CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Coronel landfill gas capture project

Version 1
25/09/2006

A.2. Description of the project activity:

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The Coronel site is an unmanaged landfill (dump) that has been operational since 1992. The site is currently still receiving municipal waste, but is expected to close by the end of 2006.

There is currently no system for the active capture and flaring of landfill gas and no system was required by the permit of 27 March 1992. The objective of the Coronel project is to replace the existing ineffective passive venting system by an active gas collection system in order to utilise the LFG of this landfill, thus minimising gaseous emissions and improving the overall landfill operation. This will involve investing in a highly efficient gas collection system, flaring equipment, and monitoring equipment.

The project developer Biogas Chile Ltda has a contract with the owner of the land where the landfill is located as well as a contract with the landfill operator, from which it is clear, that Biogas Chile Ltda. has all the rights to the landfill gas.

The main social and environmental impacts of this project will be a positive effect on health and amenity in the local area. The release of landfill gas can have a negative impact on the health of the local environment and the local population and lead to risks of explosions in the local surroundings. The project will also have a positive impact on employment in the local area as a number of staff will need to be recruited to manage the landfill gas operations, as it will need to be managed 24 hours per day.

The Project will have several positive social and environmental impacts:

- First, properly collecting and destroying flammable LFG will reduce the risks associated with explosions in and around the landfill. This is particularly important as the LFG collection system will minimise the potential for LFG migration, which can infiltrate zones outside of the landfill's boundaries and pose dangers to the surrounding population and structures.

- Second, the destruction of the LFG will improve the local environment by reducing the amount of noxious air pollution arising from the landfill, resulting in a considerable reduction of nuisance caused by the odours and also health risks associated to these emissions.

- Third, the project will provide a model for managing LFG

- Finally, the project will provide for both short- and long-term employment opportunities for local people. Local contractors and workers will be required for construction, and long-term staff will be used to operate and maintain the system.

The project is helping the Host Country to fulfil its goals of promoting sustainable development. Specifically, the project:

- Promotes the integration of environmental infrastructure, such as appropriate waste management and storage, as well as rehabilitation;
- Optimises the use of natural resources and avoids uncontrolled contaminations;
- Increases employment opportunities in the area where the project is located;
- Uses clean and efficient technologies;
- Improves the overall management practices of a landfill.

A.3. Project participants:

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Table: Project participants

Name of party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Chile (host) *Comisión Nacional del Medio Ambiente (CONAMA)*	Biogas Chile Ltda	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party (country) involved may or may not have provided its approval. At the time requesting registration, the approval by the Party(ies) involved is required.

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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Chile

A.4.1.2. Region/State/Province etc.:

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Región VIII: Región del Bíobío.

A.4.1.3. City/Town/Community etc:

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Municipality of Coronel

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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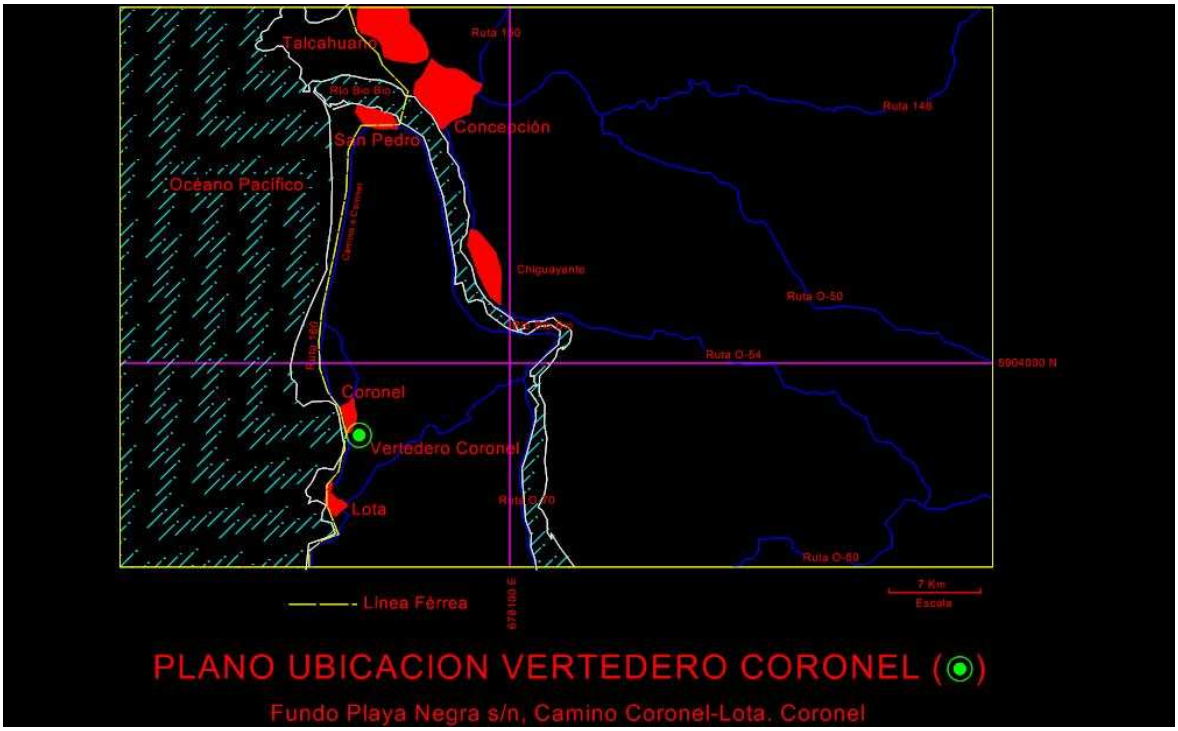
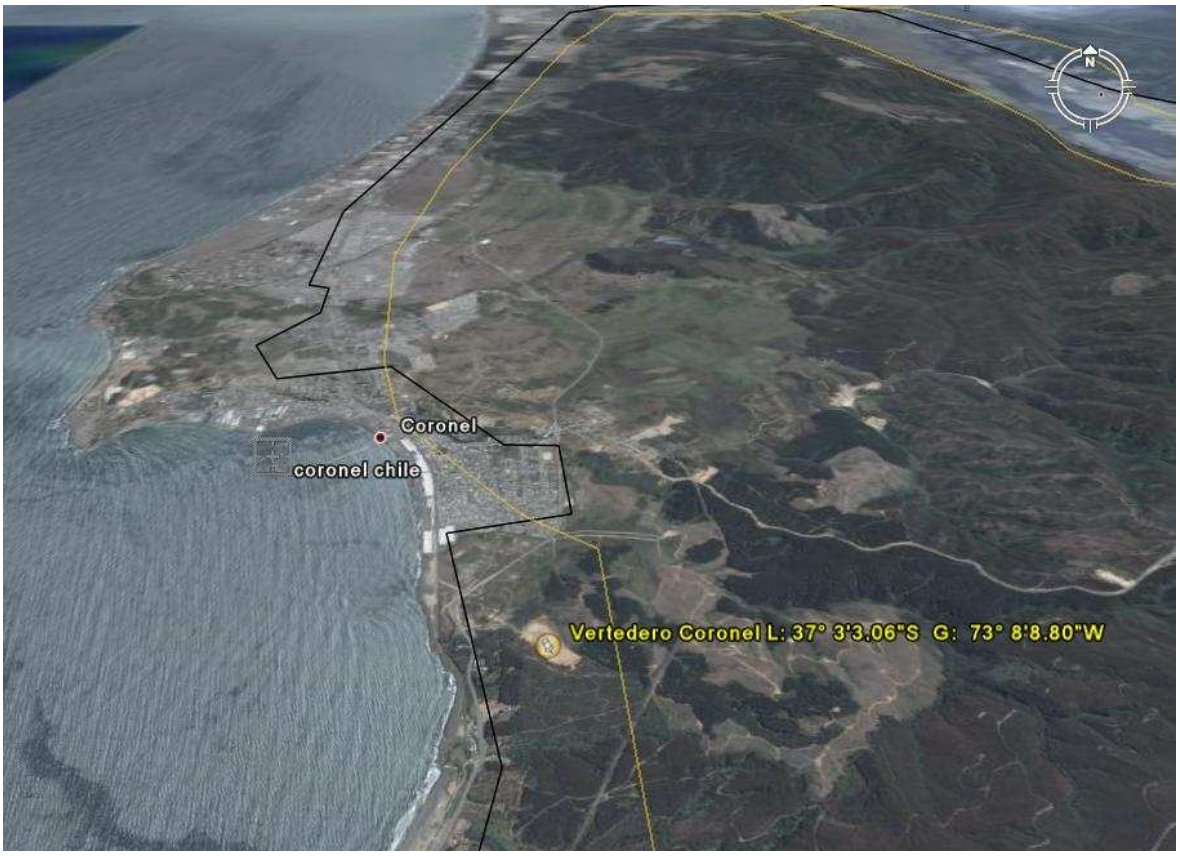
The project is located in “Fundo Playa Nagra”, on the road between Coronel and Lota (no road number).





A.4.2. Category(ies) of project activity:

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Sectoral Category 13 - Waste handling and disposal

A.4.3. Technology to be employed by the project activity:

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A summary of the technical description of the degassing installation is provided below. The flare will probably be purchased from a European manufacturer, where the rest of the equipment will mainly be purchased from Chilean companies.

Main Installation:

- Vertical gas wells (drilled holes filled with pebbles, a perforated pipeline and an air tight gas head)
- The gas wells are connected to Collection Boxes by means of HDPE (or an equivalent) suction lines.
- Inside the Collection Boxes the flow of each individual gas well can be regulated by means of a valve.
- The Collection Boxes are connected to the main collector (manifold) by means of HDPE (or an equivalent) suction lines.

- Under pressure in the suction lines is created by a gas pump (blower)
- At the pressure site of the blower the gas is directed to a flare, in which the gas is incinerated.

Important Auxiliaries:

- Condensate Pitts
  Inside these Pitts the condensate (coming from the gas) is collected and directed back to the landfill body
- Demister
  Inside the demister the last drops of condensate are being separated to prevent damage to the blower
- Flow meter
  The flow meter, monitoring the volume of landfill gas extracted, is compensated for pressure and temperature and supplies readout in normal cubic metres.
- Gas analyser
  The gas analyser monitors the methane fraction in the landfill gas.
- Flare station
  The flare station is equipped to incinerate the methane gasses in an optimal way. The mixture of landfill gas and air is regulated by means of air valves.
- PLC.
  The PLC inside the electrical cabinet of the Flare station is programmed to create an optimal combustion of the landfill gas.

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A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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Table: Estimated emission reductions from the project

Year	Annual estimation of emission reductions in tonnes of CO2e
2007	35,441
2008	32,715
2009	30,198
2010	27,876
2011	25,731
2012	23,752
2013	21,924
2014	20,238
2015	18,681
2016	17,243
Total estimated reductions (tonnes of CO2e)	**253,799**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**25,380**

A.4.5. Public funding of the project activity:

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The project will not receive any public funding from Parties included in Annex I of the UNFCCC, it is financed only with private capital.

SECTION B. Application of a baseline methodology

B.1. Title and reference of the approved baseline methodology applied to the project activity:

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The revision to the approved consolidated baseline methodology ACM0001, the "Consolidated baseline methodology for landfill gas project activities", version 4, dated 28 July 2006 has been applied to this project.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The *consolidated baseline methodology for landfill gas project activities* is applicable where the baseline is either partial or total atmospheric release of the gas and the project activity either flares or utilizes the captured gas.

The methodology ACM0001 allows for the development of projects falling under either of 3 options:

a) Landfill projects where the captured gas is simply flared; or

b) Landfill projects that use the gas to produce energy (e.g. electricity/thermal energy), but do not claim emission reductions for displacing or avoiding energy from other sources; or

c) Landfill projects where the captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources.

The Coronel project involves the situation listed under a) in the baseline methodology, as the captured gas will only be flared in the project, and not used to produce electricity. The project baseline is the partial atmospheric release of the gas. The Coronel project thus meets the applicability requirements as described in the *consolidated baseline methodology for landfill gas project activities*.

The selected approach from paragraph 48 of the CDM modalities and procedures in this methodology is: "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment." This approach is appropriate for this project, as the project involves a significant investment that would not have any financial return without CER revenue.

B.3. Description of how the sources and gases included in the project boundary

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According to ACM0001 baseline methodology, the project boundary is the site of the project activity where the gas will be captured and destroyed/used.

The following project activities and emission sources are considered within the project boundaries:

Table: Sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	LFG venting and partial flaring	CO_2	No	It is not considered because it is part of the natural carbon cycle.
		CH_4	Yes	Included as main component of LFG.
		N_2O	No	Not applicable
Project Activity	Active LFG capture and flaring	CO_2	No	It is not considered because it is part of the natural carbon cycle.
		CH_4	Yes	Included as main component of LFG.
		N_2O	No	Not applicable
	Electricity consumption for the blowers.	CO_2	Yes	CO_2 emissions of the plants supplying to the grid are taken into account via the calculation of the grid emission factor based on ACM0002.
		CH_4	Yes	Not applicable
		N_2O	No	Not applicable

- CH_4 emissions from the un-recovered LFG produced in the landfill.
- CO_2 from the combustion of landfill gas in the flare. When combusted, methane is converted into CO_2. As the methane is organic in nature these emissions are not counted as project emissions.
- Electricity required for the operation of the project activity should be accounted for in the project emissions and they need to be monitored.

For the determination of baseline emissions of the electricity generation component of the project, the project boundary will account for the CO_2 emissions from electricity generation in fossil fuel power stations operating in the Project grid system, which will be displaced by the Project activity. The spatial extent of the project boundary is defined as the project site and the plants connected to the grid system to which the project will be connected.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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ACM0001 identifies the baseline scenario as follows: "*The baseline is the atmospheric release of the gas and the baseline methodology considers that some of the methane generated by the landfill may be captured and destroyed to comply with regulations or contractual requirements, or to address safety and odour concerns."*

The specific situation at the Coronel landfill is that there is no active capture of methane at all, and the gas is indeed released into the atmosphere. Where the Coronel landfill is covered, it has a very simple venting system consisting of oil drums with holes in them to vent the biogas. The biogas also reaches the atmosphere via the cover layer itself. Although it is expected that no or only a very limited amount of gas will be burned in the baseline scenario, an Adjustment Factor of 2.5% is taken. This is considered to be conservative, as only a very small part of the gas was actually burned during site visits. Also, since the landfill will soon not be operational anymore, it is very unlikely that anyone would light the vents after flames go out because of rain or wind.

For the baseline determination, the project boundary is the site of the project activity where the gas will be captured and utilised.

There is no incentive to utilise the LFG to produce thermal energy, since there is no demand for thermal energy because the project is located in an isolated area.

Given that the results of the financial analysis conducted clearly show that implementation of this type of project is not the economically most attractive course of action, the project is considered to be additional (this is discussed in section B.5 below).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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The determination of project scenario additionality is done using the CDM consolidated Tool for the demonstration and assessment of additionality (version 2) 28 November 2005, which follows the following steps:

Step 0. Preliminary screening based on the starting date of the project activity

The project is only expected to start operation after its registration as a CDM project with the UNFCCC. In any case, as it will be demonstrated in the following steps, CDM revenue has been considered from the early stages of development of the project, and it is an integral part of the financial package of the project.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Alternative 1: The Business as Usual scenario. The continuation of the current situation without flaring, as no new requirements would be introduced for a landfill that is no longer operational, there would be no changes over time in this scenario.

Alternative 2: The landfill operator would invest in LFG collection equipment, power generation equipment and a grid connection, to supply power to the Chilean grid.

Alternative 3: The landfill operator would invest in a landfill gas collection system, as well as a high efficiency flaring system (the proposed project activity).

Other scenario's for a landfill might be the utilization of the landfill gas to supply heat, steam, or the upgrade of the landfill gas to natural gas quality. For Coronel, none of these scenario's are plausible, as the landfill is too small to make such utilization economically feasible. There is no industry to which heat or gas could be supplied in the vicinity of the landfill. A connection to the natural gas grid and equipment to upgrade the biogas to natural gas quality are too expensive.

Sub-step 1b. Compliance with applicable laws and regulations:

All the alternatives comply with the laws and regulatory requirements in the project location.
As explained under B.6., new landfill legislation in Chile would not apply to Coronel, as it operates under its existing permit and will stop operating by the end of 2006.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the methodology for determination of additionality, option I should be used if the CDM project activity generates no financial or economic benefits other than CDM related income. As this is the case for Coronel, the simple cost analysis will be used. To show that electricity production is not a viable baseline alternative, the benchmark analysis of option III will be used as well.

Sub-step 2b: Option I + III – simple cost analysis and application of benchmark analysis

Simple cost analysis
Alternative 3 (the project activity) will involve extra investments in an efficient gas collection system and flaring equipment.
The extra investments are estimated at approximately €1,000,000.

By investing in a gas capturing system, Coronel will not generate any revenues in the absence of CDM. Alternative 3 is therefore not an economically attractive scenario and not a realistic baseline scenario.

Benchmark analysis
The likelihood of Alternative 2, as opposed to the Business as Usual scenario will be determined by comparing its IRR with the benchmark of the interest rate available to a local investor, i.e., as provided

by local banks in Chile. A very conservative interest rate of 4% has been used in the analysis, which is the cost of capital for a straight forward bank loan.

Sub-step 2c: Comparison of financial indicators

The Table below shows the financial analysis for Alternative 2. As shown, the project IRR (without carbon) is negative. As the project IRR is negative, the Net Present Value will be negative at any interest rate and Alternative 2 is thus not a viable baseline alternative.

Table: Financial results of Alternative 2 without carbon finance. NPV uses 4% discount rate.

	with carbon	**without C**
Net Present Value (€)	€ 304,453	-€ 2,176,411
IRR	8.4%	N.A. (negative)
Discount rate	4.0%	4.0%

Summary of results of project analysis.

Sub-step 2d: Sensitivity analysis

Without revenue from the sale of the emission reductions, the project activity would not be profitable under any scenario. There would always be positive costs to the implementation of the project, and no other revenues can be expected.

Step 4. Common Practice Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

To date there has been limited development of landfill gas projects in the Host Country. Although permits for new landfills in Chile sometimes mention gas capture and flaring, the current practice in Chile is either no flaring at all or the unmanaged flaring of some of the gas. Currently, some LFG capture and flaring projects are being developed, but these are developed under the CDM. Without carbon revenue, development of these projects would stop and they are therefore not relevant to the common practice analysis.

The current Chilean national legislation does not require that landfills collect and dispose of landfill gases. So far, only a few landfills in Chile have been designed to collect and partially flare the gas generated. In the few cases where gases are collected, this is done for safety reasons (to avoid explosions), and it is often the case that the amounts effectively collected are very low. Investments done with this purpose is low and the technology used is very poor, with few exceptions.

Currently, only one landfill in Santiago is implementing a flaring system and a second one is installing a collecting system, but all over the country this is the case for less than three percent of the landfills.

There are some preliminary plans to install efficient capture and flaring systems for other landfills, but these are all in the context of CDM. No examples exist in Chile of landfills that have been closed down that have an active gas capturing system.

Sub-step 4b. Discuss any similar options that are occurring:

Where other similar projects are planned, these are all to be developed under the CDM. This does not call into question the claim that the Coronel project is financially unattractive without the CDM.

Step 5. Impact of CDM registration

As shown in Step 2 above, the project is unlikely to move forward without the additional financial support of the CDM. As the project will generate 253,799 tonnes of CO_2e credits over its 10-year lifetime, the revenue generated by carbon sales would be sufficient to make the project go ahead. Approval and registration as a CDM activity will thus alleviate the economic and financial hurdles.

According to the above analysis, the Coronel project is not the baseline scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The consolidated methodology for landfill gas project activities provides instructions and a formula for calculating the emission reductions of a landfill project. Since the Coronel project only involves flaring, this formula can be simplified as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP\_CH_4 - EL_{y,IM} * CEF_{electricity,\,y}$$

Where ER_y is the greenhouse gas emission reduction achieved by the project activity during a given year *y*, calculated as 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 ($MD_{reg,y}$) times the approved Global Warming Potential value for methane (GWP_CH_4). To compensate for the net incremental electricity imported ($EL_{y,IM}$), to meet the project requirements, the electricity emissions are subtracted by multiplying the net incremental electricity imported by the emission factor ($CEF_{electricity,\,y}$) of the Chilean grid.

ER_y is measured in tonnes of CO_2 equivalents (tCO_2e). $MDproject_y$ and $MDreg_y$ are measured in tonnes of methane (tCH_4). The net incremental electricity imported is measured in megawatt hour (MWh), and the emission factor is measured in tonnes of CO2 equivalents per megawatt hour (tCO2e/MWh) The approved Global Warming Potential value for methane (GWP_CH_4) for the first commitment period is 21 tCO_2e/tCH_4.

As specified by the consolidated methodology, the ex ante emission reduction estimates are made by projecting the future GHG emissions of the landfill. The US EPA First Order Decay Model is used to perform these calculations.

The actual emission reductions will be determined (*ex post*) by metering the actual quantity of methane captured and destroyed once the project activity is operational, and by monitoring the actual consumption of electricity.

Baseline emissions

ACM0001 identifies the baseline scenario as follows: "*The baseline is the atmospheric release of the gas and the baseline methodology considers that some of the methane generated by the landfill may be captured and destroyed to comply with regulations or contractual requirements, or to address safety and odour concerns.*" Since regulatory or contractual requirements do not specify MD_{reg}, an "Adjustment Factor" (*AF*) is used to determine the baseline. The equation is, as follows:

$$MD_{reg,y} = MD_{project,y} * AF$$

Where:

$MD_{reg,y}$	=	Amount of methane that would have been destroyed/combusted during the year *y* in the absence of the project activity (tCH_4)
$MD_{project,y}$	=	Amount of methane actually destroyed/combusted during the year *y* (tCH_4)
AF	=	Adjustment Factor (%)

The methodology provides guidance on how to estimate AF by the following examples:

- In cases where a specific system for collection and destruction of methane is mandated by regulatory
or contractual requirements, the ratio of the destruction efficiency of that system to the destruction efficiency of the system used in the project activity shall be used.

- In cases where a specific percentage of the "generated" amount of methane to be collected and destroyed is specified in the contract or mandated by regulations, this percentage divided by an assumed efficiency for the collection and destruction system used in the project activity shall be used.

Where the Coronel landfill is covered, it has a very simple venting system consisting of oil drums with holes in them to vent the biogas. The biogas also reaches the atmosphere via the cover layer. Under Chilean law, any new legislation could not apply to landfills that are already operating under an existing permit, nor would it apply to landfills that or not operational anymore.[1] Potential future legislation thus has no effect on the Coronel baseline. As no specific system for collection and destruction of methane is mandated by regulatory or contractual requirements an Adjustment Factor of 2.5% is selected, out of conservativeness.

At Coronel a few "chimneys" have been installed. Due to their construction (large rocks inside a frame built from old steel drums) they are not suitable for the incineration of landfill gas. The chimneys are only meant to function as "escape routes" for gasses that otherwise could built up pressure inside the landfill body. Although chimneys where in the past sometimes lit, there was a considerable danger of igniting the surrounding waste, as the combustion of the gas cannot be

[1] Source: Gonzalo Valenzuela Silva, lawyer at INFANTE, VALENZUELA, MARTINEZ & CÍA. [Ley de Bases del Medio Ambiente (Ley 19.300 de la República de Chile); el Código Sanitario de la República de Chile]

controlled. Also, as Coronel is located near the sea, the strong winds and rainfall easily blew out the flames. When no more waste is dumped on Coronel, nobody would light the flames in the vents anymore.

Leakage emissions

No leakage effects need to be accounted for under ACM0001.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**11. $EF_{electricity,y}$**
Data unit:	t CO_2/MWh
Description:	CO_2 emission intensity of the electricity and/or other energy carriers in ID 9 (compare section B 7.1)
Source of data used:	La Higuera Hydroelectric Project, Registration date: 20 March 2006 (*Slightly modified*)
Value applied:	0.509
Justification of the choice of data or description of measurement methods and procedures actually applied :	The EF was calculated according to ACM0002, using the simple Operating Margin and simple Build Margin approach.
Any comment:	

Data / Parameter:	**13.**
Data unit:	%
Description:	Regulatory requirements relating to landfill gas projects
Source of data used:	Legal analysis by Gonzalo Valenzuela Silva, see footnote 1 above.
Value applied:	2.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since this project has a 10-year crediting period, the Adjustment Factor will be fixed - without renewal - over the whole crediting period.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The consolidated methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the baseline scenario, as opposed to the amount of methane emitted in this scenario. The equation is, as follows:

$$MD_{reg,y} = MD_{project,y} * AF$$

Where:

$MD_{reg,y}$ = Amount of methane that would have been destroyed/combusted during the year *y* in the absence of the project activity (tCH_4)
$MD_{project,y}$ = Amount of methane actually destroyed/combusted during the year *y* (tCH_4)
AF = Adjustment Factor (%)

In the *Guidance related to avoided methane estimations*[2] the CDM Executive Board agreed that, in particular, the first order decay (FOD) model shall be used in estimating baseline methane emissions for projects avoiding emission from biogenic waste that would have been disposed either in landfills or left to decay in an uncontrolled manner, which would have resulted in methane emissions.

The methane destroyed by the project was estimated using the USEPA First Order Decay Model[3], applying Lo and k values appropriate for the VIII region in Chile[4] and assuming that 60% of the landfill gas generated is collected by the gas collection system (see Annex 3). In any case, this projection is merely for illustrational purposes (i.e., the actual emissions reductions will be monitored directly).

The AF value used for this project is 2.5% (see section B.6.2 for the justification of this value). The value for AF will be adjusted if it is affected by any changes in requirements or circumstances.

The Table below shows the destruction of methane that would have taken place in the baseline scenario (MD_{reg}), using the equations described above and the US EPA model.

	Per year (average)	**10 years**
$MD_{project}$ (tCH_4)	1,240	12,403
AF (%)	2.5%	2.5%
MD_{reg} (tCH_4)	**31**	**310**

Amount of methane destroyed
The consolidated methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the project scenario, as opposed to the amount of methane emitted in this scenario. The equation is, as follows:

$$MD_{project,y} = MD_{flared,y}$$

Where:

$MD_{project,y}$ = Amount of methane actually destroyed/combusted during the year *y* (tCH_4)
$MD_{flared,y}$ = Amount of landfill gas flared during the year *y* (tCH_4)

[2] Extract of the report of the twenty-third meeting of the Executive Board, paragraph 27

[3] On this model, see US EPA manual "User's Manual Mexico Landfill Gas Model" (November 2003).

[4] The US EPA model provides standards for the Lo and k values based on different precipitation rates. The precipitation rate for the VIII region in Chile are selected via WorldClimate (http://www.worldclimate.com).

The Table below shows the methane destructed in the project scenario ($MD_{project}$), using the equations described above and the US EPA model. The LFG estimate assumes a 60% capturing efficiency, and there is a reduction of 25% because of uncertainty in the US EPA model.

	Per year (average)	10 years
LFG_{flare} (m^3 LFG)	3,531,240	35,312,403
$w_{CH4\ (\%)}$	50%	50%
D_{CH4} (t CH_4/m^3 CH_4)	0.0007168	0.0007168
FE (%)	98%	98%
***MD*$_{project}$ = *MD*$_{flared}$ (tCH_4)**	**1,240**	**12,403**

Project emission from electricity imported

The net incremental electricity imported are multiplied by the emission factor ($CEF_{electricity,\ y}$) of the Chilean grid. As an estimate for the on-site electricity consumption to meet the project requirements a value of 2,450 kWh per month is provided. The Table below shows the resulting emissions from net incremental electricity imported.

	Per year (average)	10 years
$EL_{y,IM}$ (MWh)	29	294
$CEF_{electricity,\ y}$ (tCO_2e/MWh)	0.509	0.509
***Project emissions from electricity imported* (tCO_2e)**	**15**	**150**

Emission reductions

Based on the approved Global Warming Potential value for methane (GWP_CH_4) for the first commitment period (21 tCO_2e/tCH_4), the emission reductions can be calculated, applying the following formula.

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP\_CH_4 - EL_{y,IM} * CEF_{electricity,\ y}$$

The Table below provides an overview of the application of this formula.

	Per year (average)	10 years
$MD_{project}$ (tCH_4)	1,240	12,403
MD_{reg} (tCH_4)	31	310
GWP_CH4	21	21
$EL_{y,IM}$ (MWh)	29	294
$CEF_{electricity,\ y}$ (tCO_2e/MWh)	0.509	0.509
***ERy* (tCO_2e)**	**25,380**	**253,799**

B.6.4 Summary of the ex-ante estimation of emission reductions:

The ex-ante estimations of emission reduction result in an overall reduction over the chosen 10-year crediting period of 253,799 tCO2e. The summary is provided in the Table below.

Year	Estimation of project activity emission reductions (tonnes of CO2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2007	36,350	909	0	35,441
2008	33,554	839	0	32,715
2009	30,973	775	0	30,198
2010	28,591	715	0	27,876
2011	26,391	660	0	25,731
2012	24,361	609	0	23,752
2013	22,487	563	0	21,924
2014	20,757	519	0	20,238
2015	19,160	479	0	18,681
2016	17,686	443	0	17,243
Total (tCO_2e)	**260,310**	**6,511**	**0**	**253,799**

B.7 Application of the monitoring methodology and description of the monitoring plan:

Version 4 of the approved monitoring methodology ACM0001 "Consolidated monitoring methodology for landfill gas project activities" is to be used. The proposed project activity meets all the applicability requirements requested for this methodology.

B.7.1 Data and parameters monitored:

Data / Parameter:	**1. $LFG_{total,y}$**
Data unit:	Nm^3
Description:	Total amount of LFG captured
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7,847,201 (average)
Description of measurement methods and procedures to be applied:	Data will be measured continuously with a flow meter by the project developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained. Data to be aggregated monthly and yearly.

QA/QC procedures to be applied:	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	Since the project only flares landfill gas, $LFG_{total} = LFG_{flared}$

Data / Parameter:	**2. $LFG_{flared,y}$**
Data unit:	Nm^3
Description:	Amount of LFG flared
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7,847,201 (average)
Description of measurement methods and procedures to be applied:	Data will be measured continuously with a flow meter by the project developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained. Data to be aggregated monthly and yearly.
QA/QC procedures to be applied:	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	As LFG is flared only, the flow meter for parameters 1. and 2. will be the same i.e. only one flow meter will need to be installed.

Data / Parameter:	**5. FE**
Data unit:	%
Description:	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	98
Description of measurement methods and procedures to be applied:	(1) The flare operation shall be continuously monitored by continuous measurement of operation time of flare using a run time meter connected to a flame detector or a flame continuous temperature controller, irrespective of whether the flare efficiency is monitored. (2) Periodic measurement of methane content of flare exhaust gas. (3) The enclosed flares shall be operated and maintained as per the specifications prescribed by the manufacturer. An enclosed flare will be used subject to the following requirements: (1) Enclosed flares shall be monitored yearly, with the first measurement to be made at the time of installation.

	If this methods cannot be carried out, a default efficiency of 90% will be used.
QA/QC procedures to be applied:	Regular maintenance should ensure optimal operation of flares. The enclosed flare shall be operated and maintained as per the specifications prescribed by the manufacturer.
Any comment:	

Data / Parameter:	**6. $w_{CH4,y}$**
Data unit:	Nm^3 CH_4 / Nm^3 LFG [%]
Description:	Methane fraction in the Landfill gas
Source of data to be used:	Project developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50%
Description of measurement methods and procedures to be applied:	Methane content will be measured continuously with a gas analyser by the project developer. The gas analyser will be maintained and calibrated regularly in line with the manufacturer's requirements in order to ensure that factory standards of accuracy are maintained.
QA/QC procedures to be applied:	The gas analyser should be subject to a regular maintenance and testing regime to assure accuracy.
Any comment:	

Data / Parameter:	**10. EL_{IMP}**
Data unit:	MWh
Description:	Total amount of electricity imported to meet project requirements
Source of data to be used:	Grid operator
Value of data applied for the purpose of calculating expected emission reductions in section B.5	29
Description of measurement methods and procedures to be applied:	Required to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity. Electricity will be measured continuously using an electricity meter which will be maintained and calibrated regularly to assure high levels of accuracy. The records of any electricity imported in the baseline too should be recorded at the start of project.
QA/QC procedures to be applied:	Measurements are to be cross-checked with invoices.
Any comment:	

B.7.2 Description of the monitoring plan:

The monitoring plan details the actions necessary to record all the variables and factors required by the methodology ACM0001 Version 4 as detailed in section B.7.1 above. All data will be archived electronically, and backed up regularly. Moreover, it will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity (whichever occurs later).

Project staff will be trained regularly in order to satisfactorily fulfill their monitoring obligations. The authority and responsibility for project management, monitoring, measurement and reporting will be agreed between the project participants and formalized. Procedures for calibration of monitoring equipment, maintenance of monitoring equipment and installations, and for records handling will be established. As the project construction proceeds monitoring will be finalized ready for implementation at the start of project operation.

Further information on the delegation of responsibilities can be found in Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The baseline study and monitoring methodology were completed on 05/09/2006 by EcoSecurities. EcoSecurities is not a project participant listed in Annex I.

Michiel ten Hoopen
EcoSecurities
Kettingstraat 21-A
2511 AM Den Haag
michiel@ecosecurities.com
www.ecosecurities.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 15 March 2007

C.1.2. Expected operational lifetime of the project activity:

>> 10 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>> N/A

C.2.1.2. Length of the first crediting period:

>> N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> 15 March 2007

C.2.2.2. Length:

>> 10 years

SECTION D. Environmental impacts

>>

The project will actively collect and combust LFG, thereby improving overall landfill management and reducing adverse global and local environmental effects of uncontrolled releases of landfill gas. While the main global environmental concern over gaseous emissions of methane, is the fact that it is a potent greenhouse gas and thus contributes importantly to global warming, emissions of LFG can also have significant health and safety implications at the local level. For example:

- Risk of explosions and/or fires either within the landfill or outside its boundaries;
- Asphyxiation and/or toxic effects to humans from concentrated emissions of LFG;
- Local and global environmental effects such as odour nuisances, stratospheric ozone layer depletion, and ground-level ozone creation due to over 150 trace component contained in landfill gas.

Through both, the installation of a well-designed LFG collection and a destruction/utilisation system and its proper operation, LFG will be captured and combusted in a controlled way, thereby removing safety risks from the surrounding community, reducing the risks of toxic effects on the local community and the local environment as well as reducing the emissions of a potent greenhouse gas.

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

Biogas Ltda. analysed the environmental impacts of the project and submitted an environmental impact declaration to the government:
DECLARACIÓN DE IMPACTO AMBIENTAL : " OPTIMIZACIÓN DEL SISTEMA DE EXTRACCIÓN DE GASES EN EL VERTEDERO DE CORONEL". The full text of the environmental impact declaration is available to the validator.

Section 5 of the environmental impact declaration deals with the environmental analysis of emissions, discharges and residuals of the project.

With regard to emissions to the atmosphere:
During construction: particle emissions related to earth moving activities (installation of piping etc.); to the construction of the foundation of equipment; and to movement of vehicles. These are minor emissions in view of the nature of the construction (piping, wells and control systems)

During operation: no generation of odor nor gas. Practically all of the biogas is combusted in a flare specially designed for this purpose. Therefore gas emission is limited to carbon monoxide, vapour, and traces of Volatile Organic Compounds.

With regard to discharges of effluents to water courses:
There is no such discharge in any water course, neither surface nor underground.

With regard to noise generated:
There is no significant impact.

Discharges to sewer system:
There is no sewer system. Chemical toilets are used during construction, septic tank system designed for 5 operators during the operation of the project.

Related to energy production:
There is moderate production of heat , incapable of affecting the environment in a significant way, moderate heating of the air in the immediate vicinity, imperceptible to any receptor of any type outside of the project area.

With regard to interaction and combination of contaminants:
These processes do not exist in any significant way in the project

With regard to explosives
No explosives will be used

No transboundary impacts have been identified apart from the mitigation of greenhouse gas emissions.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
The government has not made any further requirements based on the environmental impact declaration.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

An informal meeting was held with the mayor of Coronel to discuss the project. He was enthusiastic about the project and also suggested to have a stakeholder consultation meeting with the city council, which would be open to the interested public. This stakeholder consultation meeting was held on Wednesday the 20th September at the Council Chambers of the Municipality of Coronel. The project developer, Biogas Ltda. was represented by:

Alfredo Kother Feest, Director
Jean Pierre van Praet, General Manager
Juan Anento, Operation Manager.

Present at the meeting were:
The Mayor of Coronel
Members of the Municipal Council
Neighbourhood Associations

The Mayor explained at the meeting that the project is an environmentally friendly project at the old Coronel dump, and that the project is worthy of consideration by the Council, which was why he invited Biogas Ltda.

Alfredo Kother explained the project involves the capture and destruction of the methane generated in the Coronel dump, and that it is at project that is developed under the Kyoto Protocol. He also provided a brief background on the Kyoto Protocol.

Juan Anento gave a technical presentation of the project, providing some details of the project components. He also showed projects of other biogas projects in Chile that are already operational.

The Mayor offered the opportunity to council members and neighbourhood associations to ask questions. The questions were related to risks, positive and negative impacts of the project, the product of the project, the profitability of the project and the impact on global warming.

The questions were answered and the further discussion was positive towards the project and led to unanimous support, under the condition that all legislation of the country and its international commitments would be respected.

In addition to the stakeholder consultation meeting, letters have been sent to explain the project and ask for comments to:

Maria Soledad Tohá, the Intendant of the Bío Bío Region
Rodrigo Díaz Wömer, the Governor of the Concepción province
René Carvajal Zúñiga, the Mayor of Coronel
Sergio Bobadilla Muñoz, Deputy of area 45 (Coronel)
Clemira Pahceco Rivas, Deputy of area 45 (Coronel)
Hosain Sabag Castillo, Senator of the 12th District
Alejandro Navarro, Senator of the 12th District
Raúl Rivas, president of the neighborhood association of Coronel (Union Comunal Coronel)
Arnaldo Salazar, president of the neighborhood association "Diego Portales"of Coronel
Carlos Arriagada, president of the Provincial Federation of neighborhood associations
Cecilia Villavicencio Rosas, Ministerial Secretariat 8th Region
Dr. Jaime Sepúlveda Cisternas and Andrea Aste, health service of Concepción (ServSalud)
Bolivar Ruiz, national environmental committee 8th Region (CONAMA)

The people involved in the meeting and the written stakeholder consultation represent everyone affected by the project activity, all stakeholders had the opportunity to submit comments.

E.2. Summary of the comments received:

>>

The responses on the letters sent out to the stakeholders were positive, some have not responded to the letter that was sent. No responses were received that requested any changes to the project. As explained above, the discussion in the stakeholder consultation meeting was positive towards the project and led to unanimous support, under the condition that all legislation of the country and its international commitments would be respected.

E.3. Report on how due account was taken of any comments received:

>>

There were no written responses that required any change to the project. Naturally, the project will respect all Chilean legal requirements and as a CDM project, it will be part of Chile's involvement in the Kyoto Protocol.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**BIOGAS CHILE Ltda**
Street/P.O.Box:	Calle B n° 1170 Lomas de San Sebastián
Building:	
City:	Concepción
State/Region:	VIII Region
Postfix/ZIP:	
Country:	CHILE
Telephone:	0056/41.2.48.50.07
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E-Mail:	a.kother@consorciosansebastian.cl
URL:	
Represented by:	Alfredo Kother
Title:	Director
Salutation:	Mr
Last Name:	Kother Feest
Middle Name:	
First Name:	Alfredo
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project will not receive any public funding from Parties included in Annex I of the UNFCCC, it is financed only with private capital.

Annex 3

BASELINE INFORMATION

The waste data is based on topographic measurements of the waste in place, and interviews with the staff on the landfill site.

Data input

ECO SECURITIES

Project name:	El Coronel Chile
Starting crediting period:	2007
location:	Coronel
Country:	Chile

LANDFILL CALCULATION PARAMETERS			
Parameter	**value**	**Unit**	**source**
Landfill data			
Year started landfill operation	**1992**	#	
Year finished operation	**2006**	#	
Waste in place at beginning of project	**1,283,752**	tonnes	
R = Average daily waste rate	**0**	ton/day	
Date gas collection project starts	**2007**	#	
Operational data			
Proportion of methane collected	**60%**	%	
Combustion effectiveness of Flare	**98%**	%	
General data			
Lo	**2690**	cft/ton	
k	**0.08**	1/yr	
Methane content of landfill gas	**50%**	%	
CH4 GWP	**21**	ton CO2e/ tonCH4	
Density of Methane	**0.0007168**	ton CH4/m3	
Uncertainty level	**25%**	%	
Baseline data			
Residual emission factor CH4 to CO2	**0%**	%	
Proportion of methane flared in baseline (AF)	**2.5%**	%	

ELECTRICITY CALCULATION PARAMETERS			
Parameter	**value**	**Unit**	**source**
Validated Country CEF for grid electricity	**0.509**	ton CO2e/MWh	
Electricity generation (?)	**n**	(y or n)	
Electricity consumption of flare	**2,450**	KWh/month	
Theoretical Methane Heating Value	0	BTU/cft	

US EPA exponential decay model LFG=2*k*Lo*M*e^(-kt)

US EPA exponential decay model	**LFG=2*k*Lo*M*e^(-kt)**
Lo (cf/ton) =	(mid value chosen from US EPA Landfill Gas to Energy Handbook for 'wet climate')
M=	ton/year
k (1/year)=	(mid value chosen from US EPA Landfill Gas to Energy Handbook for 'wet climate')
t =	time since landfill opened (years)

Annex 4

MONITORING INFORMATION

Further details on the distribution of responsibilities:

Task	On-site technician	QC manager	CDM Programme Manager	Project Participant's Representative	EcoSecurities
Collect Data	E	R	I	N/A	N/A
Enter data into Spreadsheet	I	E	R	N/A	N/A
Make monitoring report	N/A	N/A	I	R	E
Archive data & reports	I	E	R	N/A	N/A
Calibration/ Maintenance	E	R	I	N/A	N/A

Key:
E = Executive responsibility
I = To be informed
R = Responsibility for overseeing and assuring quality