Draft revision to the approved baseline methodology AM0011

"Landfill gas recovery with electricity generation and no capture or destruction of methane in the baseline scenario"

Source

This methodology is based on the Project Design Document and Baseline Study, Monitoring and Verification Plan developed for the Onyx Landfill Gas Recovery project at the SASA landfill in Tremembe, Brazil. These documents were prepared by Onyx and are dated September 26, 2003. For more information regarding the proposal and its consideration by the Executive Board please refer to case: NM0021: CERUPT methodology for landfill gas recovery on < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html >.

The methodology also refers to the latest version of the *"Tool to determine project emissions from flaring gases containing Methane*[1]*"*.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment."

Applicability

This methodology is applicable to landfill gas capture and electricity generation project activities where:

- The baseline is atmospheric release of the landfill gas;
- There are no regulations and/or contractual requirements governing the landfill gas emissions;
- The captured gas is used to evaporate leachate, generate electricity for on-site use and/or is flared;
- Emissions reductions associated with generation of the displaced electricity do not generate credits.

Emission Reduction[2]

The greenhouse gas emission reduction achieved by the project activity during a given year (ER_y) is the amount of methane actually destroyed during the year ($MDproject_y$) times the approved Global Warming Potential value for methane (GWP_CH_4).

~~$ER_y = MDproject_y \times GWP\_CH_4$~~

$$ER_y = MDproject_y \text{ x } GWP\_CH_4 - PE_{flare,y}$$

[1] Please refer to < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html >

[2] The Executive Board, at its twelfth meeting, requested the secretariat to prepare a technical paper, for consideration by the Panel on Methodologies of the Board, on the impact of oxidation of biogas in the calculation of emission reductions of methane (CH_4) for landfill gas project activities. The Board agreed that the Meth Panel shall prepare a recommendation on this issue to be presented to the Board for its consideration. This methodology might be revised in order to incorporate considerations by the Board on this issue. Any revisions shall not affect CDM project activities already registered using this current version of the methodology.

ER_y is measured in tonnes of CO_2 equivalents (tCO_2e). $MDproject_y$ is measured in tonnes of methane (tCH_4). The approved Global Warming Potential value for methane (GWP_CH_4) for the first commitment period is 21 tCO_2e/tCH_4. $PE_{flare,y}$ are the project emissions from flaring of the residual gas stream in year y (tCO_{2e}) determined following the procedure described in the *"Tool to determine project emissions from flaring gases containing Methane"*.

The methane destroyed by the project activity ($MDproject_y$) during a year is the sum of the methane flared and used to evaporate leachate or to generate electricity.

$$MDproject_y = [(CH_4flared_y + CH_4leachate_y + CH_4electricity_y) * D_{CH4}]$$

The $CH_4flared_y$, $CH_4leachate_y$, and CH_4electricityy are measured in cubic metres (m^3) and are determined as product of ~~by~~ metereding the volume of landfill gas used for each of these purposes and the methane concentration of the landfill gas (w_{CH4})[3]. D_{CH4} is the methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)[4]. ~~The volume of methane is then converted to tonnes of methane using the molecular weight and molecular volume of methane.~~

For the Project Design Document, (ex ante) emission reduction estimates are made by projecting the future greenhouse gas emissions of the landfill using a first order kinetic model. These estimates are for reference purposes only, since emission reductions will be determined (ex post) by metering of the actual the quantity of methane captured and used for leachate evaporation, electricity generation or flaring once the project activity is operational.

Baseline

The baseline scenario is the release of the landfill gas to the atmosphere.

Additionality

Additionality is established through a 4 step process, as follows:

Step 1. Assess the legal requirements related to the landfill gas emissions. The project developer must state whether capturing CH_4 from landfills in any way is prescribed by any legislation or will/may be prescribed in the future. Thorough research on the likely future legislation needs to be carried out, preferably by a legal consultant in the host country. If such research shows that legislation will come into force that makes LFG extraction obligatory, the project will no longer be additional from that date.

Step 2. Demonstrate that there is no economically attractive scenario that involves recovery of the landfill gas. The project developer must show that the situation without the project would have implied full atmospheric release. Scenarios to be considered include, but are not limited to:

- a scenario without recovery;
- a scenario where a modified amount of LFG is extracted;
- a scenario with air or O_2 injection in the landfill;
- a scenario with a changed/changing waste composition;

[3] To be measured at wet basis.
[4] At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH4/m3CH4

- a scenario with an other on-site LFG use;
- a scenario with an other off-site LFG use;
- a scenario in which the project is deferred with five years;
- a scenario with combinations of the above;
- the project scenario.

If there is no income (usually from electricity generation), the scenarios are compared on the basis of their long-term costs. If this comparison shows that the proposed CDM project activity is not the least cost option (i.e. there is at least one scenario cheaper than the proposed CDM activity), it is considered to be additional.

If there is income from electricity generation or other sources, the scenarios are compared on the basis of their internal rate of return (IRR). The IRR is calculated using conservative assumptions for each scenario over the lifetime of the project. The IRR calculation is includes the capital and operating costs required to implement the scenario. The calculation must also include any avoided expenditures, such as the cost of disposing of leachate evaporated on-site and the cost of electricity purchases avoided, as well as any revenues, such as sale of methane or electricity. Revenue from the sale of CERs is not included in the IRR calculation. Conservative assumptions reduce the costs and increase the revenue and avoided expenditures and so raise the IRR for the scenario.

Determine whether the IRR for each scenario is significantly lower than a conservatively (i.e. rather low) expected and acceptable IRR for a comparable project type in the relevant country. The conservatively acceptable IRR can be based on:

- Government bond rates or other appropriate estimates of the cost-of-capital (e.g. commercial lending rates);
- Expert views on expected IRRs for this or comparable project types;
- Other hurdle rates that can be applied for the country and/or sector.

The choice of conservatively acceptable IRR should be justified. Conservatism of the assumptions should be ensured by obtaining expert opinions and by the Operational Entity validating the project.

If the scenario IRR is clearly and significantly lower than a conservatively acceptable IRR, the scenario is not an economically attractive course of action. If all of the scenarios are not financially attractive, the most likely baseline scenario is the release of the gas to the atmosphere.

Step 3: If the proposed CDM project activity has a higher IRR than one of the other scenarios, it may be additional if there are barriers to implementation of the project. Two procedures – *barriers* and *common practice* --must be followed to establish that the proposed project activity would be, or would have been, unlikely to occur.

Barriers
Barriers to investment can require that the risks of the proposed project be mitigated by relying on benefits related to registration of the proposed project activity under the CDM. Such barriers can be identified in countries where no developed markets exist. Barriers must be clearly identified, justified, and documented.

Possible barriers are:

- Investment barrier: the absence of access to capital in undeveloped markets to finance the proposed project activity would have led to higher emissions;

- Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
- Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Common Practice
A project that is economically the most attractive course of action can be additional if there is an indication that the project type is not common practice (e.g. occurs in less than 5 percent of similar cases) in the proposed area of implementation, and is not required by recent/pending legislation/regulations.

Step 4: Extra check on credibility of the baseline
The baseline scenario typically is the most attractive option resulting from the financial (IRR) analysis. There may be reasons why this baseline scenario would still not be credible, which can be determined with the following questions:
· Is the baseline scenario realistic from a financing perspective?
· Would there be sufficient (local) support for the baseline scenario?
· Would other physical obstructions (fuels, skills, techniques) impede baseline scenario from ever being realized?
· Would legislation or other obligations (if enforced) influence the baseline scenario?
These questions should be asked/judged by the Designated Operational Entity, if possible during an on-site visit.

Leakage

No increase in emissions outside the project boundary – leakage – is expected as a result of the project activity.

Draft revision to the approved monitoring methodology AM0011

"Landfill gas recovery with electricity generation and no capture or destruction of methane in the baseline scenario"

Source

This methodology is based on the Project Design Document and Baseline Study, Monitoring and Verification Plan developed for the Onyx Landfill Gas Recovery project at the SASA landfill in Tremembe, Brazil. These documents were prepared by Onyx and are dated September 26, 2003. For more information regarding the proposal and its consideration by the Executive Board please refer to case: NM0021: Cerupt methodology for landfill gas recovery on < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html >.

The methodology also refers to the latest version of the *"Tool to determine project emissions from flaring gases containing Methane*[5]*"*.

Applicability

This monitoring methodology can be used for project activities that reduce greenhouse gas emissions through landfill gas capture and destruction of the methane by evaporation of leachate, generation of electricity and/or flaring. This methodology must be used in conjunction with the baseline methodology above.

Monitoring Methodology

The monitoring methodology is based on direct measurement of the amount of landfill gas, the amount of methane used to evaporate leachate, to generate electricity and flared[6].

The amount of methane used for each of these purposes is determined by monitoring the:

- amount of landfill gas (m^3) used for that purpose using a continuous flow meter and monitoring temperature and pressure;
- percentage of landfill gas that is methane (% - using a continuous analyzer)[7].

[5] Please refer to < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html >

[6] The Executive Board may revise this methodology based on further recommendations of the Meth Panel to reflect more accuracy in metering the methane destruction by electricity generation. Any revisions shall not affect CDM project activities already registered using this current version of the methodology.

[7] In case a continuous methane analyzer is not used, periodic analysis of landfill gas composition using statistically valid samples using calibrated portable gas meters and delivering a confidence level of 95% should be applied instead.

The amount of electricity generated (MWh) will be metered continuously.
In addition, the methane content of the emissions from flares and boilers/engines will be analyzed quarterly to determine the fraction of the methane destroyed. The parameters used for determining the project emissions from flaring of the residual gas stream in year y ($PE_{flare,y}$) should be monitored as per the *"Tool to determine project emissions from flaring gases containing Methane"*.
The national/local regulatory framework shall be monitored on an annual basis and if necessary the baseline scenario and emissions shall be adapted accordingly during the crediting period.

Data to be collected or used to monitor emissions from the project activity, and how this data will be archived

ID number	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic : e / paper : p)	For how long is archived data kept?	Comment
1.	Amount of landfill gas collected from project wells	m^3	M	continuous	100%	Electronic	Duration of crediting period	Measured by a flow meter. Data will be aggregated monthly and yearly.
2.	Methane fraction in the landfill gas (w_{ch4})	%	M	continuous/ periodic	100%	Electronic	Duration of crediting period	Measured by continuous gas quality analyser[8] To be measured at wet basis.
3.	Amount of landfill gas used for leachate evaporation	m^3	M	continuous	100%	Electronic	Duration of crediting period	Measured by a flow meter. Data will be aggregated monthly and yearly.
4.	Amount of landfill gas used for electricity generation	m^3	M	continuous	100%	Electronic	Duration of crediting period	Measured by a flow meter. Data will be aggregated monthly and yearly.
5.	Amount of landfill gas ~~flared~~fed to the flare	m^3	M	continuous	100%	Electronic	Duration of crediting period	Measured by a flow meter. Data will be aggregated monthly and yearly.
6. EG_y	Amount of electricity generated	MWh	M	continuous	100%	Electronic	Duration of crediting period	Measured by a kWh meter. Data will be aggregated monthly and yearly
7.	Combustion efficiency	%	m and c	semi-annual, monthly if unstable	n/a	Electronic	Duration of crediting period	Methane content of boiler/engine exhaust gas

[8] In case a continuous methane analyzer is not used, periodic analysis of landfill gas composition using statistically valid samples using calibrated portable gas meters and delivering a confidence level of 95% should be applied instead.

8.	LFG Temperature and pressure	°C/Pa	m	continuously / periodically	100%	Electronic	During the crediting period and two years after	Measured to determine the density of methane D_{CH4}.
ID number	**Data variable**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording Frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic: e / paper : p)**	**For how long is archived data kept?**	**Comment**
9.	Project emissions from flaring of the residual gas stream in year *y* ~~Flare working hours~~	tCO_{2e}	m/c	see comment	n/a	electronic	During the crediting period and two years after	The parameters used for determining the project emissions from flaring of the residual gas stream in year y ($PE_{flare,y}$) should be monitored as per the *"Tool to determine project emissions from flaring gases containing Methane"*.
~~10.~~	~~Flare temperature~~							

Data to be collected or used to monitor leakage, and how this data will be archived

Leakage will be zero unless the amount of electricity supplied by the project is large relative to the total amount of electricity delivered by the grid. If that is the case this methodology can not be used.

Quality control (QC) and quality assurance (QA) procedures to be undertaken for the items monitored*. (see tables above)*

Appropriate quality control and quality assurance procedures are needed for the monitoring equipment and the data collected.

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
1.	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
2.	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
3.	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
4.	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
5.	Low	Yes	The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy.
6.	Low	Yes	Electricity meters will be subject to a regular maintenance and testing regime to ensure accuracy.
7.	Low	Yes	Regular maintenance will ensure optimal operation of engines and generators. The heat rate will be checked semi-annually, with monthly checks if the heat rate shows significant deviations from previous values.
9.			The parameters used for determining the project emissions from flaring of the residual gas stream in year y ($PE_{flare,y}$) should use the QA/QC procedures as per the *"Tool to determine project emissions from flaring gases containing Methane"*.

Miscellaneous Parameters

Factor Used for Converting Methane to Carbon Dioxide Equivalents[1]

Factor used (CO_2e/CH_4)	Period Applicable	Source
21	1996-present	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories

[1] This table is updated as reporting guidelines are modified.