CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• 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>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Irani Wastewater Methane Avoidance Project
PDD Version Number 01
09 April 2007

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

The Irani Wastewater Methane Avoidance Project (hereafter, the "Project") developed by Celulose Irani S.A. (hereafter referred to as the "Project Developer") is a wastewater methane avoidance project in Campina da Alegria district, Vargem Bonita city, Santa Catarina state, Brazil, hereafter referred to as the "Host Country".

Celulose Irani is a Brazilian pulp and paper manufacturing company with years of experience in the manufacturing of a diverse range of paper products for both domestic and export markets. Currently, the wood used in the paper manufacturing process comes from Irani's own 16,800 hectares of forest plantation. The company uses only electricity generated on-site through the burning biomass residues to generate renewable electricity to the plant.

The current wastewater treatment at Celulose Irani consists of primary treatment only, characterised by a series of ponds with superficial aeration – aeration in only the superficial layer of the water column - only in the first pond. Except for this minimal and inefficient superficial aeration in the first pond, the waste water is anaerobically degraded. The organic material degrades anaerobically in the facility's lagoon system producing significant amounts of methane.

The world production of methane generated in wastewater treatment under anaerobic conditions varies between 30 and 40 Tg/yr, with industrial effluents alone contributing between 26 and 40 Tg/yr to this amount.[1]

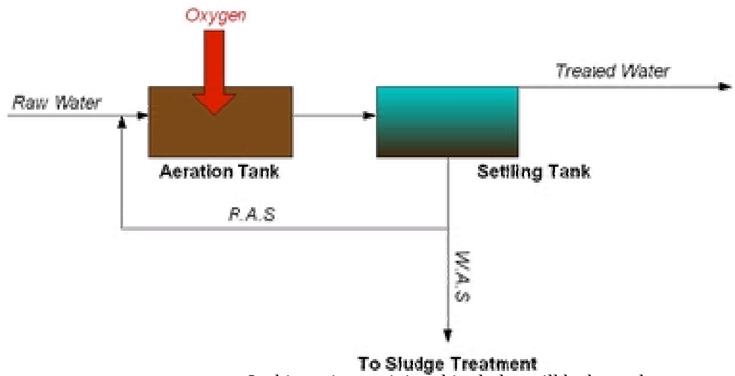
The purpose of the project is to avoid methane emissions from the current wastewater treatment and disposal practices. The project activity will involve implementation of a new wastewater treatment scheme, involving aerobic treatment, referred to as secondary or biologic treatment. The new wastewater treatment system will use highly aerated activated sludge, which will be decanted and reused.

With these measures, the project developer will stop anaerobic digestion of the organic wastewater in the ponds. A schematic representation of the old and the new treatment of the wastewater can be seen in Section B.3.

The activated sludge is a result of a process (figure below) in which oxygen is forced into wastewater to develop a biological floc (or solid) which reduces the organic content of the sewage. After undergoing this biological treatment, the organic material in the wastewater eventually decreases, resulting in clean

[1] Vieira, S.M.M. & Silva, J.W. (2006). Residues Treatment. In: Brazilian Science and Technology Ministry (MCT). Methane emissions in residues treatment and disposal. First Brazilian inventory of greenhouse gases anthropic emissions: Reference reports. 84p.

water. After the wastewater treatment, the activated sludge can be used as a fertilizer, landfilled or incinerated.



In this project activity, this sludge will be burned.

Figure: Example of Activated Sludge treatment system[2]. R.A.S - Return Activated Sludge; W.A.S - Waste Activated Sludge.

A significant environmental benefit of the project is that the treated wastewater can be directed to a river without potentially harmful organic material in it. Moreover, the project is helping the Host Country fulfil its goals of promoting sustainable development. Specifically, the project:

- Increases employment opportunities in the area where the project is located, either during the implementation work or to operate the new facilities;
- Uses clean and efficient technologies, and conserves water
- Acts as a clean technology demonstration project;
- Optimises the use of natural resources such as water;
- Improves the overall management practices of the wastewater treatment.

A.3. Project participants:

Table 1 - 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)
Brazil (host)	Celulose Irani S.A.	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group Plc	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 involved may or may not have provided its approval. At the time requesting registration, the approval by the Party(ies) involved is required.

[2] http://en.wikipedia.org/wiki/Activated_sludge

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

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

A.4.1.1. Host Party(ies):

Brazil. (the "Host Country")

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

South region, Santa Catarina state.

A.4.1.3. City/Town/Community etc:

Vargem Bonita city

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

The project is located at the Celulose Irani main industrial complex, in the Campina da Alegria integrated mill, located in Campina da Alegria district, in the municipality of Vargem Bonita, Santa Catarina State (Rodovia BR 153, km 47 CEP: 89600-000). Celulose Irani also has other production units in other parts of Santa Catarina and São Paulo States that will not be part of this project. See below the map of Santa Catarina State.

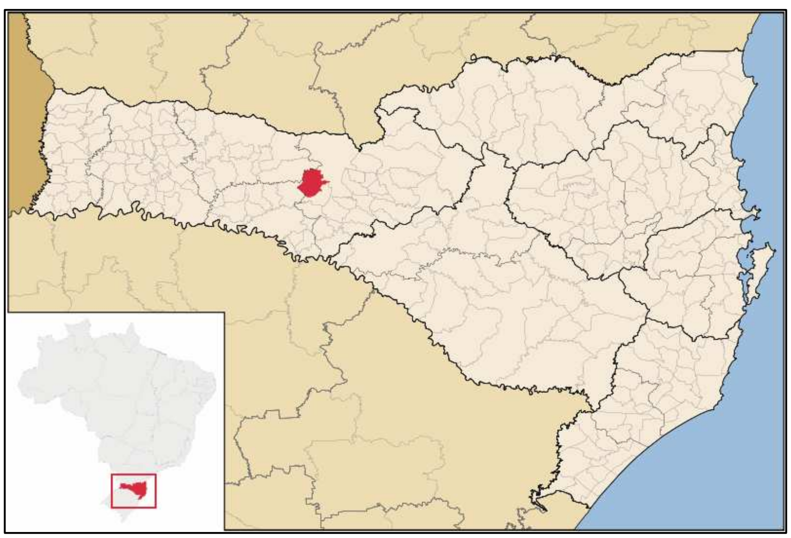


Figure: Physical location of Vargem Bonita City (red), in Santa Catarina state, South Brazil[3].

[3] http://pt.wikipedia.org/wiki/Vargem_Bonita_(Santa_Catarina)

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

According to Annex A of the Kyoto Protocol, this project fits in Sectoral Scope 14 (Waste handling and disposal).

The highly organic wastewater effluent from this pulp and paper mill is currently being treated by anaerobic digestion, which produces methane which is emitted directly into the atmosphere.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

The project activity reduces GHG emissions by avoiding the production of methane from wastewater which is currently being treated in anaerobic lagoons. The wastewater effluent in the ponds is anaerobically digested due to high levels of organic materials and the presence of facultative anaerobic bacteria. The project activity will convert the current the anaerobic system (without methane recovery), to an aerobic system.

Table - Estimated emissions reductions from the project

Years	**Annual estimation of emission reductions over the chosen crediting period***
2008	**55 966**
2009	**55 966**
2010	**55 966**
2011	**55 966**
2012	**55 966**
2013	**55 966**
2014	**55 966**
Total estimated reductions (tonnes of CO_2)	**391 762**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2)	**55 966**

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

The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

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

Debundling is the fragmentation of a large project activity into smaller parts. As the project participants already have a registered SSC project activity, the "Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities" was applied. The criteria to evaluate if the project is a debundling are the following:

[4] http://cdm.unfccc.int/DOE/scopes.html

Table – Debundling criteria

Category	Yes	No
Same participants in both projects	X	
Same project category and technology/measure in both projects		X
Registered within the previous 2 years	X	
Project boundary within 1 km of the project boundary of the other project	X	

Only a project that complies with all categories above can be considered a debundling. The other project activity uses the registered methodologies AMS-I.D. and AMS-III.E., and reduces Greenhouse Gases (GHG) emissions by switching from grid electricity to electricity generated from biomass residue burning, and also methane avoidance from biomass residues that would have otherwise been landfilled. The other project does not involve wastewater treatment, and thus, employs a technology completely different from the project activity described in this PDD. Therefore, this project activity is not considered debundled.

SECTION B. Application of a baseline and monitoring methodology

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

The project uses approved methodology AMS-III.I, Avoidance of methane production in wastewater treatment through replacement of anaerobic lagoons by aerobic systems, Version 4, Dated 23 December 2006.

B.2 Justification of the choice of the project category:

The project qualifies as a small-scale project activity (SSC) and will remain under the limits of the cap of 60 000 CERs for type III projects during every year of the crediting period. Section B.6.4 shows the estimated values for project and baseline emissions for this project activity.

The project activity consists of a shift from an anaerobic to aerobic wastewater treatment system thus falling under the type III SSC project category.

B.3. Description of the project boundary:

According to the III.I methodology used for this project activity, the project boundary is the physical, geographical site where the wastewater treatment takes place. For this project activity, this includes emissions reductions associated with part of the wastewater treatment cycle.

Only a portion of the treatment system is included in the project boundary because the project activity will only affect emissions and the wastewater treatment system of that portion.

Below is a schematic diagram of the anaerobic treatment system (left) and the aerobic treatment system (right).

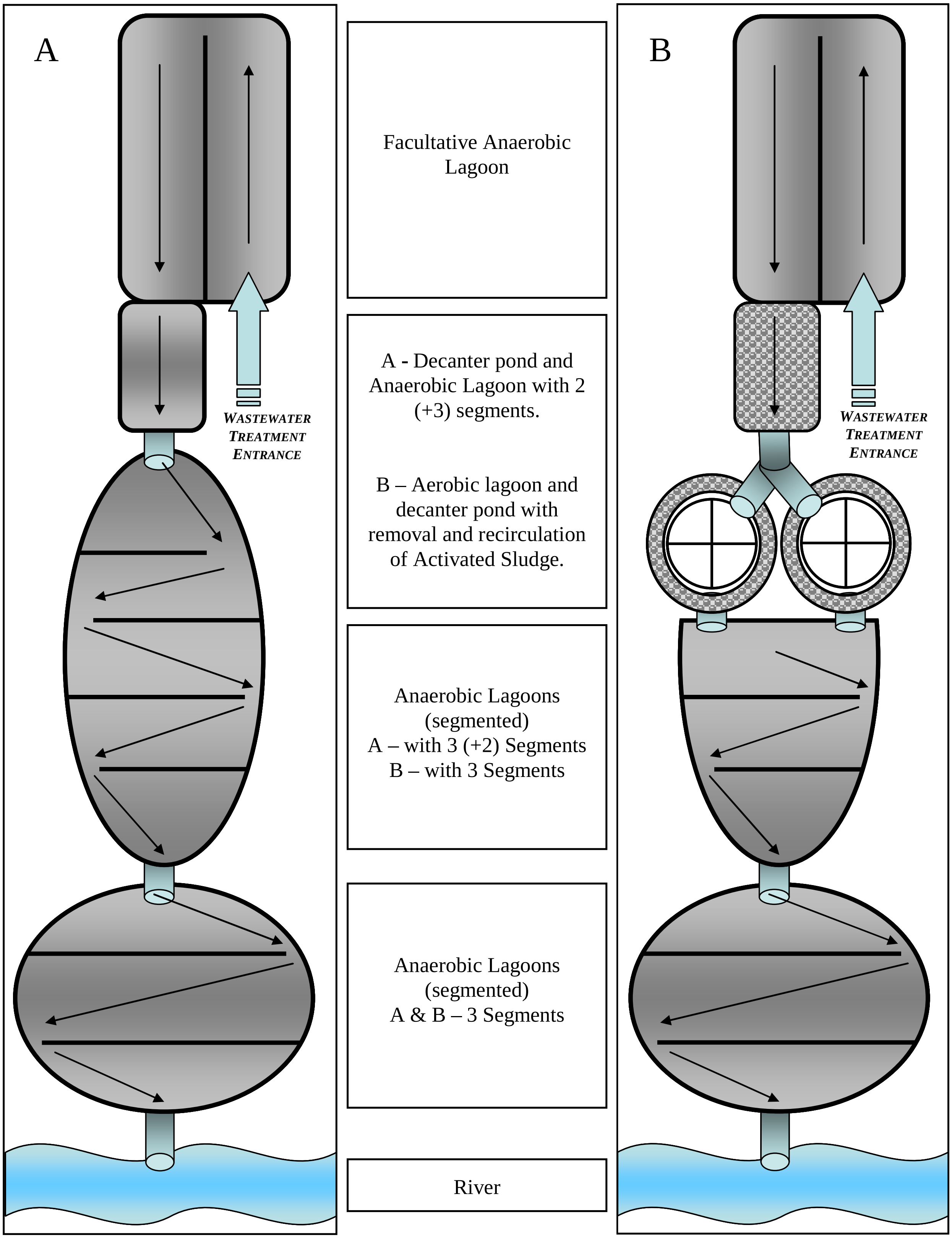


Figure – Baseline (A) and Project Activity (B) wastewater treatment systems, at Celulose Irani plant. The blue arrow indicates the entrance of the wastewater in the treatment and the thin black arrows indicates the flow of the water throughout the system.

B.4. Description of baseline and its development:

The baseline scenario is the situation where, in the absence of the project activity, degradable organic matter in wastewater is treated in anaerobic lagoons and methane is emitted to the atmosphere. Baseline emissions are calculated as the amount of methane produced in the anaerobic system (that will be replaced with an aerobic system in the project activity).

Three alternatives to the project scenario are considered:

Alternative 1: The proposed project activity without CDM. Modification of the former wastewater treatment system, establishing a new wastewater treatment system based on aerobic digestion of the organic matter, implemented without considering CDM revenue.

Alternative 2: Continuation of the current practice. The wastewater will continue to be treated anaerobically.

Alternative 3: Construction of an alternative treatment system, such as anaerobic treatment with methane recovery or composting.

Assessment of Alternatives:

Alternative 1:

This alternative would face investment and other barriers outlined in section B.5 below, therefore is not considered viable.

Alternative 2:

Continuation of the current situation would require no investments on the part of the project developer, and would not face any technological or other barriers. The wastewater would continue to be treated by anaerobic digestion of the organic matter in ponds deeper than 2 meters (as discussed in section B.5 below).

Alternative 3:

This alternative would also face several barriers, as described in section B.5 below. The construction of other wastewater treatment systems would require either a high investment or a significant deviation from the core business of the project developer. Moreover, this alternative involves technologies not well established in the pulp and paper sector of the host country, and would completely change the current wastewater treatment system. Given that this alternative would require significant additional investments to be made and given that the technologies that could be applied are not well established in pulp and paper industry in Brasil, this alternative is not considered as a possible baseline scenario.

Furthermore, Alternative 1, construction of a new wastewater anaerobic treatment system, faces more barriers than Alternative 2, and therefore is unlikely to implemented in the absence of the CDM (i.e. is not the baseline scenario).

Alternative 2, continuation of the current situation, would face the least barriers, and is therefore identified as the baseline scenario.

The following table provides the key information and data used to determine the baseline scenario:

Variable	Unit	Data Source
Chemical Oxygen Demand (COD) of the wastewater	Mg/L	Project developer
Effluent of wastewater to the treatment lagoon	m^3/h	Project developer
Temperature at the site, on a monthly average	ºC	Project developer
Wastewater treatment station project	text	Project developer / Third party
First Brazilian inventory of greenhouse gases anthropic emissions	text	Host country – Science and Technology Ministry

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 small-scale CDM project activity:

The project activity consists of reducing methane emissions by switching from an anaerobic wastewater treatment system to an aerobic system using activated sludge.

The project activity could not be carried out without carbon credit revenue as it implies high investment costs. It is demonstrated in this section that the proposed project activity is additional as per options provided under attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

The project participants shall provide an explanation to show that the project activity would not have occurred in the absence of the CDM due to at least one of the following barriers:

Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Three alternatives are evaluated in order to demonstrate the baseline scenario, as shown in section B.4 above. However, Alternative 3 (construction of other treatment system, such as anaerobic treatment with methane recovery or composting.) would involve too many changes in the actual wastewater treatment system. This alternative not only would demand high investments, but it also requires the project developer to change the entire wastewater system as the existing lagoons would need to be deactivated or the wastewater treatment would need to be adapted to a new technology; it is therefore not a realistic alternative. Other technologies than the two being analyzed present much higher risks for the company, such as lack of knowledge in the host country or in the region of the project activity, and significant diversion of the company's core business as Celulose Irani S.A. has always treated its wastewater using an anaerobic system with incipient aeration which is superficial and inefficient at aerating the ponds. Moreover, within the technologies available in the Brasil, this industry sector traditionally uses open anaerobic lagoons or activated sludge with a biological filter[5], fact that corroborates the information above. Therefore, as the majority of companies from this sector industry in the host country do not choose other technologies to treat their wastewater, this project will not consider this alternative to analyze additionality.

In order to demonstrate that the proposed project activity is additional to the baseline scenario chosen, a Barrier Analysis is performed below.

Table: Scenarios considered in barrier analysis.

Scenarios	Description
Alternative 1	Proposed project activity without CDM
Alternative 2	Continuation of current practice

Investment Barrier

- *Alternative 1*: the investment to perform the necessary modifications is risky, compared to other types of investment found in the host country, as it will not result in any financial gains for the company. It would be very difficult for the company to invest this sum of money in these new installations without any incentive, such as CDM revenue. As can be seen below, the Net Present Value (NPV) without carbon credits revenues is *negative* 7 million Reais. Even in the best case, with a decrease of 50% in investments, the NPV would still be almost negative 4.5 million Reais. This is an investment that the company would not perform without any guarantees, and the carbon credits revenues offered some security to them. Moreover, there is a significant increase in O&M costs as a result of the proposed project activity, and the project developer also would never have committed to one more expense without carbon credits revenues to alleviate it. Please refer to Annex 2 for additional information regarding the Financial Analysis. Therefore, *investment poses a major barrier for this alternative*.
- *Alternative 2*: there is no investment needed for this alternative. The continuation of current practice would require no investments or changes in the wastewater treatment system or O&M. Therefore, there are no *investment barriers for this alternative*.

Table: Sensitivity analysis of project activity without CDM (Alternative 1).

Sensitivity Analysis - Without Carbon (R$)			
Data	**%**	**Source**	**NPV 21yr**
Auxiliary material	-50%	calculated	**(5 998 926)**
Equipments cost	-50%	calculated	**(5 886 352)**
Investments	-50%	calculated	**(4 586 352)**

[5] Vieira, S.M.M. & Silva, J.W. (2006). Residues Treatment. In: Brazilian Science and Technology Ministry (MCT). Methane emissions in residues treatment and disposal. First Brazilian inventory of greenhouse gases anthropic emissions: Reference reports. 84p.

Table: Comparison of NPV between both scenarios

Carbon Credits Impact on CDM (R$)	
Data	**NPV 21yr**
NPV without carbon	**(7 056 852)**
NPV with carbon	**(1 611 116)**

Technological Barrier

According to the Brazilian Science and Technology Ministry[6], the wastewater from the pulp and paper industry has historically been treated using anaerobic lagoons or activated sludge and biologic filters. Since these two practices are common in Brazil, there is available technology in the host country to allow both alternatives to happen, thus, not posing a barrier to either of these alternatives.

Barrier due to prevailing practice

Generally anaerobic ponds are the most used treatment system in warm weather countries, whereas the aerobic process is more used in developed countries[7]. However, the same arguments used above can be used here. As the industries in this sector have been using the two options for wastewater treatment system for a long time, it already is practiced in the sector. Therefore, there are no barriers due to prevailing practice for either of the alternatives.

Other barriers

- *Alternative 1:* the construction of the new wastewater treatment system involves changes in the actual treatment system. Decanters must be installed; lagoons must be changed and destroyed in order to be transformed from anaerobic to aerobic. This kind of work is not part of the company's core business and construction of this sort would cause a disturbance in day-to-day activities of the factory. Moreover, the company would need to train its employees to work with new equipment and technology. Therefore, *there are other barriers, as stated in this paragraph, to this alternative.*
- *Alternative 2:* the continuation of current practice does not involve any construction, systematic changes or additional training or labor. Therefore, *there are no other barriers to this alternative.*

Table: Summary of barrier analysis.

Barriers	1 – Proposed project activity without CDM	2 – Continuation of previous activities
Investment barrier	**Yes**	No
Technological barrier	No	No
Prevailing practice	No	No
Other barriers	**Yes**	No

Since the project activity is subject to financial and other barriers while the current treatment system is not, **the baseline is confirmed as the continuation of current wastewater treatment system practice and, therefore, the Project is additional.**

[6] Vieira, S.M.M. & Silva, J.W. (2006). Residues Treatment. In: Brazilian Science and Technology Ministry (MCT). Methane emissions in residues treatment and disposal. First Brazilian inventory of greenhouse gases anthropic emissions: Reference reports. 84p.

[7] Vieira, S.M.M. & Silva, J.W. (*op. cit.*).

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The Methodology AMS-III.I is applicable to the proposed project activity, as it is applicable to measures that avoid the production of methane from biogenic organic matter in wastewater being treated in anaerobic lagoons. The project activity does not recover or combust methane in wastewater treatment facilities.

The lagoons or lagoon segments present at the facility fit the criteria for the definition of an anaerobic lagoon as stated in the methodology: Anaerobic lagoons are ponds deeper than 2 meters, without aeration, with a temperature above 15° C, at least during part of the year, on a monthly average basis, and with a volumetric loading rate of Chemical Oxygen Demand above 0.1 kg COD/(m^3/day).

The project activity involves a change from the current anaerobic wastewater treatment system to an aerobic system, therefore reducing the methane emissions from anaerobic ponds. Also, as stated in section B.2, the project activity will not reduce more than 60 ktCO_2e in any year of the crediting period.

The temperature at the site is constantly measured. This historical data proves that, during the majority of the year, the monthly average temperature is beyond 15ºC. The graph below, with data from 2006, demonstrates that the temperature is consistent with the requirements of the methodology.

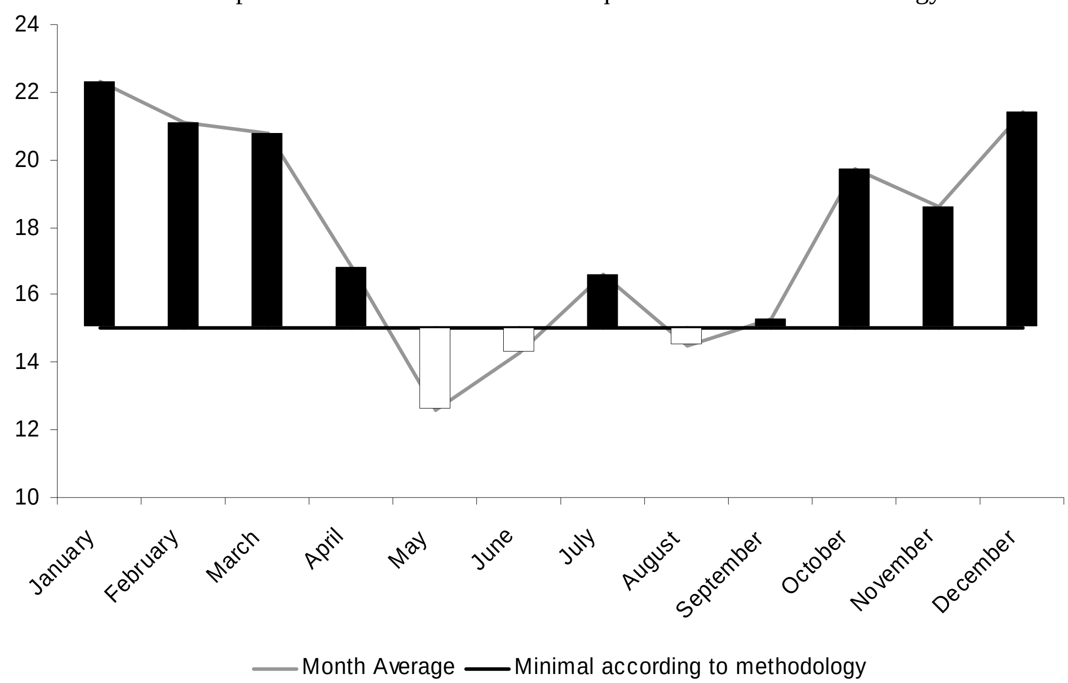


Figure: Graphic showing variation of temperature at Celulose Irani site, on a monthly average basis for the year 2006. The temperature is in ºC. The central black line represents the threshold of 15ºC.

The volumetric loading rate refers to the amount of organic matter flowing into the wastewater treatment system at the facility. The volumetric loading rate is 3.4 kg COD/(m^3/day). Below is a table showing the data and formulae used to calculate this COD estimate[8].

$$C_v = \frac{Qméd \times S_a}{V}$$

Where:
C_v: Volumetric Loading Rate (kgCOD/m^3/d)
$Q_{méd}$: Average flow (m^3/d)
S_a: Concentration of COD (kgCOD/m^3)
V: Volume of the lagoons (m^3)

Table: Values used for the Volumetric Loading Rate calculation.

Parameter	Value	Unit	Source
$Q_{méd}$	19 200	m^3/day	Project developer data
S_a	3	kgCOD/m^3	Project developer data
V	16 746.8	m^3	Project developer data

The Project therefore fulfils the eligibility requirements for the AMS-III.I methodology.

Project emissions:

According to the methodology, project emissions consist of CO_2 emissions from:
1. CO_2 emissions related to the power used by the project activity facilities
2. Methane emissions from the aerobic wastewater treatment
3. Methane emissions from the decay of sludge produced by the aerobic system (if the sludge is disposed to decay anaerobically in a landfill without methane recovery)

The project activity includes an estimation consumption of electricity of around 450 KW. The definite value for electricity consumed will be available when the type and model of aerators are chosen. Therefore, this minimal amount of electricity consumed will be accounted as project emissions for this component (1 above). The Brazilian South-Southeast-Midwest grid emission factor calculation will follow guidance provided by ACM0002 (please refer to Annex 3 for explanations).

The sludge produced by the new treatment system will be recirculated, resulting in more thorough and accelerated degradation of the organic matter. Occasional sludge removal will be conducted, and this residual sludge will be burned in the biomass boiler. In order to burn the sludge, the project developer will not need to perform any kind of treatment with this sludge because it will already be stabilized. Therefore, the sludge will not be disposed to decay anaerobically, thus, not resulting in methane emissions. Consequently, emissions from this component (3 above) are zero.

[8] GONÇALVES, R. F. ; CHERNICHARO, C. A. L. ; ANDRADE NETO, C. O. de ; ALEM SOBRINHO, P. ; KATO, M. T. ; COSTA, R. H. R. ; AISSE, M. M. ; ZAIAT, M. (2001). Pós-Tratamento de Efluentes de Reatores Anaeróbios por Reatores com Biofilme. In: CHERNICHARO, C. A. L. (Coord). Pós-Tratamento de Efluentes de Reatores Anaeróbios. Belo Horizonte: Programa de Pesquisas em Saneamento Básico (PROSAB), p. 171-278.

Therefore, the only project emissions are the emissions related to the electricity used by the project activity facilities (1 above) and the methane emissions from aerobic wastewater treatment (2 above). Project emissions are calculated according to the methodology, and IPCC default values are used for the methane producing capacity for the wastewater. For the Methane Correction Factor (MCF), the value for well managed systems is used. For the Grid Emission Factor, the guidance presented in AMS-I.D. and further guidance from the host country were used.

Baseline emissions:

The current wastewater treatment system at Celulose Irani consists of a sequence of decanter and anaerobic lagoons. The baseline emissions are the methane emissions from anaerobic digestion of the organic matter inside the anaerobic lagoons. It is calculated exactly as stated in the methodology. The MCF value used is for anaerobic lagoons deeper than 2 meters.

Leakage emissions:

The equipment for the aerobic treatment system is not transferred from another facility and the existing equipment will not be transferred to another activity, therefore, leakage effects are not considered.

Emission reductions:

According to the Methodology the greenhouse gas emission reductions achieved by the project activity during a given year "y" (ER_y) shall be estimated as follows:

$$ER_y = BE_y – (PE_y + LEAKAGE_y)$$

Where:

ER_y	Emission reduction in the year y (t CO_2e);
BE_y	Baseline emissions in the year y (tCO_2e)
PE_y	Project activity emissions in the year y (tCO_2e)
$LEAKAGE_y$	Leakage effects

As the project emissions include neither energy (power) component nor sludge component, the following simplified equation will be applied to estimate the emission reductions:

$$ER_y = BE_y – (PE_{y,ww,treatment}[9] + LEAKAGE_y)$$

All equations applied to obtain the emission reduction from the project activity are listed in Section B.6.3.

[9] These methane emissions occur due to anaerobic pockets that may occur in aerobic systems, and are considered in 2006 IPCC Guidelines. Methane emissions through inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater will be neglected, since they would also be accounted for in the baseline scenario, and would approximately cancel each other.

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

Data / Parameter:	B_o
Data unit:	kg CH_4/kgCOD
Description:	Methane Producing Capacity (industrial wastewater)
Source of data used:	IPCC 2006
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data suggested by the methodology
Any comment:	

Data / Parameter:	$MCF_{aerobic}$
Data unit:	-
Description:	Methane Correction Factor for Aerobic Systems
Source of data used:	UNFCCC approved baseline methodology AMS-III.H.
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data suggested by the methodology
Any comment:	

Data / Parameter:	GWP_CH_4
Data unit:	-
Description:	Methane Global Warming Potential
Source of data used:	IPCC 2006
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data suggested by the methodology
Any comment:	

Data / Parameter:	$\sum(COD_{y,m})$
Data unit:	tonnes
Description:	Chemical oxygen demand of wastewater during months hotter than 15ºC
Source of data used:	Calculated
Value applied:	19 440
Justification of the	Monitoring data from former treatment system.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	MCF_{lagoon}
Data unit:	-
Description:	Methane Correction Factor for Anaerobic Systems
Source of data used:	UNFCCC approved baseline methodology AMS-III.H.
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data suggested by the methodology
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Project activity emissions consist of methane emissions during the aerobic wastewater treatment, as discussed in section B.6.1. The formula used to calculate project emissions is:

$$PE_y = PE_{y,ww,treatment} + PE_{y,power}$$

Where:

PE_y Project activity emissions in the year "y" (tCO_2e)
$PE_{y,ww,treatment}$ Project emissions from the aerobic wastewater treatment in the year "y"[10]
$PE_{y,power}$ Emissions on account of electricity consumption in the year "y"

For one of the components:

$$PE_{y,ww,treatment} = Q_{ww,y} * COD_y * B_o * MCF_{aerobic} * GWP\_CH_4$$

Where:

$PE_{y,ww,treatment}$ Project emissions from the aerobic wastewater treatment in the year "y"
$Q_{ww,y}$ Volume of the wastewater treated during the year "y" (m^3)
COD_y Chemical oxygen demand of effluent entering the lagoons in the year y (tonnes).
B_o Methane producing capacity for the wastewater (IPCC default value for domestic wastewater of 0.21 kg CH_4/kg.COD)
$MCF_{aerobic}$ Methane correction factor for the wastewater treatment in aerobic systems

[10] These methane emissions occur due to anaerobic pockets that may occur in aerobic systems, and are considered in 2006 IPCC Guidelines. Methane emissions through inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater will be neglected, since they would also be accounted for in the baseline scenario, and would approximately cancel each other.

GWP_CH_4 Global Warming Potential for CH_4 (value of 21)

And for the other component, we have:

$$PE_{y,power} = EC_y * EF_y$$

Where:
$PE_{y,power}$ Emissions on account of electricity consumption in the year "y"
EC_y Electricity consumed by the project activity devices, in the year "y" (MWh/yr)
EF_y Emission factor of the applicable grid, calculated as per methodology AMS-I.D. (tCO2e/MWh)

As the Brazilian grid emission factor needs to be calculated, the South-Southeast-Midwest grid emission factor calculations are shown in Annex 3.

Table: Values used in project emissions estimation.

Parameters	Values used for estimation	Source
$Q_{ww,y}$	1 000 m^3/h	Wastewater treatment station project
COD_y	3 000 mg/L	Wastewater treatment station project
B_o	0.21 kg CH_4/kg.COD	IPCC 2006
$MCF_{aerobic}$	0.1	UNFCCC Methodology AMS III.H
GWP_CH_4	21	IPCC 2006
EF_y	0.2611 tCO_2	ONS
EC_y	3 942 MWh/yr	Project Developer

Table: Estimation of project emissions per sources.

Average PEy,power	tCO2/year	**1 029**
Average PEy,ww,treatment	tCO2/year	**11 589**
Average PEy,sludge	tCO2/year	**0**
Average project emissions (PE)	tCO2/year	**12 618**

The baseline emissions from the lagoon are estimated using the procedure defined under category AMS III.H.:

$$BE_y = \sum (Q_{ww,y,m} * COD_{y,m}) * B_0 * MCF_{lagoon} * GWP\_CH4$$

Where:
BE_y Baseline emissions in the year "y" (tCO_2e)
$Q_{ww,y,m}$ Volume of the wastewater treated during the months m, during year "y", for the months with average lagoon temperature above 15°C (m^3)
$COD_{y,m}$ Chemical oxygen demand of influent entering the lagoons in the year y (tonnes/m^3) for the months with average lagoon temperature above 15ºC.
B_o Methane producing capacity for the wastewater (IPCC default value for domestic wastewater of 0.21 kg CH_4/kg.COD)
MCF_{lagoon} Methane correction factor for the wastewater treatment in anaerobic lagoons
GWP_CH_4 Global Warming Potential for CH_4 (value of 21)

Table: Values used in baseline emissions estimation.

Parameters	Values used for estimation	Source
$\sum(Q_{ww,y,m})$	6 480 000 m^3	Calculated
$\sum(COD_{y,m})$	19 440 tonnes	Calculated
B_o	0.21 kg CH_4/kg.COD	IPCC 2006
MCF_{lagoon}	0.8	UNFCCC Methodology AMS III.H
GWP_CH_4	21	IPCC 2006

Table: Values used to estimate emission reductions based on previous data from project developer.

Parameters	Value	Unit	Source
Working hours per Day	24	Hour	Developer
Working days per year	365	Day	Developer
Months with temperature above 15ºC	9	Month	Developer
Working days per Month	30	Day	Developer

Table: Estimation of baseline emissions.

Average baseline emissions (BE)	tCO_2/year	**68 584**

According to the methodology, the leakage should only be considered if the aerobic treatment technology is equipment transferred from another activity or if the existing equipment is transferred to another activity. Therefore, as none of these situations occur, leakage is not considered as per this project.

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

Table – Forecasted values for each type of emissions.

Years	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of overall emission reductions (tonnes of CO2 e)
2008	**12 618**	**68 584**	**0**	**55 966**
2009	**12 618**	**68 584**	**0**	**55 966**
2010	**12 618**	**68 584**	**0**	**55 966**
2011	**12 618**	**68 584**	**0**	**55 966**
2012	**12 618**	**68 584**	**0**	**55 966**
2013	**12 618**	**68 584**	**0**	**55 966**
2014	**12 618**	**68 584**	**0**	**55 966**
Total (tonnes of CO_2)	**88 326**	**480 088**	**0**	**391 762**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	S_y
Data unit:	tonnes
Description:	Amount of sludge generated by the wastewater treatment in the year y
Source of data to be used:	Direct measurement (estimation can be found at the wastewater treatment station project)
Value of data	7 000 000 (estimation)
Description of measurement methods and procedures to be applied:	Measured automatically when discharging the sludge by a flow meter.
QA/QC procedures to be applied:	
Any comment:	This sludge will be burned in the boiler. Therefore, the amount of sludge produced is not accounted in project emission calculations because it will not produce any methane.

Data / Parameter:	Temperature
Data unit:	ºC
Description:	Average monthly temperature
Source of data to be used:	Direct measurements from Project Developer
Value of data	Higher than 15ºC during 9 months in a year (please refer to graph in page 14)
Description of measurement methods and procedures to be applied:	The project developer has a weather monitoring station at the site, and daily readings will be kept.
QA/QC procedures to be applied:	
Any comment:	According to historical measurements, on average temperatures are above 15ºC for nine months of the year.

Data / Parameter:	COD
Data unit:	tonnes/yr
Description:	Chemical Oxygen Demand of the wastewater treated
Source of data to be used:	Direct measurements from Project Developer
Value of data	26 280
Description of measurement methods and procedures to be applied:	The COD of the wastewater entering the boundary of the project activity will be measured monthly using a calibrated spectrophotometer. The calibration certificate will be available for verifications. The measurements will take place at Celulose Irani’s own laboratory.
QA/QC procedures to be applied:	The measuring procedures will follow the procedures recommended by the equipment supplier.

Any comment:	

Data / Parameter:	Q_{ww}
Data unit:	m^3
Description:	Volume of Wastewater treated
Source of data to be used:	Direct measurements from Project Developer
Value of data	8 760 000
Description of measurement methods and procedures to be applied:	The volume of the wastewater entering the boundary of the project activity will be regularly measured online, with monthly averages available. Will be measured using a flow meter.
QA/QC procedures to be applied:	As online measurements will take place, any changes can be easily noticed. The Parshall flume will be used as quality assurance.
Any comment:	To monitoring, only the months with temperature equal or higher than 15ºC will be accounted to calculate emission reductions.

Data / Parameter:	EC_y
Data unit:	MWh
Description:	Electricity consumed by the project activity devices, in the year “y”
Source of data to be used:	Direct measurements from Project Developer
Value of data	3 942
Description of measurement methods and procedures to be applied:	Electricity that will be consumed by all devices installed in result of Project Activity implementation.
QA/QC procedures to be applied:	When measurements could not be performed, the installed capacity of the devices will be entirely accounted when calculating this parameter.
Any comment:	

B.7.2 Description of the monitoring plan:

All measurements will be performed by the “Área de Efluentes” (Effluent Area) which will be controlled by the “Divisão de Qualidade” (Quality Assurance Management Sector). There is a central control room at the Wastewater Treatment Station that will centralize all information regarding the monitoring. In this room, the supervisory system and computers will control the process.

The flow of the wastewater will be measured on-line, with daily and monthly averages available. It will be measured by Celulose Irani S.A. itself, with calibrated equipment. The Parshall flume will work as quality assurance, to crosscheck the data.

The COD will be measured monthly, by Celulose Irani S.A. itself using a calibrated spectrophotometer in laboratory.

The amount of sludge to be discarded will be measured by the dewatering of the sludge. The sludge discard measured by a flow meter will work as quality assurance, to crosscheck the data. All sludge measurements are automatic.

As Celulose Irani S.A. already has one CDM project ongoing, the company is aware of monitoring crucial part in project development. Therefore, the staff is committed to monitor the data correctly for the entire crediting period.

All data to be monitored will be collected and cross checked by the Quality Assurance management sector. EcoSecurities will assure the quality of monitoring by adequately training the personnel involved and controlling monthly the data acquired.

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

The baseline study and the monitoring methodology were concluded on 05/04/2007. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group Plc. Contact:

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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:

01/01/2006

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

More than 21 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:

01/01/2008

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Celulose Irani S.A. is in compliance with all laws and regulations applicable. All applicable licenses were obtained and all conditions were obeyed. The State Environmental Authority, i.e. Fundação do Meio Ambiente do Estado de Santa Catarina (FATMA/SC), requests Environmental Impact Assessment (EIA) for all activities with a high potential to harm the environment. However, as this project does not have a high potential to harm the environment, an EIA was not requested for this project activity.

Therefore, given that the project activity will not induce significant impacts, no impact assessment was undertaken.

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:

Not applicable.

SECTION E. Stakeholders' comments

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

According to Resolution #1 dated December 2nd, 2003 from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima - CIMGC), any CDM project must send a letter with a description of the project and an invitation for comments by local stakeholders. In this case, letters were sent to the following local stakeholders:

- City Hall of Vargem Bonita;
- Chamber of Deputy of Vargem Bonita;
- District Attorney (known in Portuguese as Ministério Público, i.e. the permanent institution essential for legal functions responsible for defending the legal order, democracy and social/individual interests);
- Environment agencies from the State and Local Authority;
- Brazilian Fórum of NGOs;
- Local community association(s).

Local stakeholders were invited to raise their concerns and provide comments on the project activity for a period of 30 days after receiving the letter of invitation.

E.2. Summary of the comments received:

To date, only one formal comment has been received from stakeholders.

The comment received was sent by the Brazilian Forum of NGOs (FBOMS). It suggests the use of the Gold Standard Certificate and states that the FBOMS wasn't able to evaluate the project.

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

As shown in Section E.2, the project received comments which led to no changes of the initial project planning.

As EcoSecurities' staff has strong technical skills and all PDDs developed by EcoSecurities have a high quality standard, the use of other Certificates is, up to the present moment, unnecessary.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding from Annex 1 parties.

Annex 3

BASELINE INFORMATION

Financial Analysis:

Investments	Unit	Source	NPV 21yr
Civil work	R$	contract	-2 250 000
Equipments	R$	contract	-2 341 000
Installation	R$	contract	-350 000
Investments NPV	R$	calculated	**(4 941 000)**

Operational	Unit	Source	NPV 21yr
Hand labour	R$	client	0
General expenses	R$	contract	0
Auxiliary material	R$	client	-2 252 128
Operational NPV	R$	calculated	**(2 252 128)**

The discount rate used is 17.98% (Selic Tax from 02 January 2006) based on Central Bank of Brazil data - www.bcb.gov.br.

Please refer to Section B to Baseline analysis.

INFORMATION REGARDING EMISSION FACTOR CALCULATION

For this project, data for combined margin calculation have been based on ONS – Operador Nacional do Sistema.

The Brazilian electricity system has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO). This is due mainly to the historical evolution of the physical system, which was naturally developed nearby the biggest consuming centers of the country.

The natural evolution of both systems is increasingly showing that integration is to happen in the future. In 1998, the Brazilian government was announcing the first leg of the interconnection line between S-SECO and N-NE. With investments of around US$700 million, the connection had the main purpose, in the government's view, at least, to help solve energy imbalances in the country: the S-SE-CO region could supply the N-NE in case it was necessary and vice-versa.

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)[11]:

[11] Bosi, M. *An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study*. International Energy Agency. Paris, 2000.

"… where the Brazilian Electricity System is divided into three separate subsystems:
(i) The South/Southeast/Midwest Interconnected System;
(ii) The North/Northeast Interconnected System; and
(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

Moreover, Bosi (2000) gives a strong argumentation in favor of having so-called *multi-project baselines*:

"For large countries with different circumstances within their borders and different power grids based in these different regions, multi-project baselines in the electricity sector may need to be disaggregated below the country-level in order to provide a credible representation of 'what would have happened otherwise'".

Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It has also to be considered that only in 2004 the interconnection between SE and NE was concluded, i.e., if project proponents are to be coherent with the generation database they have available as of the time of the PDD submission for validation, a situation where the electricity flow between the subsystems was even more restricted is to be considered.

The Brazilian electricity system nowadays comprises of around 91,3 GW of installed capacity, in a total of 1,420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5.3% are diesel and fuel oil plants, 3.1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1.4% are coal plants, and there are also 8,1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6,3 GW of the Paraguayan part of *Itaipu Binacional*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

Approved methodology AM0015 and ACM0002 asks project proponents to account for "all generating sources serving the system". In that way, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

In fact, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – *Operador Nacional do Sistema* – argues that dispatching information is strategic to the power agents and therefore cannot be made available. On the other hand, ANEEL, the electricity agency, provides information on power capacity and other legal matters on the electricity sector, but no dispatch information can be got through this entity.

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants' daily dispatch information was made available for years 2002, 2003 and 2004.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75,547 MW of installed capacity by 31/12/2004, out of the total 98,848.5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76.4% of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23.6% are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study "Road-Testing Baselines For Greenhouse Gas Mitigation Projects in the Electric Power Sector", published in October 2002. Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found more conservative when considering ONS data only, as the table below shows the build margin in both cases.

IEA/ONS Merged Data Build Margin (tCO2/MWh)	**ONS Data Build Margin (tCO2/MWh)**
0,205	0,1045

Therefore, considering all the rationale explained, project developers decided for the database considering ONS information only, as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way.

Efficiency data on fossil fuel plants were taken from IEA document. This was made after considering that there was no more detailed information on efficiency, from public, renowned, and reliable sources.

From the reference as mentioned, the efficiency of conversion (%) of fossil fuels to thermo electrical plants fed with fossil fuel was calculated based on the installed capacity of each plant and on the power effectively produced. For most thermo electrical plants under construction, a constant value of 30% was used to estimate its fossil fuel conversion efficiency.

This value was based on data as available in the literature and on observation of real conditions of this kind of plants operating in Brazil. It was assumed that the only 02 natural gas-combined cycle plants (amounting to 648 MW) have higher efficiency rate, i.e. 45%.

Also, only data relative to plants under construction in 2002 (starting operation in 2003) were estimated. All other efficiencies were calculated. As far as it is know, there has been no upgrade of the older thermo electrical plants as analyzed in the period (2002 to 2004).

Therefore project participants have concluded that the best option available was to use such numbers, although they are not well consolidated.

All this information was directed to the current CDM project validators and thoroughly discussed with them, with the purpose to clarify every item and every possible doubt.

The table below summarizes conclusions of the analysis, with the calculation of the emission factor as presented.

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [MWh]	Imports [MWh]
2003	0,9823	288.933.290	274.670.644	459.586
2004	0,9163	302.906.198	284.748.295	1.468.275
2005	0,8086	314.533.592	296.690.687	3.535.252
	Total (2003-2005) =	**906.373.081**	**856.109.626**	**5.463.113**
	$EF_{OM, simple-adjusted}$ [tCO2/MWh]	**$EF_{BM,2005}$**	**Lambda**	
	0,4349	0,0872	λ_{2003}	
	Alternative weights	**Default weights**	0,5312	
	w_{OM} = 0,75	w_{OM} = 0,5	λ_{2004}	
	w_{BM} = 0,25	w_{BM} = 0,5	0,5055	
	Alternative EF_y [tCO2/MWh]	**Default EF_y [tCO2/MWh]**	λ_{2005}	
	0,3480	**0,2611**	0,5130	

Annex 4

MONITORING INFORMATION

Please refer to section B.7.2 to all necessary monitoring information.

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