Measurement methods and procedures	As per data from the Meteorological department, the climate in the area of the landfill is both tropical (MAT > 20^0C) and Dry (MAP < 1000mm)[31]. Therefore, values provided by tool "Emissions from solid waste disposal sites", version 06.0.1, for a tropical, dry climate were applied.
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	η_{PJ}
Unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	Default value as per the methodology ACM 0001, version 12.0.0
Value(s) applied	50
Choice of data or Measurement methods and procedures	The default value provided in page 16 of the methodology ACM 0001, version 12.0.0 has been used in the calculation as the manufacturer's technical specifications does not provide the value for efficiency of LFG capture system
Purpose of data	Calculation of Baseline Emissions
Additional comment	Applicable to Step A.1.1

The values of following constants used in the equations have been obtained from the "Tool to determine project emissions from flaring gases containing methane", version 1.

Parameter	SI unit	Description	Value
MM_{CH4}	kg/kmol	Molecular mass of methane	16.04
MM_{CO}	kg/kmol	Molecular mass of carbon monoxide	28.01
MM_{CO2}	kg/kmol	Molecular mass of carbon dioxide	44.01
MM_{O2}	kg/kmol	Molecular mass of oxygen	32.00
MM_{H2}	kg/kmol	Molecular mass of hydrogen	2.02
MM_{N2}	kg/kmol	Molecular mass of nitrogen	28.02
AM_C	kg/kmol	Atomic mass of carbon	12.00
AM_H	kg/kmol	Atomic mass of hydrogen	1.01
AM_O	kg/kmol	Atomic mass of oxygen	16.00
AM_N	kg/kmol	Atomic mass of nitrogen	14.01
P_n	Pa	Atmospheric pressure at normal conditions	101325
R_u	$Pa.Nm^3/kmol.K$	Universal ideal gas constant	8314.472
T_n	K	Temperature at normal conditions	273.15
MF_{O2}	-	O_2 volumetric fraction of air	0.21
GWP_{CH4}	tCO_2/tCH_4	Global warming potential of methane	21
MV_n	$Nm^3/kmol$	Volume of one mole of any ideal gas at normal	22.414
$\rho_{CH4,n}$	kg/Nm^3	Density of methane gas at normal conditions	0.716

B.6.3. Ex ante calculation of emission reductions

>>

Baseline Emissions:

[31] http://www.dia.ae/DubaiMet/Met/Climate.aspx

Since the project is yet to be implemented data related to *ex-post* estimation of baseline emissions are not available.

Ex ante estimation of the amount of methane that would have been destroyed/combusted during the year, in tonnes of methane ($F_{CH4,PJ,y}$)

$$BE_{CH4,SWDS,y} = \varphi_y \cdot (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j})$$

As per the tool and ACM0001, version12.0.0, the following default values are applied:

Parameters	Unit	Values	Justification
φ_y	-	0.75	As per the tool "Emissions from solid waste disposal sites", version 06.0.1
f_y	-	0	As per ACM0001 ver.12.0.0, as this is already accounted for in the equation 2 of the methodology, a value of 0 shall be assigned.
GWP_{CH4}	tCO_2e/tCH_4	21	IPCC
OX	-	0.1	The Al Qusais Landfill is covered with sand, which is not an oxidizing material. As per tool "Emissions from solid waste disposal sites", version 06.0.1 and the IPCC 2006 guidelines for National Greenhouse Gas Inventories, a value of 0.1 shall be applied for solid waste disposal sites.
F	-	0.5	Default value determined by the tool "Emissions from solid waste disposal sites", version 06.0.1
$DOC_{f,y}$	-	0.5	Default value determined by the tool "Emissions from solid waste disposal sites", version 06.0.1
MCF_y	-	0.8	The Al Qusais Landfill is an **unmanaged solid waste disposal site,** with depth of the landfill being more than 5 meters. As per the tool "Emissions from solid waste disposal sites", version 06.0.1, for unmanaged solid waste disposal site, a default value of 0.8 shall be applied.

Due to the fact that the waste quantities and composition are available on a wet basis, the following values were applied for DOC_j:

Waste type *j*	**DOC_j(% wet waste)**
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24

Garden, yard and park waste	20
Glass, plastic, metal, and other inert waste	0

Due to the fact that the climate in the area of the landfill is both tropical (MAT >20^{0}C) and Dry (MAP < 1000mm), the following values were applied for k_j:

Waste type *j*	k_j
Pulp, paper and cardboard (other than sludge), textiles	0.045
Wood, wood products and straw	0.025
Other (non-food) organic putrescible garden and park waste	0.065
Food, food waste, sewage sludge, beverages and tobacco	0.085

<u>Total amount of waste deposited in year *x:*</u>

Though waste is being deposited in the landfill since 1989, the data related to waste is available with Dubai Municipality since 1999. Hence the quantity of waste deposited from 1989 to 1998 has been considered as zero.

Year	**Waste (W_x) in tons**
1999	787739
2000	863179
2001	1046404
2002	1145953
2003	1324227
2004	1523677
2005	1794294
2006	2364914
2007	2908980
2008	4068058
2009	3746509
2010	2338002
2011	1557955
2012	1557955
2013	1557955

The dumping of waste in the Al Qusais landfill is expected to be continued till 2013. However, depending on the availability of other landfill sites, the dumping of waste in Al Qusais landfill may be continued beyond 2013. For *ex-ante* estimation of emission reduction the waste quantity for the years 2012 and 2013 has been assumed as same as the waste quantity deposited in the year 2011.

<u>Composition of waste[32]:</u>

Waste type	% of total waste
Wood and wood products	3.7
Pulp, paper and cardboard(other than sludge)	19.4
Food, food waste, beverages and tobacco(other than sludge)	28.2

[32] Analysis from Dubai municipality for the year 2010 latest available data the time of webhosting of PDD

Textile	6.2
Garden, yard and park waste	0
Glass, plastic, metal, other inert waste	42.5

Year	$BE_{CH4,SWDS,y}$ (tCO_2e)	$F_{CH4,PJ,y}$ (tCH_4)
2012	587765	13994
2013	600425	14296
2014	612505	14583
2015	577457	13749
2016	544651	12968
2017	513931	12236
2018	485151	11551
2019	458178	10909

Therefore the baseline emissions are as follows:

Year	BE_y
2012	293588
2013	299912
2014	305946
2015	288439
2016	272053
2017	256708
2018	242332
2019	201898

Project Emissions:

The project activity will not consume thermal energy, and is expected to only consume electricity generated on-site in the DG set. Therefore, for the purpose of the *ex-ante* emission reduction calculations:

$$PE_{EC,y} = \sum_{j} EC_{PJ,j,y} \times EF_{EL,j,y} \times \left(1 + TDL_{j,y}\right)$$

Parameters	Unit	Values	Source
$PE_{EC,y}$	tCO_2e	3074	Calculated
$EC_{PJ,j,y}$	MWh	2365.2	*Calculated based on electrical load of 540KW*[33]
$EF_{EL,j,y}$	tCO_2/MWh	1.3	*Default value as per Option B2 of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"*
$TDL_{j,y}$	-	0	*Default value for scenario B of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"*

Leakage Emissions:

L_y= 0 tCO_2e

Emission Reduction:

[33] Obtained from electrical load details provided by Hofstetter through mail dated 27th May 2012, the breakup of electrical load has been provided in section A.4.3

$$ER_y = BE_y - PE_y$$

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2012	34,587	362	0	34,225
2013	299,912	3,074	0	296,838
2014	305,946	3,074	0	302,872
2015	288,439	3,074	0	285,365
2016	272,053	3,074	0	268,979
2017	256,708	3,074	0	253,634
2018	242,332	3,074	0	239,258
2019	201,898	2,712	0	199,186
Total	1,901,875	21,518	0	1,880,357
Total number of crediting years	7			
Annual average over the crediting period	271,696	3074	0	268,622

The above figures have been estimated considering 1st Crediting period from 19th November 2012 to 18th November 2019

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$V_{t,wb,n}$ (same as $FV_{RG,h}$)
Unit	Nm^3 LFG/h
Description	Volumetric flow of the gaseous stream per hour on a wet basis at normal conditions
Source of data	On-site measurements[34]
Value(s) applied	Based on *ex-ante* estimation (hourly average) 2012: 2232 2013: 2281 2014: 2326 2015: 2193 2016: 2069 2017: 1952 2018: 1843 2019: 1740

[34] The parameter monitors the amount of methane flared, the amount of methane being destroyed by way of energy generation is not included and no claims are made against the same for conservativeness.

Measurement methods and procedures	Measured directly by flow meter as the flow meter provides the flow rate at normal conditions. (For detailed discussion please refer section B.6.1) To be ensured that the same basis (wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ($fv_{i,h}$) when the residual gas temperature exceeds 60 ºC.
Monitoring frequency	Monitoring frequency: Continuous Recording frequency : Hourly
QA/QC procedures	Calibration Frequency: Annually Accuracy class : +/- 1.2 ~2 % Calibration protocol: as per manufacturer's spec.
Purpose of data	Calculations of Baseline Emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$F_{CH4,sent\_flare,y}$
Unit	t CH_4
Description	Amount of methane in the LFG which is sent to the flare in year *y*
Source of data	On-site measurements
Value(s) applied	Based on *ex-ante* estimation 2012: 13994 2013: 14296 2014: 14583 2015: 13749 2016: 12968 2017: 12236 2018: 11551 2019: 10909
Measurement methods and procedures	Data type: Calculated Recording frequency: Monthly This parameter would be calculated based on the measured data of Volumetric flow of the gaseous stream per hour on a wet basis at normal conditions and methane concentration in the LFG. The gas flow rate would be measured on continuous basis using gas flow meters and the total flow would be aggregated by totaliser integrated with flow meter on monthly basis. The methane concentration would be measured continuously through analyser and recorder on monthly basis and average value used for determination of amount of methane gas send to flare on annual basis.
Monitoring frequency	Data type: Calculated Recording frequency: Monthly Recording frequency of methane concentration: Monthly and averaged annually

QA/QC procedures	Flow meters and analysers should be subject to a regular maintenance and testing regime to ensure accuracy.- Accuracy : Flowmeters : +/- 1.2% Analyser : +/- 1% Calibration frequency : Analysers : weekly Flow meters : Annually Calibration protocol : As per manufacturer's specification
Purpose of data	Calculation of Baseline Emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$PE_{flare,y}$
Unit	tCO_{2e}
Description	Project emissions from flaring of the residual gas stream in year *y*
Source of data	Calculated as per the "Tool to determine project emissions from flaring gases containing methane"
Value(s) applied	Based on *ex-ante* estimation (@ 99.9%[35] flare efficiency as provided by the supplier) 2012: 293 2013: 300 2014: 306 2015: 288 2016: 272 2017: 256 2018: 242 2019: 229
Measurement methods and procedures	Calculated as per the "Tool to determine project emissions from flaring gases containing methane"
Monitoring frequency	This is a calculated parameter
QA/QC procedures	Not Applicable.
Purpose of data	Calculation of Project Emission from flaring
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$fv_{i,h}$
Unit	-
Description	Volumetric fraction of component i (i represents CH_4, CO_2, O_2, N_2) in the residual gas in the hour h
Source of data	On-site measurements
Value(s) applied	0.5 (CH_4), 0.5 (CO_2) for *ex ante* estimation.

[35] *Based on document "HOFGAS_Confirmation Combustion efficiency" submitted by Hofstetter*

Measurement methods and procedures	To be ensured that the same basis (wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 ºC. Measured by continuous gas quality analyser.
Monitoring frequency	Monitoring frequency: Continuous Recording frequency of methane concentration: Monthly and averaged annually
QA/QC procedures	Accuracy : Analyser : ± 1% (forCH_4 & O_2) ± 2% (for CO_2) Calibration Frequency: As per manufacturer's specification (weekly) Calibration protocol : As per manufacturer's spec.
Purpose of data	Calculation of Baseline Emissions
Additional comment	This parameter is same as $v_{i,t,wb}$ (Volumetric fraction of greenhouse gas i in the gaseous stream on a wet basis) as mentioned in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$t_{O2,h}$
Unit	-
Description	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h
Source of data	On-site measurements
Value(s) applied	~6-12%
Measurement methods and procedures	Measured by continuous gas quality analyser. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level.
Monitoring frequency	Monitoring frequency: Continuous
QA/QC procedures	Calibration Frequency: Weekly Calibration protocol: as per manufacturer's specification. A zero check and a typical value check should be performed by comparison with a standard gas.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$fv_{CH4,FG,h}$
Unit	mg/Nm^3
Description	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
Source of data	On-site measurements
Value(s) applied	0 (flare efficiency is assured to be as high 99.9 % by the supplier Hofstetter[36])
Measurement methods and procedures	Measured by continuous gas quality analyser. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level.

[36] *Based on document "HOFGAS_Confirmation Combustion efficiency" submitted by Hofstetter*

Monitoring frequency	Monitoring frequency: Continuous Recording frequency: daily.
QA/QC procedures	Calibration Frequency: As per manufacturer's specification (weekly) Accuracy class : +/- 2% Gas analysers would be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of Baseline Emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	T_{flare}
Unit	°C
Description	Temperature in the exhaust gas of the flare
Source of data	On-site measurements
Value(s) applied	1000~1200 (design basis)
Measurement methods and procedures	Measured by a Type S thermocouple. A temperature above 500 °C indicates that significant amount of gases are still being burnt and that the flare is operating.
Monitoring frequency	Monitoring frequency: Continuous
QA/QC procedures	Calibration Frequency: As per manufacturer's specification the temperature element would be replaced annually
Purpose of data	Calculation of Project Emission from Flaring
Additional comment	Type S thermocouples are suitable upto 1600 Deg C[37] and are most stable thermocouple in this range of temp. This is used in place of Type N thermocouples as given in Methodology. Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$\eta_{flare,h}$
Unit	%
Description	Flare efficiency in hour *h*
Source of data	Calculated based on the steps mentioned in the "Tool to determine project emissions from flaring gases containing methane", version 1
Value(s) applied	99.9 (*Ex-ante* data assumed based on the data provided by Hofstetter[38], the supplier of the LFG capture and flare system)
Measurement methods and procedures	Calculated based on the steps mentioned in the "Tool to determine project emissions from flaring gases containing methane", version 1
Monitoring frequency	Not Applicable. This is a calculated parameter
QA/QC procedures	Not Applicable. This is a calculated parameter
Purpose of data	Calculation of Project Emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$PE_{EC,y}$
Unit	tCO_2

[37] http://en.wikipedia.org/wiki/Thermocouple

[38] Based on document "HOFGAS_Confirmation Combustion efficiency" submitted by Hofstetter

Description	Project emissions from electricity consumption by the project activity during the year *y*
Source of data	Calculated as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"
Value(s) applied	3074 (Based on electrical load of 540 kW)
Measurement methods and procedures	Calculated as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". The value for amount of electricity consumed by the project plant will be obtained from below mentioned parameter.
Monitoring frequency	This is a calculated parameter, hence not applicable
QA/QC procedures	This is a calculated parameter, hence not applicable
Purpose of data	This data has been used to calculate project emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

Data / Parameter	$EC_{PJ,j,y}$
Unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source *j* in year *y*
Source of data	On-site measurements
Value(s) applied	2365.2
Measurement methods and procedures	Measurement procedure: Measured by an energy meter. The energy meter would be measuring the amount of electricity supplied by the DG set to the landfill gas recovery and flaring system.
Monitoring frequency	Data Type: Measured Monitoring frequency: Continuous Recording frequency: Recorded daily and aggregated on monthly basis.
QA/QC procedures	Calibration Frequency: Annually
Purpose of data	This data has been used to calculate project emissions
Additional comment	Data Archiving Policy: Paper/ Electronic for crediting period + 2 years

B.7.2. Sampling plan

>>

No sampling plan has been envisaged for the project activity

B.7.3. Other elements of monitoring plan

>>

The data monitoring will involve all the parameters mentioned in the section B.7.1. Due care will be taken for the measurement of all these parameters and maintenance of records. Proper training will be imparted to concerned personnel for accurate measurement and collection of data for each parameter.

1. The CDM monitoring team will compose the following staff:

Position	**Report to:**
Field monitoring personnel	Project owner
Environmental engineer	
Site manager	
CDM monitoring project manager	Project Owner/External CDM consultant

2. The allocation of responsibility to ensure compliance with the monitoring requirement of the methodology is given here below:

#	Tasks description	Field monitoring personnel	Environmental engineer	Site Manager	CDM monitoring project manager
Monitoring activity					
1	Recording of monitored data	✓	✓		
Quality Assurance & Quality Control					
2	Verification of data monitored (consistency and completeness)		✓	✓	
3	Ensuring adequate training of staff			✓	✓
4	Ensuring adequate maintenance		✓	✓	✓
	Ensuring calibration of monitoring instruments		✓	✓	✓
5	Data archiving: ensuring adequate storage of data monitored (integrity and backup)			✓	✓
6.	Identification of non-conformance and corrective/preventive actions and monitoring plan improvement			✓	✓
7	Emergency procedures		✓	✓	
Calculation of GHG emission reductions and reporting					
9	Processing of data and calculation of emission reductions				✓
10	Monitoring report: management review of monitoring report (internal audit)			✓	✓

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion of application of methodology and standardized baseline: 01/12/2011

Contact Information of responsible persons/entities: Provided Below:

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	First Climate (India) Private Limited
Street/P.O. Box	3C, Camac Street

Building	Camac Tower, 9th Floor
City	Kolkata
State/Region	West Bengal
Postcode	700 016
Country	India
Telephone	+91 33 4005 6786
Fax	+91-33-4064 9199
E-mail	
Website	www.firstclimate.com
Contact person	Mr. Subhendu Biswas
Title	Director
Salutation	Mr.
Last name	Biswas
Middle name	
First name	+91 33 4005 6786 (Extension: 22)
Department	subhendu.biswas@firstclimate.co.in
Mobile	+91 9748756709
Direct fax	+91-33-4064 9199
Direct tel.	+91 33 4005 6786
Personal e-mail	subhendu.biswas@firstclimate.co.in

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

Date of placement of purchase order on Hofstetter for the gas collection and flaring system: 26/10/2011

C.1.2. Expected operational lifetime of project activity

>>
15 years & 0 month[39]

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Renewable crediting period is selected.

C.2.2. Start date of crediting period

>>
19/11/2012

C.2.3. Length of crediting period

7 years & 0 month

[39] Letter dated 14/02/2012 from Hofstetter mentioning the life time of the equipment

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
The project activity as per the prevailing laws[40] does not have any environmental impact or cross boundary effect

D.2. Environmental impact assessment

>>

There is no negative impact on the environment due to the project activity.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
Green energy Solutions & Sustainability LLC has organised stakeholder consultation with the objective to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity.

The project had invited comments and feedbacks of the local stakeholders by posting an advertisement in the local newspaper “Gulf News” from 31/03/2011 to 02/04/2011. Furthermore, a notice was put at the Al Qusais landfill site to invite comments from stakeholders. The opinions expressed by them were recorded and are available for validation.

The stakeholders identified for the project activity are as under:
1. Own employees
2. Local Populations
3. Equipment suppliers
4. Statutory bodies

The project participant has presented the PDD to a validation agency for web hosting as a part of international stakeholder consultation.

E.2. Summary of comments received

>>

No adverse comments have been received till date.

E.3. Report on consideration of comments received

>>

No negative comments have been received till date therefore no action has been taken.

SECTION F. Approval and authorization

>>
The Approval and Authorisation of the project has been received on 16/11/2012

[40] http://moew.gov.ae/portal/en/laws-and-legislations.aspx#page=1

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Green Energy Solutions & Sustainability LLC
Street/P.O. Box	Sheikh Zayed Road/P.O. Box 93808
Building	Ontario Tower, Suite # 1601
City	Dubai
State/Region	
Postcode	
Country	United Arab Emirates
Telephone	+971 4 450 8974
Fax	+971 4 450 8976
E-mail	Anita.nouri@Gess-uae.com
Website	http://gess-uae.com/
Contact person	Ms Anita Nouri
Title	General Manager
Salutation	Ms
Last name	Nouri
Middle name	
First name	Anita
Department	
Mobile	
Direct fax	+971 4 450 8976
Direct tel.	+971 4 450 8974
Personal e-mail	Anita.nouri@Gess-uae.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity

Organization name	Dubai Municipality
Street/P.O. Box	P.O Box:67
Building	
City	Dubai
State/Region	
Postcode	
Country	United Arab Emirates
Telephone	+971 4 221 5555
Fax	+971 4 221 5555
E-mail	smmesmar@dm.gov.ar
Website	www.dm.gov.ae
Contact person	Mr. (Name)
Title	Director of Environment
Salutation	Mr. Salem Mohammed Bin Mesmar
Last name	Bin Mesmar
Middle name	
First name	Salem Mohammed
Department	
Mobile	
Direct fax	+971 4 221 5555
Direct tel.	+971 4 221 5555
Personal e-mail	smmesmar@dm.gov.ar

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	First Climate (India) Private Limited
Street/P.O. Box	3C, Camac Street
Building	Camac Tower, 9th Floor
City	Kolkata
State/Region	West Bengal
Postcode	700 016
Country	India
Telephone	+91 33 4005 6786
Fax	+91-33-4064 9199
E-mail	
Website	www.firstclimate.com
Contact person	Mr. Subhendu Biswas
Title	Director
Salutation	Mr.
Last name	Biswas
Middle name	
First name	+91 33 4005 6786 (Extension: 22)
Department	subhendu.biswas@firstclimate.co.in
Mobile	+91 9836423008
Direct fax	+91-33-4064 9199

Direct tel.	+91 33 4005 6786
Personal e-mail	subhendu.biswas@firstclimate.co.in

Appendix 2. Affirmation regarding public funding

Please refer to Section A.5 for further information

Appendix 3. Applicability of methodology and standardized baseline

Please refer to section A.4 and A.5 for further information

Appendix 4. Further background information on ex ante calculation of emission reductions

Please refer to Section B.6.1 for further information

Appendix 5. Further background information on monitoring plan

Please refer to section B.7.1 for further information

Appendix 6. Summary of post registration changes

Summary of Post Registration Changes has been provided below:

In the registered project activity the power consumed onsite was being generated from Diesel based generator sets. There were 2 Nos. Gensets (one with each line of blower and flare assembly) for the entire plant. Post project implementation PP decided to install a 1 MW landfill gas based power generation unit as.
The project got recognised as the largest and the best environmental project in the Entire Middle east[41] and received several awards from different authorities. Being s show case project they decided to take the risk of installing a landfill gas based power unit for self-consumption only.
In case of failure of the gas based power unit a backup diesel based generator system is kept onsite for power generation.

[41] http://www.constructionweekonline.com/article-27820-dms-al-qusais-landfill-gas-project-wins-award/ Green Energy Solutions & Sustainability LLC was awarded the Bronze Award for Small Energy Project of the Year from the Supreme Council of Energy for 2015. GESS has also been recognized and awarded "Green Initiative of the Year 2014" and "Sustainable Project of the Year" 2015 for two consecutive years at the Big Project Middle East Construction and Sustainability Awards for the Al Qusais Landfill.

For conservativeness no change in the monitoring plan is done and the entire amount of power consumed onsite (both from the landfill gas based generation system as well as the DG set) is used to calculate the project emissions and credits for gas based generation are not claimed in the project.

In line with paragraph 292 of Project Standard, version 09.0 guidelines, the effect of the changes are evaluated below.:

a) ***The applicability and application of the applied methodology and, where applicable, the applied standardized baseline under which the project activity or PoA has been registered:*** *The change does not affect the applicability of the applied methodology.*

(b) ***Compliance of the monitoring plan with the applied methodology and, where applicable, the applied standardized baseline****: there is no change to the monitoring plan, the amount of energy generated from the onsite gas based generation system is accounted under the energy meter which also measures the amount of power generated from DG sets, the entire amount of power consumed is taken for Project emissions calculations for conservativeness.Methane destroyed by way of energy generation is not being claimed under baseline emissions for conservative estimates and thus no change is required in the monitoring plan. The amount of methane being flared is monitored separately in line with the original monitoring plan.*

*(c****) The level of accuracy and completeness in the monitoring of the project activity or PoA;*** *As there is no change in the monitoring plan and the existing instrumentation system accounts for the power generated on site so there is no change in the level of accuracy as well.*

(d) ***The additionality of the project activity, PoA or CPA****; The energy generated from the 1 MW machine is used onsite and it is not sold to any third party resulting in revenue generation, moreover any savings in diesel resulting in lower operating cost does not have a bearing on the additionality as no operation cost has been included in the initial additionality assessment and thus no notional savings are to be accounted for. thus the additonality of the project remains unchanged except that the project cost increases.During additionality evaluation no cost of operations was included and thus savings due to diesel avoidance (notional) does not affect the same.*

(e) ***The scale of the project activity or CPA:*** *The project remains in the large scale category. .*

(f) ***The eligibility criteria of PoA.:*** *This is not a POA but a standalone project.*

- - - - -

Document information

Version	*Date*	*Description*
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).

Version	Date	Description
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document