



Approved baseline methodology AM0010

“Landfill gas capture and electricity generation projects where landfill gas capture is not mandated by law”

Source

This methodology is based on the Durban Landfill Gas to Electricity Project in South Africa, whose project design document and baseline study, monitoring and verification plan were prepared by the Carbon Finance Unit of the World Bank (version 14 July 2003). For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0010-rev: “Durban Landfill Gas to Electricity Project” on <http://cdm.unfccc.int/methodologies/approved>.

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 landfill is subject to regulation of methane (CH₄) concentration but landfill gas capture is not mandated by law;
- The captured gas is used to generate electricity and the CO₂ emissions intensity of this electricity is lower than the emissions intensity of the electricity displaced;
- The electricity generation capacity of the project shall not exceed 15 MW.

This methodology must be used in conjunction with the monitoring methodology below. It is applicable only where the only plausible outcomes are a business-as-usual scenario (with minor changes and modifications) and the proposed project. In other words, the methodology is inapplicable where a plausible outcome is substantial change in practice or technologically different from the proposed technology.

Emission Reduction¹

The greenhouse gas emission reduction achieved by the project activity during a given year (ER_y) is the difference between the amount of methane actually destroyed/combusted during the year ($MD_{project,y}$) and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{baseline,y}$), times the approved Global Warming Potential value for methane (GWP_{CH_4}) plus the quantity of electricity sold to the grid during the year (ES_y) multiplied by the CO₂ emissions intensity of the electricity displaced ($EI_{grid,y}$).

¹ 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 (CH₄) 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.



$$ER_y = (MD_{project_y} - MD_{baseline_y}) \times GWP_{CH_4} + ES_y \times EI_{grid_y}$$

ER_y is measured in tonnes of CO₂ equivalents (tCO₂e). $MD_{project_y}$ and $MD_{baseline_y}$ are measured in tonnes of methane (tCH₄). The approved Global Warming Potential value for methane (GWP_{CH_4}) for the first commitment period is 21 tCO₂e/tCH₄. ES_y is measured in megawatt hours (MWh). The CO₂ emissions intensity, EI_{grid_y} , is measured in tonnes of CO₂ equivalents per megawatt hour (tCO₂e/MWh).

For the project design document, (ex ante) emission reduction estimates are made by projecting the future greenhouse gas emissions of the landfill using the US EPA First Order Decay Model. These estimates are for reference purposes only, since emission reductions will be determined (ex post) by metering of the actual quantity of methane captured and used for electricity generation once the project activity is operational.

The methane destroyed by the project activity ($MD_{project_y}$) during a year is determined by monitoring the quantity of methane used to generate electricity.

The CO₂ emissions intensity of the electricity displaced by the project (EI_{grid_y}) is the average annual CO₂ emissions intensity for the grid, which is obtained from the grid operator.

Baseline

The baseline scenario reflects the actions that need to be implemented to meet the regulation governing the allowed methane concentration, as well as good management practice to address safety and odour concerns.

If these actions correspond to the establishment of several “baseline” wells, the quantity of methane collected via these wells shall be monitored, and it should be demonstrated that the quantity collected is sufficient to meet the regulation governing the allowed methane concentration during the entire crediting period.

Additionality

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

Step 1: Provide a convincing justification that there is no plausible baseline scenario except the project and the business as usual (BAU) scenario. If there is another plausible baseline scenario, this methodology cannot be used for the proposed project activity. The justification of the baseline scenario shall take into account whether national or local regulations require capture of landfill gas.

Step 2: Calculate the cost of a kWh of electricity generated by the project using conservative assumptions. The calculation must include the incremental investment cost, the operations and maintenance costs, and all other costs of upgrading the BAU scenario to the proposed project activity. Assumptions are conservative if they tend to reduce the cost of the electricity generated. Conservatism of the assumptions should be ensured by obtaining expert opinions and by the Operational Entity validating the project.



Step 3: Determine the long run marginal cost (LRMC) of continued electricity generation by the grid. The LRMC is expressed as a cost per kWh. To be conservative, assumptions used to calculate the LRMC should increase the cost per kWh.

Step 4: Demonstrate that the cost of the electricity generated by the project (*Step 2*) is higher than the LRMC (*Step 3*). If that is the case, it can be assumed that generation by the grid (the baseline scenario) is financially more attractive than generation by the project and that the project is additional.

Leakage

No increase in emissions outside the project boundary – leakage – is expected as a result of the project activity. It is possible that the increased supply of electricity might lower electricity tariffs and so lead to more electricity consumption. This is only possible, if the amount of electricity supplied by the project is large relative to the total amount of electricity delivered by the grid. If the amount of electricity supplied by the project is large relative to the total amount of electricity delivered by the grid this methodology cannot be used.



Approved monitoring methodology AM0010

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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 generation of electricity. 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 collected at the “baseline” wells, if any and the amount of methane used to generate electricity².

The amount of methane destroyed by generating electricity (MD_{project}) is determined by monitoring the:

- Amount of landfill gas collected (m³) using a continuous flow meter and monitoring temperature and pressure;
- Percentage of landfill gas that is methane (% - using a continuous analyzer)³;

The amount of electricity sold to the grid (MWh) will be metered continuously.

In addition, the methane content of the boiler/engine emissions will be analyzed quarterly to determine the fraction of the methane destroyed.

² 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.

³ 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 national/local regulatory framework shall be monitored on an annual basis and, if such regulations come into effect, the amount of methane that would have been destroyed/combusted in the absence of the project activity (MDbaseline) shall be increased to the extent required to meet the new regulations.

*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 monitored	How will data be archived? (electronic/paper)	For how long is archived data kept?	Comments
1. MV _{base-line_y}	Amount of landfill gas collected from baseline wells	m ³	m	continuous	100%	electronic	Duration of crediting period	Measured by a flow meter. Temperature and pressure must also be measured with volume adjusted to standard temperature and pressure. Volume data are aggregated monthly and yearly.
2. MV project _y	Amount of landfill gas collected from project wells	m ³	m	continuous	100%	electronic	Duration of crediting period	Measured by a flow meter. Temperature and pressure must also be measured with volume adjusted to standard temperature and pressure. Volume data are aggregated monthly and yearly.
3.	Methane fraction in the landfill gas	%	m	continuous/ periodic	100%	electronic	Duration of crediting period	Measured by continuous gas quality analyser ⁴ .
4. ES _y	Amount of electricity sold to the grid	MWh	m	continuous	100%	electronic	Duration of crediting period	Measured by a kWh meter. Data will be aggregated monthly and yearly.
5. 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.
6.	Combustion efficiency	%	m and c	semi-annual, monthly if unstable	n/a	electronic	Duration of crediting period	Methane content of engine/ boiler exhaust gas.

⁴ 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.



ID number	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/paper)	For how long is archived data kept?	Comments
7.	LFG Temperature and pressure							
8.	Flare working hours							
9.	Flare temperature							
10. HRy	Heat rate of the generator	GJ/MWh	m and c	semi-annual, monthly if unstable	N/a	electronic	Duration of crediting period	Data will be used to test and, if necessary, correct the generator's name plate heat rate.



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. LFG _y	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
2. EG _y	Low	Yes	Electricity meters will be subject to a regular maintenance and testing regime to ensure accuracy. Their readings will be checked by the electricity distribution company.
3. HR _y	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.

**Miscellaneous Parameters***Factor used for converting methane to carbon dioxide equivalents¹*

Factor used (CO₂e/CH₄)	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.