



**CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02**

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**Revision history of this document**

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	<ul style="list-style-type: none">• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.• As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

**SECTION A. General description of the small-scale project activity****A.1. Title of the small-scale project activity:**

- De Martino WWTP upgrade
- Version number: Version 004
- Date: 25-07-2006

A.2. Description of the small-scale project activity:

Santa Teresa S.A. (so called: De Martino vineyard) will implement an Sequential Batch Reactor (SBR¹) at their wine production facility.

The SBR will utilize organic material currently emitted in wastewater to a series of anaerobic ponds. The pond system aerobically reduce the organic material released, producing vast amounts of biogas methane.

The SBR will remove the organic material in the wastewater, and hence reduce the Chemical Oxygen Demand (COD)² and subsequent **avoids** fugitive CH₄ emissions.

	Baseline	Project activity
Waste water treatment	Wastewater, high in COD, is treated via an anaerobic pond system, producing massive amounts of biogas methane	An SBR will be used to treat this wastewater, dramatically reducing the COD prior to release it to the local irrigation system

Project activity highlights:

- Project is implemented in existing lagoon-based industrial wastewater treatment facility for wastewater with high organic loading;³
- The organic wastewater mainly contains simple organic compounds (mono-saccharides).⁴

¹ The SBR design is a fill and draw type with non-steady state activated sludge process where individual reactors are filled one by one in five discrete periods i.e. Anoxic fill, React, Settle, Decant and Idle / Waste sludge. The SBR design provides excellent process control over a wide range of growth by varying the operating strategy in Aerobic or Anoxic conditions.

² An easily biological degradable pollutants (COD/BOD₅ = 2.54) ratio will be used, but empirical data will be collected and updated on a regular basis.

³ Proven by a public notary's certificate number 05/9613 Annexe 3 (attached).

⁴ A theoretical and conservative emissions factor used for this SSC-PDD will be 0,21 kgCH₄/kgCOD but, yearly, during each harvest season a new emission factor will be empirically measured by external certified laboratories and used until the next season. Good practice is to use project or country-specific data expressed in terms of kg CH₄/kg COD removed consistent with the activity data. IPCC Guidelines suggest a default value of 0.25 kg CH₄/kgCOD, subject to an uncertainty range of -30%, +30%, leading to a correction of 0.83, that is a default value of

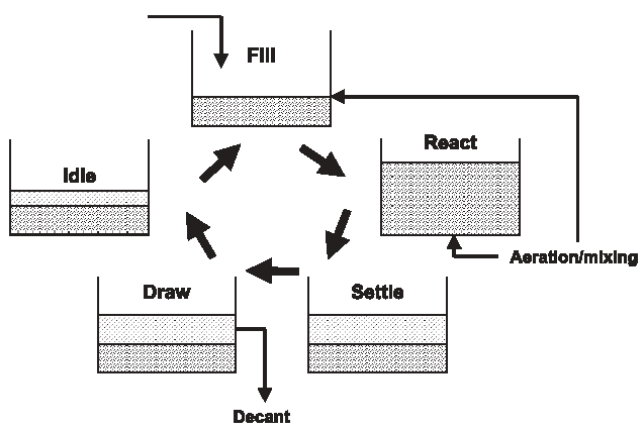
- The project involves the improvement of existing wastewater treatment facility.⁵
- It will be shown that the baseline is the expansion of a current lagoon system for managing waste water in full compliance with existing rules and regulations;
- The depth of the anaerobic lagoons are 2,5 m ;
- The temperature of the wastewater in the anaerobic lagoons is always at least 15 °C;

A.3. 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)	Santa Teresa S.A.	NO

A.4. Technical description of the small-scale project activity:

The sequencing batch reactor (SBR) process is a sequential suspended growth (activated sludge) process in which all major steps occur in the same tank in sequential order (see figure). There are two major classifications of SBRs: the intermittent flow (IF)⁶ or "true batch reactor," which employs all the steps in the figure, and the continuous flow (CF) system, which does not follow these steps. Both have been used successfully at a variety of U.S. and worldwide installations. SBRs can be designed and operated to enhance removal of nitrogen, phosphorus, and ammonia, in addition to removing TSS and BOD. The intermittent flow SBR accepts influent only at specified intervals and, in general, follows the five-step sequence.



There are usually two IF units in parallel. Because this system is closed to influent flow during the treatment cycle, two units may be operated in parallel, with one unit open for intake while the other runs through the remainder of the cycles. In the continuous inflow SBR, influent flows continuously during all phases of the treatment cycle. To reduce short-circuiting, a partition is normally added to the tank to separate the turbulent aeration zone from the quiescent area.

The SBR system is typically found in packaged configurations for onsite and industrial or cluster applications. The major components of the package include the batch tank, aerator, mixer, decanter device,

0.2075 kg CH₄/kgCOD (see IPCC Good Practice guidance and Uncertainty Management in National Greenhouse Gas Inventories, section 5.16 and the table of conservativeness factors of technical guidance on methodologies for adjustments under article 5, paragraph 2, of the Kyoto Protocol contained in document FCCC/SBSTA/2003/10/add.2)

⁵ Proven by a public notary's certificate number 05/9613 Annexe 3 (attached).

⁶ De Martino vineyards will install a IF – SBR type.



process control system (including timers), pumps, piping, and appurtenances. Aeration may be provided by diffused air or mechanical devices. SBRs are often sized to provide mixing as well and are operated by the process control timers. Mechanical aerators have the added value of potential operation as mixers or aerators. The decanter is a critical element in the process. Several decanter configurations are available, including fixed and floating units. At least one commercial package employs a thermal processing step for the excess sludge produced and wasted during the "idle" step. The key to the SBR process is the control system, which consists of a combination of level sensors, timers, and microprocessors. Programmable logic controllers can be configured to suit the owner's needs. This provides a precise and versatile means of control.

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Chile

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

Region: Metropolitan

Province: Talangante

Latitude	-33.7500	Longitude	-70.9000	Altitude (feet)	1.049
Lat (DMS)	33° 45' 0S	Long (DMS)	70° 54' 0W	Altitude (meters)	319

A.4.1.3. City/Town/Community etc:

Town: Isla de Maipo

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

To get to the De Martino vineyard from Santiago (Chilean's capital) you must join the Autopista del Sol highway (Ruta 78) to Melipilla and go west as far as the town of Talagante, located about 45 km from the centre of Santiago. Then take the exit to Talagante. At the crossroad, turn left to Isla De Maipo, which is about 11km away. When you arrive to Isla de Maipo, follow Jaime Guzman Avenue until you reach Manuel Rodriguez Street, turn left and follow the street signs to DE MARTINO





Vineyard. Total trip will take almost 1 hour.

A.4.2. Type and category(ies) and technology of the small-scale project activity:

TYPE III - OTHER PROJECT ACTIVITIES

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectorial policies and circumstances:

	Baseline	Project activity	Emissions Reductions
Waste water treatment	Wastewater, high in COD, is treated via an anaerobic pond system, producing massive amounts of biogas methane	An SBR will be used to treat this wastewater, dramatically reducing the COD prior to release it to the local irrigation system	Wastewater related fugitive emissions (currently over 271 tones CH ₄ per annum) dramatically avoided GHG ERs = 5.696 tones CO ₂ e pa

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of project emissions (tonnes CO₂equ)	Annual estimation of emission reductions (tonnes CO₂equ)
2007	320	5.696
2008	320	5.696
2009	320	5.696
2010	320	5.696
2011	320	5.696
2012	320	5.696
2013	320	5.696
Total estimated (tonnes of CO₂equ)	2.240	39.872
Total numbers of crediting years	7 y	7 y
Annual average over the crediting period (tonnes CO₂equ)	320	5.696

A.4.4. Public funding of the small-scale project activity:

No public funding was spend on this project activity.



A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

The proposed project activity is a component of a larger project activity.

**SECTION B. Application of a baseline methodology:****B.1. Title and reference of the approved baseline methodology applied to the small-scale project activity:**

III.I. Avoidance of methane production in wastewater treatment through replacement of anaerobic lagoons by aerobic systems

The applied methodology tests the continuation of current wastewater management practices where significant amounts of organic material are produced and deposited into wastewater streams. The methodology attempts to assess whether current wastewater anaerobic management practices would prevail in the absence of any CDM project intervention.

B.2 Project category applicable to the small-scale project activity:**TYPE III - OTHER PROJECT ACTIVITIES****B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:**

The analysis of plausible options indicates that the baseline in this situation is a continuation of current treatment regime and historic emissions. In the absence of the project, fugitive emissions of methane from the pond system continue unabated. The project will engineer a more sustainable waste treatment solution that dramatically avoids fugitive methane emissions.

Currently the De Martino vineyards facility produces a significant amount of GHG emissions. These emissions, estimated approximately 6.017 tones CO₂e per annum in the final full year and subsequent years of operation, arise from the three main sources shown in the table below. Under the project scenario these emissions are expected to be reduced by approximately 5.696 tones CO₂e pa, with project emissions of about 320 tones CO₂e during the final year of operation.

The sources of emissions and their contributions to the baseline and project scenarios during the final full calendar year of operation (2007) are described below:

Source		t CO ₂ e		
		Baseline Emissions	Project Emissions	Emissions Reductions
Fugitive pond emissions	Direct	6.017	0	0
Grid fed electricity	Indirect	0	320	5.696

The fact that there are no functioning projects similar to this in Chile or in the winery sector (to our knowledge) is a clear indication as to the barriers to investment and project development. It is these factors that drive the clear additionality of this project.

Approximately 70% of the companies in Chile (including De Martino vineyards) have introduced the open lagoon system, in the context of the Clean Production Agreement signed between the winery association



and the Chilean government in 2003⁷ to enhance the level of wastewater treatment in the country. Assuming a conservative approach, this project activity has considered the anaerobic lagoon as the baseline, based on a cost analysis for the different waste treatment technologies. Therefore, it represents one of the likely economically attractive scenarios for De Martino vineyards production.

National and regional policies and circumstances

The existing legislation in Chile allows to use a partially treated winery wastewater for farm's irrigation ($BOD_5 < 410$ mg/L) this level of treatment can be easily achieved by simple anaerobic lagoons. De Martino vineyards decide to install an advanced WWTP SBR type for voluntarily achieve a higher environmental discharge standard ($BOD_5 < 35$ mg/L) and reduce GHG, even a much more cheaper anaerobic solution can be deployed (lagoons).

During the last years, De Martino vineyard has used anaerobic lagoons as wastewater treatment due the fact it is still the most cost effective alternative. This system was also recognized as the technology that the industry and the Government are encouraging to use in Chile.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

The project boundaries define the technical extent to which the effects of the project must be measured, monitored and verified.

The project boundary is the physical, geographical site where the wastewater treatment takes place.

Wastewater Methane Emissions: The boundaries are assumed to be the methane producing ponds (Baseline).

Electricity Emissions: The boundaries are assumed to be Chile's territorial boundaries, within which the grid system operates. Project activity will need blowers, pumps and other ancillary equipments that would require electricity (Project)

SBR WWTP Methane Emissions & Boundaries: It is assumed that continued low level (i.e., potentially non significant) fugitive emissions of methane would be observed in the project activity (inside the pump stations, pipelines, etc). The boundaries, as set, act to limit the analysis to what is measurable and attributable to the project.

B.5. Details of the baseline and its development:

The first draft of the baseline was completed in July 2005 and this version was completed on the 12/30/2005

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⁷ www.pl.cl/documentos.asp?cod_doc=55



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Eratech Chile Ltda. is not a project participant.

SECTION C. Duration of the project activity / Crediting period:**C.1. Duration of the small-scale project activity:**

21 years

C.1.1. Starting date of the small-scale project activity:

01/01/2006

C.1.2. Expected operational lifetime of the small-scale project activity:

25 years

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

Renewable crediting period

C.2.1. Renewable crediting period:

Yes

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

01/01/2007

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

Not applicable.

**C.2.2.1. Starting date:**

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Application of a monitoring methodology and plan:**D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:**

III.I. Avoidance of methane production in wastewater treatment through replacement of anaerobic lagoons by aerobic systems

A number of key elements are monitored here.

- Emissions associated with the use of electricity by the SBR wastewater treatment.
- Fugitive emissions and degradability monitored via COD & BOD₅ monitoring of wastewater before and after the SBR system.
- Fugitive emissions monitored via flow monitoring of wastewater after the SBR system.
- Fugitive emissions monitored via kg CH₄/kg COD ratio monitoring of wastewater before the SBR system.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

The De Martino vineyards Monitoring Plan (MP) provides a roadmap of the necessary methodological, data collection, and auditing needs and procedures for the project. Wherever possible, the methodology aims to allow for project specific data to be applied to the baseline situation, in order to monitor both project and baseline emissions.

To calculate emission reductions and support their verification, the project will require collection of the following data, which will be collected routinely by De Martino's staff:

- Wastewater flows from the industrial facility to the SBR (inflow);
- Wastewater flows from the SBR to the irrigation system (outflow);
- Wastewater COD to the SBR (inflow);
- Wastewater COD from the SBR (outflow);
- Wastewater kg CH₄/kg COD emission factor;



These indicators will allow the quantification of the organic material that would have flowed to the pond system in the absence of the project and hence degrading to produce fugitive emissions in the baseline. (volume x concentration = organic matter entering pond in baseline scenario).

- Total energy (electricity) used by the SBR and ancillary equipment.

D.3 Data to be monitored:

ID number	Data type	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment	
1.	SBR Inflow	m ³	m	Continuously	100%	Electronic	Two years after the end of the crediting period.	Indicator of project and baseline emissions	
2.	SBR Outflow								
3.	Wastewater COD Inflow	kg COD /m ³	m	Weekly measurement	100%	Electronic	Two years after the end of the crediting period.		
4.	Wastewater COD Outflow								
5.	Wastewater emission factor Inflow	kg CH ₄ /kg COD	m	Seasonally measurement[MSoftware1] and recording.	100%	Electronic	Two years after the end of the crediting period.		
6.	Chemical Oxygen demand vs. Biochemical oxygen demand ratio	COD/BOD ₅	c	Seasonally measurement[MSoftware2] and recording.	100%	Electronic	Two years after the end of the crediting period.		Degradability index.
7.	Total amount of electricity used in the project for the SBR	kWh	m	Continuously	100%	Electronic	Two years after the end of the crediting period.		
8.	CO ₂ emission intensity of the electricity in ID 6.	t CO ₂ / MWh	c	Annually	100%	Electronic	Two years after the end of the crediting period.		Indicator of project emissions
9.	Working hours per year	h	m	Monthly measurement and annually recording.	100%	Electronic	Two years after the end of the crediting period.		
10.	Amount of sludge produced	t	m	Monthly measurement and annually recording.	100%	Electronic	Two years after the end of the crediting period.		The sludge will be disposed into a compost facility or a landfill with



D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

Agricola Santa Teresa Ltda. (So called De Martino vineyards) is on process to get the ISO 9.000 certification therefore the QA/QC will be undertaken according with such guidelines.

ID number	Data type	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1.	SBR Inflow	Low	A standard flow meters periodically calibrated will be used.
2.	SBR Outflow	Low	
3.	Wastewater Inflow COD	Low	EPA Method 410.4 standard
4.	Wastewater Outflow COD	Low	
5.	Wastewater emission factor Inflow	Medium	<p>Emission Factor = Bo</p> <p>Where Bo = Maximum theoretical methane producing capacity (kg CH₄/kg BOD or kg CH₄/kg COD)</p> <p>Deriving Bo</p> <p>Bo IPCC default value is specified as 0.25 (+/- 30%), and is based on theoretical grounds. The MCF is site and project specific and primarily depends on the nature of the waste, and other (environmental) factors.</p> <p>It is important to note that the value of 0.25 is entirely based on the definition of COD and is thus independent of the nature of the waste stream in question.⁸ This is the reason why this parameter should be monitored seasonally.</p>

⁸ If the emission of methane cannot be measured directly, Bo will be used to estimate the amount of methane from the degradation of COD. This however, assumes methane fermentation as the only mechanism for degradation of the organic matter, so that the conversion of COD into methane is maximal. There are however a number of potential mechanisms that could lead to a reduction of the theoretical maximum methane yield. These factors are:

- Growth of new bacteria (biomass) reduces the amount of methane emitted. This factor is ever present, as the biochemical conversion of organic matter by bacteria without bacterial growth is not possible. For anaerobic digestion processes the conversion of COD into biomass is generally accepted to be within the range between 4% and 10%, thus reducing the methane yield accordingly
- The presence of sulfate in the wastewater. Sulfate is often present in agro-industrial wastewaters as a result of the use of sulfuric acid during the production process. Sulfate is reduced by Sulfate Reducing Bacteria (SRB) leading to the production of hydrogen sulfide, at the expense of COD. As a result, the methane yield is reduced.



6.	Chemical Oxygen demand vs. Biochemical oxygen demand ratio	Low	Meters will be subject to regular maintenance and testing regime to ensure accuracy.
7.	Total amount of electricity used in the project for the SBR	Low	
8.	CO ₂ emission intensity of the electricity in ID 6.	Low	Public data available at the UNFCCC and other country specific web site (s).
9.	Working hours per year	Low	Meters will be subject to regular maintenance and testing regime to ensure accuracy.
10.	Amount of sludge produced	Low	Public data will be available either at the compost or landfill final disposal

The measurement of a WWTP's outputs is relatively simple. For other hand the electricity consumed by the project activity can be determined from measuring energy generation meter readings. This method is the preferred measurement method, and requires installing an electric input meter ant that constantly measures the electricity used.

The meter must meet the calibration standards of the grid market (local, national or international). Meter readings records will be particularly important to auditors and must be readily available. This method may produce errors if the meter is not properly calibrated, therefore calibration should be checked periodically for accuracy. Calibration tests' records are useful and should be kept for the auditors.

All relevant data for monitoring comes from direct and verifiable sources (whenever available) and is crosschecked with commercial and / or other official data (whenever available) to assure the accuracy, comparability, completeness and validity of the data.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

Project monitoring will be perform by Mr. Pietro De Martino, General Manager of Agricola Santa Teresa Ltda. and other 2 professionals at De Martino vineyard.

D.6. Name of person/entity determining the monitoring methodology:

- The presence of other compounds in the wastewater that could consume COD at the expense of methane production. There are a number of chemical compounds that could lead to oxidation of COD, and thus consume COD at the expense of methane formation. These compounds are oxidants of which dissolved oxygen and nitrate are the most common.

These factors could affect the Bo in a particular project is unknown. So if Bo measurement system applies to this project a conservative adjustment factor will be used otherwise if we will follow a direct methane measurement protocol it will not requires an adjustment factor.



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SECTION E.: Estimation of GHG emissions by sources:**E.1. Formulae used:****E.1.1 Selected formulae as provided in appendix B:**

Due the applicable project category from Appendix B does not indicate a specific formula to calculate the GHG emission reductions by sources, we will complete section E.1.2 below.

E.1.2 Description of formulae when not provided in appendix B:**E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:**

$$PE_y = PE_{y,power} + PE_{y,sludge}$$

where:

PE_y: project activity emissions in the year “y” (tonnes of CO₂ equivalent)

PE_{y,power} emissions through electricity consumption or diesel consumption in the year “y”

PE_{y,sludge} emissions through anaerobic decay of the sludge produced in the year “y”

PE_{y,sludge} emissions:

Methane emissions from the decay of the sludge generated by the aerobic systems, if the sludge is left to decay anaerobically and disposed in a landfill without methane recovery. **In this case the sludge will go to a compost facility or a landfill with methane recovery.**

Therefore: PE_{y,sludge} = 0

PE_{y,power} emissions :

The monitoring plan take into account the project emissions due to the running of the SBR treatment plant. The electricity needs to be monitored and an adequate CO₂ emission factor needs to be applied and justified.



- a) The projected SBR's power requirement will be $(118 \text{ HP}^9) = 0,000088\text{GW}$.
- b) The projected SBR's energy requirement will be $0,000088\text{GWh} \times 24 \text{ h/d} \times 365 \text{ d/y} = 0,77 \text{ GWh/y}$.
- c) The proposed baseline methodology considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. In this case, the De Martino vineyard is connected to the SIC Chilean grid. The Central Interconnected System of the Republic of Chile (SIC), is comprised by the transmission systems and the generating Power Plants that operate interconnected from Rada de Papos in the north (II Region), to Isla Grande de Chiloe in the south (X Region). This system is the largest of the four electric systems that supply energy to the Chilean territory, accounting for about 75% of the power generation capacity in Chile and supplying to approximately 93% of the Chilean population. Despite its long extension (the system is basically a long 220KV double / simple circuit transmission line with some higher capacity and alternative circuits in some segments) the SIC does not present important transmission limitations.

The emissions factor calculated as the chosen methodology describes as the electricity baseline emission factor CEF_y :

$$EF_{ELECTRICITY} = wOM * EFOM,y + wBM * EFBM,y$$

It is therefore necessary to calculate electricity baseline emission factor $EF_{ELECTRICITY}$ of the SIC Chilean grid, which operates independently in Chile, in order to determine the emission to be accounted by the De Martino vineyard. This implies to calculate the corresponding Operating Margin emission factor ($EFOM,y$) and the Build Margin emission factor ($EFBM,y$) for the SIC grid to which the De Martino vineyard is connected.

Operating Margin Emission Factor Calculation

Other IPCC methodologies offer four methods to calculate the Operating Margin emission factor:

- (1) Simple OM,
- (2) Simple adjusted OM
- (3) Dispatch data analysis OM
- (4) Average OM

The methodology suggests for Power plants with less than 15 MW of power that option (4) should be the first choice, however, this SSC-PDD will select option (a) for determining the Operating Margin. The reasons to choose option (1) instead of option (4) are:

In Chile, electricity generation takes place mostly in hydroelectric plants. More than 50% of the power generated by all power plants come from hydroelectric power plants. Option (4) for calculation of the operating margin includes the low operating cost and must run power units in the calculation. Since low cost/must run units are represented in Chile by 57.5% of hydroelectrical and 0.25% of biomass power plants of the total generation, these units represent the majority of the electricity generated (MWh), and

⁹ The engineering project are under development but we got this figure from the project's draft report.



very few emissions of GHG, because hydroelectrical power plants do not generate any emissions. Considering this, using option (4) for the calculations of the operating margin would result in a much smaller operating margin factor that would not represent the actual situation of the Chilean SIC grid. Option (1) then, represents a much more realistic approach considering the characteristics of the SIC grid, to which the De Martino vineyard would be connected.

The Simple OM emission factor ($EF_{OM, simple, y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO₂/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM, simple, y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}}$$

The calculations were performed as follows:

$$\sum F_{i,j,y} * COEF_{i,j} = 8,303,139.05 \text{ (tCO}_2\text{/year)}$$

$$\sum GEN_{i,j} = 15,361 \text{ (GWh /year)}$$

- The information above was obtained from CDEC-SIC official and public information for year 2004 and using default values from IPCC 1996 Revised Guidelines and the IPCC Good Practice Guidance.
- The above calculation does not include low cost / must run units emissions.

So, replacing the above values in the equation for calculation the operating margin emission factor we obtain the following:

$$EF_{OM, simple, y} = 8,303,139.05 \text{ [tCO}_2\text{/year]} / 15,361 \text{ [GWh/year]}$$

$$EF_{OM, simple, adjusted} = 540.51 \text{ (tCO}_2\text{/GWh)}$$

Build Margin emission factor calculation

According to the methodology, there are two options to calculate the Build Margin. In each of these options, the Project Proponent must select a sample group of *m* power plant that comprises the larger annual generation from either:

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise the 20% of the system generation (in MWh) and that have been built most recently.



In this case, the Project Proponent chose Option 2 for the Build Margin calculation. Under this option, the largest annual generation was from the sample group m of power plants that comprised the 20% of the system total generation in 2004 (see Annex 6):

$$EF_{BM} = 289.29 \text{ (tCO}_{2e} / \text{GWh)}$$

As in the Operating Margin calculation case, the Build Margin calculation also considered official CDEC-SIC data. In cases data were not available, IPCC default factors was used.

Having obtained both $EF_{OM,y}$ and $EF_{BM,y}$, and assuming the default values for the weights w_{OM} and w_{BM} established in the proposed methodology, it is possible to calculate $EF_{electricity,y}$

$$EF = 0.5 * 540.51 \text{ (tCO}_{2e}/\text{year)} + 0.5 * 289.29 \text{ (tCO}_{2e} / \text{GWh)}$$

$$CEF = 414.9 \text{ (tCO}_{2e}\text{qu} / \text{GWh)}$$

If we compare the previous value of this PDD vs. others EF values obtained for the same Chilean interconnected central grid (SIC) taken from other renewable projects presented for the UNFCCC's approval the obtained value is:

Project Title	EF (t CO ₂ equ/GWh)
La Higuera Hydroelectric Project	589
Nueva Aldea Biomass Power Plant Phase 1	466
Nueva Aldea Biomass Power Plant Phase 2	426
Trupán Biomass Power Plant Project in Chile	416
De Martino WWTP upgrade	415

d) CO₂ emission intensity of the electricity for De Martino WWTP upgrade project:

$$PE_{y,\text{power emissions}} = 0,77 \text{ GWh/year} \times 415 \text{ t CO}_2/\text{GWh} = 320 \text{ t CO}_2/\text{year}$$

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

Due the aerobic treatment technology is not equipment transferred from another activity or the existing equipment is not transferred to another activity, therefore no leakage calculation is required.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

$$PE_y = PE_{y,\text{power}} + PE_{y,\text{sludge}} = 320 + 0 = 320 \text{ t CO}_2/\text{year}$$

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:



$$BE_y = COD_y * Bo * GWP_{CH4} * MCF \text{ (Equation 0)}$$

where:

BE_y Baseline emissions in the year “y” (tonnes of CO₂ equivalent).

COD_y Chemical oxygen demand of effluent entering the lagoons in the year y (tonnes).

Bo Maximum methane producing capacity. A value of 0.21 kg CH₄/kg COD is used.

MCF Methane conversion factor (fraction). The MCF default value to be adopted for projects in Africa, Asia and Latin America & Caribbean shall be 0.738.

GWP_{CH4} Global Warming Potential for CH₄ (value of 21)

Fugitive Methane Emissions From Lagoons are:

$$COD_y \times Bo \times GWP_{CH4} = E_{CH4 \text{ lagoons}} = M_{\text{lagoon anaerobic}} \times EF_{CH4} \times GWP_{CH4}/1000 \text{ (Equation 1)}$$

where:

- $E_{CH4 \text{ lagoons}}$ is the methane emissions from the lagoons (tCO₂e)
- $M_{\text{lagoon anaerobic}}$ is the amount of organic material removed by anaerobic processes in the lagoon system (kg COD¹⁰)
- EF_{CH4} is the methane emission factor (kg CH₄ / kg COD). A default IPCC - COD to methane conversion factor of 0.21kg CH₄/kgCOD is used.¹¹
- GWP_{CH4} is the Global Warming Potential of methane ($GWP_{CH4} = 21$)

The total removal of COD from individual lagoons is a function of:

- Aerobic surface oxidation of COD;
- Chemical oxidation in lagoons (where oxidative species such as sulphate are present);
- Sedimentation of material that microbes are unable to degrade before they form a bottom sediment; and,
- COD degradation as a result of anaerobic micro bacterial activity.

Because individual ponds act in unique manner the total removal and its components must be characterized on a project specific basis.

The mass balance in the considered lagoon system provides the amount of organic material removed by anaerobic processes:

¹⁰ IPCC quantification of industrial wastewater treatment recommend to apply COD.

¹¹ Empirical data will be collected, updated & adjusted seasonally due higher values are reported by other authors such as Marais, G.v.R. (1970); "Dynamic behaviour of Oxidation pond". In: *Proceedings of the Second International Symposium on Waste Treatment Lagoons*. Ed. R.E. McKinney, pp15-46. Laurence: University of Kansas.



$$M_{lagoon_anaerobic} = M_{lagoon_total} - M_{lagoon_aerobic} - M_{lagoon_chemical_ox} - M_{lagoon_deposition} \quad \text{(Equation 2)}$$

where:

- M_{lagoon_total} is the total amount of organic material removed in the lagoon system from equation 3 (kg COD)
- $M_{lagoon_aerobic}$ is the amount of organic material degraded aerobically in the lagoon system (kg COD). Surface aerobic losses of organic material in pond based systems equal to 254 kg COD per hectare of pond surface area and per day is assumed to be lost through aerobic processes.
- $M_{lagoon_chemical_ox}$ is the amount of organic material lost through chemical oxidation in the lagoon system (kg COD)
- $M_{lagoon_deposition}$ is the amount of organic material lost through deposition in the lagoon system from equation 4 (kg COD)

Total Material Removed In Lagoon System is:

$$M_{lagoon_total} = M_{lagoon_input} \oplus R_{lagoon} \quad \text{(Equation 3)}$$

where:

- M_{lagoon_total} is the total amount of organic material removed in the lagoon system through various routes (kg COD)
- R_{lagoon} is the total organic material removal ratio of the lagoon (-). It is a project specific factor, and is equal to the proportion of organic material removed (through all routes) within the boundaries of the lagoon system under consideration. This factor should be determined by carrying out a series of biochemical tests prior to project implementation. These tests will determine the COD flows into the system, and the COD flows out of the system at the system boundary. The relative difference of COD flowing in and out of the system over a period of time will allow determination of the Total Organic Material Removal Ratio.

Material Deposition In Lagoon System is:

$$M_{lagoon_deposition} = M_{lagoon_input} \times R_{deposition} \quad \text{(Equation 4)}$$

Where:

- $R_{deposition}$ is the organic material deposition ratio of the lagoon. It is equal to the proportion of organic material physically sedimented in lagoons within the project boundaries. It is a project specific factor derived by assessing the relative ability of COD in the waste water stream to sediment in the project boundaries, through pre project analysis.

Therefore:

*Fugitive Methane Emissions From Lagoons*¹²

$$(((5.242 - 117/1000) \text{ t COD/d} \times 365 \text{ d/y}) \times 0,21 \text{ t CH}_4/\text{t COD} \times 21 \text{ t CO}_2/\text{t CH}_4 = 8.152 \text{ t CO}_2/\text{y}$$

Finally:

$$BE_y = 8.152 \text{ t CO}_2/\text{y} * \text{MCF} = 8.152 \text{ t CO}_2/\text{y} \times 0,738 = 6.017 \text{ t CO}_2/\text{y}$$

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

$$\text{Emission Reductions} = BE_y - (PE_y + Leakage_y) = (6.017 - (320 + 0)) \text{ t CO}_2/\text{y} = 5.696 \text{ t CO}_2/\text{y}$$

E.2 Table providing values obtained when applying formulae above:

Year	Baseline emissions <i>t CO₂/y</i>	Project emissions <i>t CO₂/y</i>	Emission Reductions <i>t CO₂/y</i>
2007	320	6.017	5.696
2008	320	6.017	5.696
2009	320	6.017	5.696
2010	320	6.017	5.696
2011	320	6.017	5.696
2012	320	6.017	5.696
2013	320	6.017	5.696
2014	320	6.017	5.696
2015	320	6.017	5.696
2016	320	6.017	5.696
2017	320	6.017	5.696
2018	320	6.017	5.696
2019	320	6.017	5.696
2020	320	6.017	5.696
2021	320	6.017	5.696
2022	320	6.017	5.696
2023	320	6.017	5.696
2024	320	6.017	5.696
2025	320	6.017	5.696
2026	320	6.017	5.696
2027	320	6.017	5.696
2028	320	6.017	5.696
Total	6.720	132.374	125.312

¹² For details see annexe 4.

**SECTION F.: Environmental impacts:****F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:**

On March 9th 1994 the Official Gazette (Diario Nacional) published Law N° 19.300, the General Framework Law on the Environment, which the National Congress had passed in January that year. The Law had begun its legislative process in the Senate, at the initiative of the President of the Republic, in September 1992.

Currently, companies that wish to develop a new project will have to follow the legal regulations prescribed in Law N° 19300, Bases del Medio Ambiente (Environmental Basis). From this law we can enhance as the most important element, the presentation of an Environmental Impact Study (EIS) or Environmental Impact Statement (DIA) in the corresponding cases. Such study is evaluated by the corresponding Environmental Commission, which will could approve it or reject it.

Fundamental to this is the Environmental Impact Assessment System (EIA), for both public and private investment projects. The Law indicates the type of projects that must submit to environmental impact assessment and sets out the criteria for determining whether an investment project needs to present an **Environmental Impact Statement (DIA)** —a rapid formula applicable to projects whose activities are adequately regulated by standards— or whether it needs to draw up an Environmental Impact Study (EIS) —a more complex document basically applicable to large-scale investment projects, which might have a significant impact on the environment, and whose potential effects are either not entirely regulated or else depend on subjective opinions (for example the alteration of landscapes with heritage value or effects on a community and its culture, etc.).

The DIA is presented in the form of a sworn statement, in which the responsible party (the proponent) states that the project or activity complies with ruling environmental legislation (Art. 18 – Law 19.300).

The resolution classifying an DIA as positive or negative has the nature of a environmental super-permit, because if it is positive, no state agency can deny the relevant environmental authorizations, and if it is negative, state agencies are obliged to deny the corresponding authorizations or relevant environmental permits (Art. 24 – Law 19.300).

This project does require and already approved an Environmental Impact Statement (DIA) under Chilean Law. The project has tight project boundaries, with immediate physical impacts focused within these boundaries.

These include;

- Total elimination in biogas production and fugitive emissions of biogas from current pond system;
- Improved water quality;
- Improved biodiversity impacts within the surrounding water bodies

The De Martino's Environmental Impact Statement was review an approved by the following institutional stakeholders:



- Regional Governor;
- Ministerial Secretary for Economics, Development and Reconstruction;
- Ministerial Secretary for Public Works;
- Ministerial Secretary for Agriculture;
- Ministerial Secretary for National Heritage;
- Ministerial Secretary for Health,
- Ministerial Secretary for Mining;
- Ministerial Secretary for Housing and Urban Development
- Ministerial Secretary for Transport and Telecommunications;
- Ministerial Secretary for Planning and Cooperation;
- Four regional counsellors elected by the respective council;
- Regional Director of the Environment.
- Regional Directors of Public Services with environmental competencies (Health, Agriculture, Geology and Mining Service, Water, CONAF, etc.):
- Maritime Governor.

SECTION G. Stakeholders' comments:

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

Under the existing Chilean environmental legislation, the local DNA (CONAMA) calls for a Public Consultation Process (PCP) to identify concerns of the local stakeholders and response of the developer, as part of the EIA.

However, due to the technical & legal characteristics of the proposed CDM project activity (see section F.1) Chilean Law do not require an open public consultation for an Environmental Impact Statement (DIA). In this case, what the common sense recommended, and it was done that way, was a focused public consultation, surveying the neighbors in the area of direct influence of the project and leaders or organized local groups in that same area.

Therefore the following independent PCP's activities was performed by the project developer:

- a) 02 public announcements were performed in a regional newspaper.
- b) Letters to all the public authorities and neighbors was sent explaining the project.

The PCP has been developed following crystal-clear procedures and tried to cover the interested parties and/or by those affected by the project.

G.2. Summary of the comments received:



In general, the perception of the project is positive and related benefits regarding the use of clean mechanisms for wastewater treatment are well recognized by local stakeholders. Other concerns about the local permits and operation are seen as solvable and not as key within their general concerns about the vineyard itself.

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

The project developer will take the suggestions up and will inform the stakeholders regularly on the progress of the project at De Martino vineyards site.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.**

Organization:	Santa Teresa S.A.
Street/P.O.Box:	Manuel Rodríguez 229 . P.O. Box 416-V
Building:	
City:	Isla de Maipo
State/Region:	Región Metropolitana
Postfix/ZIP:	
Country:	Chile
Telephone:	(56-2) 819 29 59
FAX:	(56-2) 819 29 86
E-Mail:	pietro@demartino.cl
URL:	www.demartino.cl
Represented by:	Mr. PIETRO DE MARTINO
Title:	Managing Director
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	(56-2) 819 29 59
Direct tel:	(56-2) 819 29 86
Personal E-Mail:	pietro@demartino.cl



Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.



Annex 3

PUBLIC NOTARY'S CERTIFICATE NUMBER 05/9613

REPUBLICA DE CHILE
MINISTERIO DE RELACIONES EXTERIORES

OFFICIAL TRANSLATION

Under the oath prescribed by article sixty-three of the Code of Civil Procedure of the Republic of Chile, I do hereby certify that the following translation from the Spanish original numbered 05/9613 is genuine. -----

----- RUBRICATO NE VARIETUR -----



DEED

----- The document whereof the translation follows hereinbelow is a DEED, issued in the Spanish language, signed, authorized and legalized according to Chilean laws and reads as follows: -----

----- (Letterhead): Maria Eugenia Le-Bert Acharitogaray
- Notary Public - Id. Card No. 4,943,896-6 - Av. Bernardo O'Higgins 1360 - Phone: 8151285 - Fax: 8380804 - Talagante ---

DEED

----- Talagante, November 8, 2005. At the verbal request

----- // -----



REPUBLICA DE CHILE
MINISTERIO DE RELACIONES EXTERIORES

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- // -----
of Mr. Marco Sergio de Martino Cáceres, Id. Card No. 6,250,003-4, acting on behalf of "SOC. AGRÍCOLA SANTA TERESA LIMITADA", Taxpayer Identification Card No. 79,513,550-2, at 4.15 pm, in my capacity as a Notary Public in and for the Province of Talagante and Authenticating Officer, I met with Mr. Francisco Acuña Carter, Id. Card No. 10,319,569-1, draftsman of the new plant, and Mr. Carlos Muñoz Aceval, Id. Card No. 7,403,632-5, Project and Development Manager of "Agrícola Santa Teresa Ltda." at the premises located at Manuel Rodríguez 229, district of Isla del Maipo, to head for road Santa Inés, n/n, of this district, where I verified the existence of: -----



- 1.- A facility housing wine-making metallic tanks, equipped with running waste water gutters, and workers in full activity. -----
- 2.- An export wine bottling facility, equipped with water gutters leading to outside water collection tanks, and workers in full activity. -----
- 3. An old water treatment facility, in operation since 1998, as stated by Mr. Carlos Muñoz A., Project and Development Manager of "Agrícola Santa Teresa Ltda.". -----
- 4. Jointly with Mr. Carlos Muñoz A., Project Manager, I visited the new plant, consisting of 4 tanks of approximately 3.5 meters, as stated by Mr. Carlos Muñoz A., never used, no water under treatment and housing new machinery and equipment. It is located in the same site as the old plant, which fact I verified during my *in situ* visit. -----
- 5. The visit ended at 5.30 pm. Sixteen photographs ----- // -



REPUBLICA DE CHILE
MINISTERIO DE RELACIONES EXTERIORES

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- // -----
of the said place were taken and certified, which form an
integral part of this deed. -----

----- Illegible signature -----

----- Maria Eugenia Le-Bert Acheritogaray -----

----- Notary Public -----

----- Talagante -----

----- The relevant seal is affixed -----

----- The Ministry of Justice of Chile does hereby
legalize the signature of Ms M. E. Le-Bert. -----

----- Santiago, November 28, 2005 -----

----- Illegible signature -----

----- Patricia Illanes Klug -----

----- Legalization Officer -----

----- The signature of Ms P. Illanes is legalized by
the Ministry of Foreign Affairs of Chile. -----

----- Illegible signature -----

----- Ana Lobo Donaire -----

----- Legalization Officer -----

----- November 28, 2005 -----

----- Seal: Ministry of Foreign Affairs - Chile -----

IN WITNESS WHEREOF, I have hereunto set my hand and seal in
Santiago, Chile, on this 13th day of December, 2005.



THE OFFICIAL TRANSLATOR

Legalizada en el Ministerio
de Relaciones Exteriores de Chile
Firma del Señor _____
[Handwritten Signature]

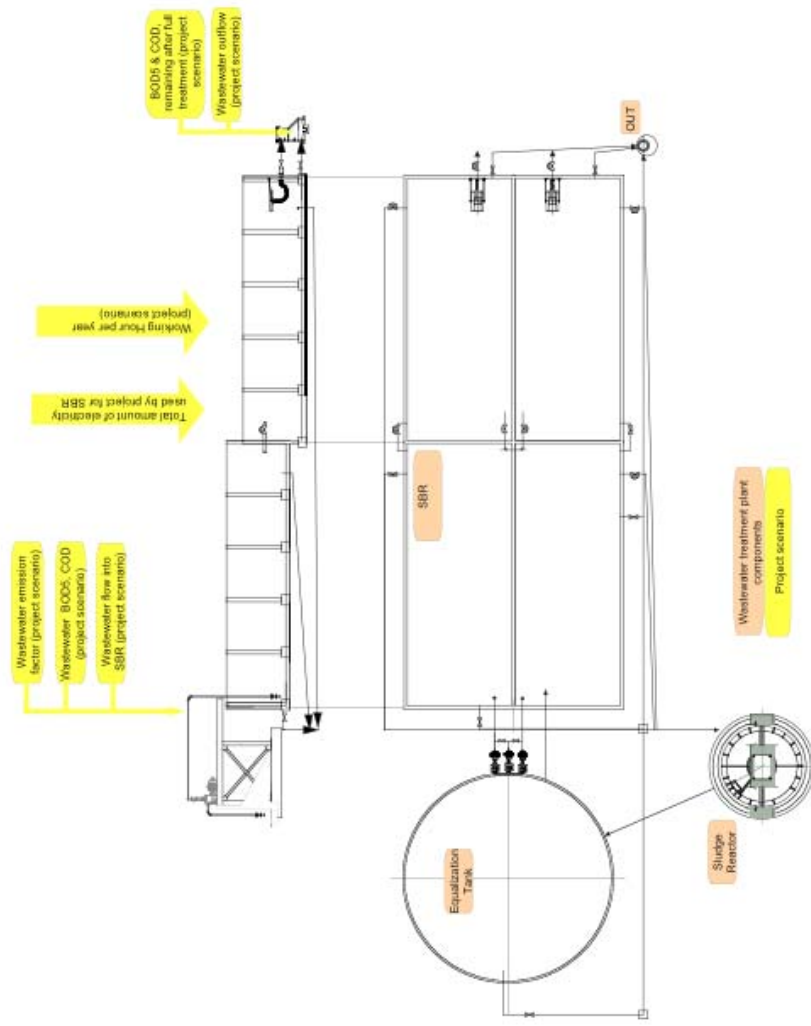


Annex 4 BASELINE

Input Data		De martino anaerobic lagoon - WWTP system		Mara D. & Pearson H 1986 "Artificial Freshwater environments: waste stabilisation ponds" in: Biotechnology Vol8, Ed W. Schoenborn p177-206	
	Total flow	216.350	m ³ /year		
	Flow	593	m ³ /day		
	Incoming BOD ₅ to WWTP	3.902	ppm		
	kg COD/ kg BOD ₅	2.54			Since AM022 v02
	Outgoing BOD ₅ to WWTP	420	ppm		
	Kg BOD ₅ loss through aerobic chemical reaction in WWTP	100	kg/ha		Since AM022 v02
	Year	365	days		
	Maximum methane production	0.21	tCH ₄ /tCOD		
	GWP	21	for methane		
	Out going BOD ₅ content from De martino to WWTP	3.902	ppm		
	Out going flow from De martino facility	593	m ³ /day		
Anaerobic lagoon first stage					
	Incoming Flow	593	m ³ /day		
	Average T in cold month	15	°C		
	Average T in warm month	23	°C		
	Lagoon Load cold month	200	kg/m ³ .day		
	Lagoon Load warm month	300	kg/m ³ .day		
Volume required	cold month	11.564	m ³	Total system	
	warm month	7.710	m ³	A1+A2	11.600 m ³
	depth	5	m		
Surface required				could be 3 to 5 m	
	cold month	2.313	m ²	A1+A2	2.500 m ²
	warm month	1.542	m ²		
Retention time	cold month	13	days		
	warm month	9	days		
Anaerobic lagoon efficiency BOD ₅ (each one)					
	cold month	50	%		
	warm month	60	%		
	Out going BOD ₅ content				
	cold month	1.951	ppm		
	warm month	1.561	ppm		
Anaerobic lagoon second stage					
Volume required	cold month	5.782	m ³	A3 + A4	6.000 m ³
	warm month	3.084	m ³		
	depth	5	m		
Surface required	cold month	1.156	m ²	A3 + A4	1.200 m ²
	warm month	617	m ²		
Retention time	cold month	7	days		
	warm month	3	days		
	Out going BOD ₅ content				
	cold month	976	ppm		
	warm month	780	ppm		
Anaerobic lagoon third stage					
Volume required	cold month	2.891	m ³	A5 + A6	3.000 m ³
	warm month	1.542	m ³		
	depth	5	m		
Surface required	cold month	578	m ²	A5 + A6	600 m ²
	warm month	308	m ²		
Retention time	cold month	3	days		
	warm month	2	days		
	Out going BOD ₅ content				
	cold month	488	ppm		
	warm month	312	ppm		
Anaerobic lagoon fourth stage					
Volume required	cold month	1.446	m ³	A7 + A8	1.500 m ³
	warm month	617	m ³		
	depth	5	m		
Surface required	cold month	289	m ²	A7 + A8	300 m ²
	warm month	123	m ²		
Retention time	cold month	2	days		
	warm month	1	days		
	Out going BOD ₅ content				
	cold month	244	ppm		
	warm month	125	ppm		
				A1+A2+A3+A4+A5+A6+A7+A8	
				VOLUME	22.100 m ³
				SURFACE	4.600 m ²
				EFFICIENCY	89.24 %
Total amount of organic material degraded on WWTP system					
a		5.242	kg/day		
Total amount of organic material degraded through aerobic chemical reaction					
b		117	kg/day		
Replacing all the values on eq 2 we have					
Fugitive methane emission of project					
8.152 tCO ₂ e/year					



Annex 5 - Monitoring Plan



**Annex 6****Operating Margin Calculation**

Emissions generated by operating units	8.303.139	tCO ₂ e/year
Energy generated by all units in the SIC	36.344	GWh/year
Energy generated by operating units in the SIC	15.361	GWh/year
Operating Margin	540,52	tCO ₂ e/GWh

Low cost / must run units emissions are zero because in Chile this units are 57.5% of the total SIC system generation.

Build Margin Calculation

In 2004, the SIC system generated 36,344 GWh of electricity. The latest capacity additions, which represent 20% of the total generation of the electricity system are listed below:

Power Plant	Year	Fuel Type	Electricity Generation (MWh)
Licanten	2004	Biomass	21.391,00
Valdivia	2004	Biomass	155.707,00
Antihue TG	2004	Diesel	870,00
Horcones TG	2004	Diesel	12.078,00
Ralco	2004	Hydro	1.332.259,00
Nehuenco II	2003	Natural Gas	1.996.332,00
Cholguan	2003	Biomass	93.234,00
Nehuenco 9B Diesel	2002	Diesel	39.223,00
Nehuenco 9B CCGT	2002	Natural Gas	68.377,00
SF de Mostazal	2002	Diesel	9.380,00
Chacabuquito	2002	Hydro	152.945,00
Taltal 2 Diesel	2000	Diesel	59,00
Taltal 2 OCGT	2000	Natural Gas	364.308,00
Taltal 1	2000	Natural Gas	624.493,00
Peuchen	2000	Hydro	262.257,00
Mampil	2000	Hydro	174.152,00
Petropower	1998	Pet coke (coal)	526.232,00
Nehuenco Diesel	1998	Diesel	47.800,00
Nehuenco	1998	Natural Gas	1.800.051,00
			7.681.148,00



Power Plant	Fuel Type	Fuel Consumption (t)	COEF (tCO ₂ /t fuel)	Fuel consumption*COEF
Licanten	Biomass	70.642	0,0069	485,1
Valdivia	Biomass	514.679	0,0069	3.534,3
Antihue TG	Diesel	722	3,1458	2.272,4
Horcones TG	Diesel	10.039	3,1458	31.581,0
Ralco	Hydro	0	0,0000	0,0
Nehuenco II	Natural Gas	395	1,9258	761,2
Cholguan	Biomass	308.257	0,0069	2.116,8
Nehuenco 9B Diesel	Diesel	7.970	3,1458	25.071,7
Nehuenco 9B CCGT	Natural Gas	24	1,9258	45,4
SF de Mostazal	Diesel	3.160	3,1458	9.940,6
Chacabuquito	Hydro	0	0,0000	0,0
Taital 2 Diesel	Diesel	49	3,1458	153,9
Taital 2 OCGT	Natural Gas	121	1,9258	232,1
Taital 1	Natural Gas	207	1,9258	397,8
Peuchen	Hydro	0	0,0000	0,0
Mampil	Hydro	0	0,0000	0,0
Petropower	Pet coke (coal)	675.000	2,5958	1.752.181,2
Nehuenco Diesel	Diesel	9.000	3,1458	28.311,8
Nehuenco	Natural Gas	352	1,9258	677,4
			TOTAL	1.857.762,7

The build margin was calculated dividing the sum of the emissions of all the power plants listed above by the total generation from the power plants listed. So, the build margin calculated for this project was 241.86 tCO₂e/GWh.

All the information was obtained from the CDEC-SIC information for the year 2004 and from the IPCC Good Practice Guidance default factors.