Project design document form for small-scale CDM project activities

(Version 08.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Irani Wastewater Methane Avoidance Project
Version number of the PDD	04
Completion date of the PDD	19/12/2016
Project participant(s)	Celulose Irani S.A. EcoSecurities Group Plc
Host Party	Brazil
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	AMS-III.I
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral Scope 13 (Waste handling and disposal)
Estimated amount of annual average GHG emission reductions	47,667

SECTION A. Description of project activity

A.1. Purpose and general description of 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. Most of Currently, the wood used in the paper manufacturing process comes from Irani’s own forest plantation. The company uses only electricity generated on-site through the burning biomass residues to generate renewable electricity to the plant.

The former wastewater treatment at Celulose Irani consisted 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 wastewater was anaerobically degraded. The organic material degraded anaerobically in the facility’s lagoon system producing significant amounts of methane.

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

With these measures, the project developer will stop anaerobic degradation of the organic wastewater in the ponds. A schematic representation of the old and the new wastewater treatment can be seen in Section B.3. The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs.

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.

According to the Project Standard v9.0, the eligibility criteria for projects Type III (Other project activities not included in Type I – Renewable Energy or Type II – Energy Efficiency) is that the project result in GHG emission reductions not exceeding 60 kt CO2e per year in any year of the crediting period. The estimate of annual average and total GHG emission reductions for the chosen crediting period is the following:

Total estimated reductions (tCO_2)	333,669
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tCO_2)	47,667

A.2. Location of project activity

A.2.1. Host Party

Brazil

A.2.2. Region/State/Province etc.

South region, Santa Catarina state.

A.2.3. City/Town/Community etc.

Vargem Bonita city

A.2.4. Physical/Geographical location

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). This is the biggest plant of Celulose Irani. The company also has another smaller production unit in Santa Catarina (Rio Negrinho Municipality) that will not be part of this project. See below the map of Santa Catarina State.

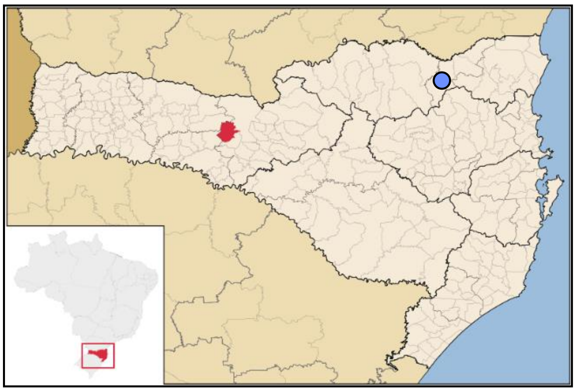


Figure: Physical location of Vargem Bonita City (red), in Santa Catarina state, South Brazil[1]. The blue circle marks the Rio Negrinho Municipality, which is not included in this project activity.

A.3. Technologies and/or measures

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

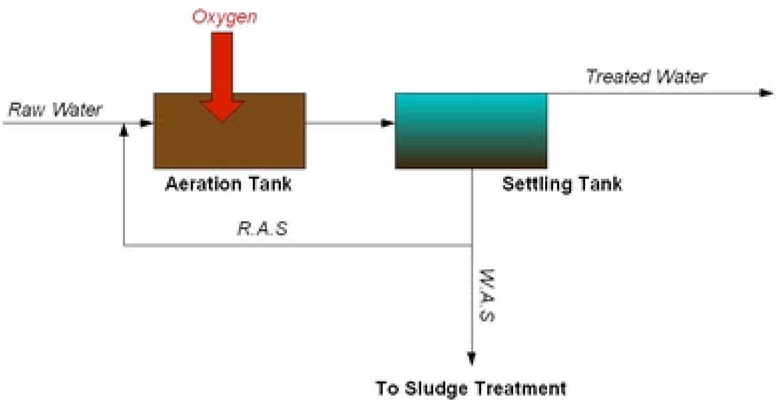


Figure: Example of Activated Sludge treatment system[2]. R.A.S - Return Activated Sludge; W.A.S - Waste Activated Sludge.

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

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

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	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

A.5. Public funding of project activity

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

A.6. Debundling for project activity

Debundling is the fragmentation of a large project activity into smaller parts. The project developer already have another registered SSC project activity. However, the other project activity:

- Uses different registered methodologies than the present project activity;
- 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;
- 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 selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

The project uses approved methodology AMS-III.I, Avoidance of methane production in wastewater treatment through replacement of anaerobic lagoons by aerobic systems, Version 8.0, valid from 31 Jul 09 onwards.

The following methodologies were used as guidance, as required by AMS-III.I:
For grid emission factor calculations (used in project emissions) was used guidance provided by the approved methodology AMS-I.D., Energy efficiency and fuel switching measures for industrial facilities, Version 18, valid from 28 Nov 14 onwards, and the Tool to calculate the emission factor for an electricity system, Version 5.0, valid from From 27 Nov 2015 onwards.

B.2. Project activity eligibility

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. Project boundary

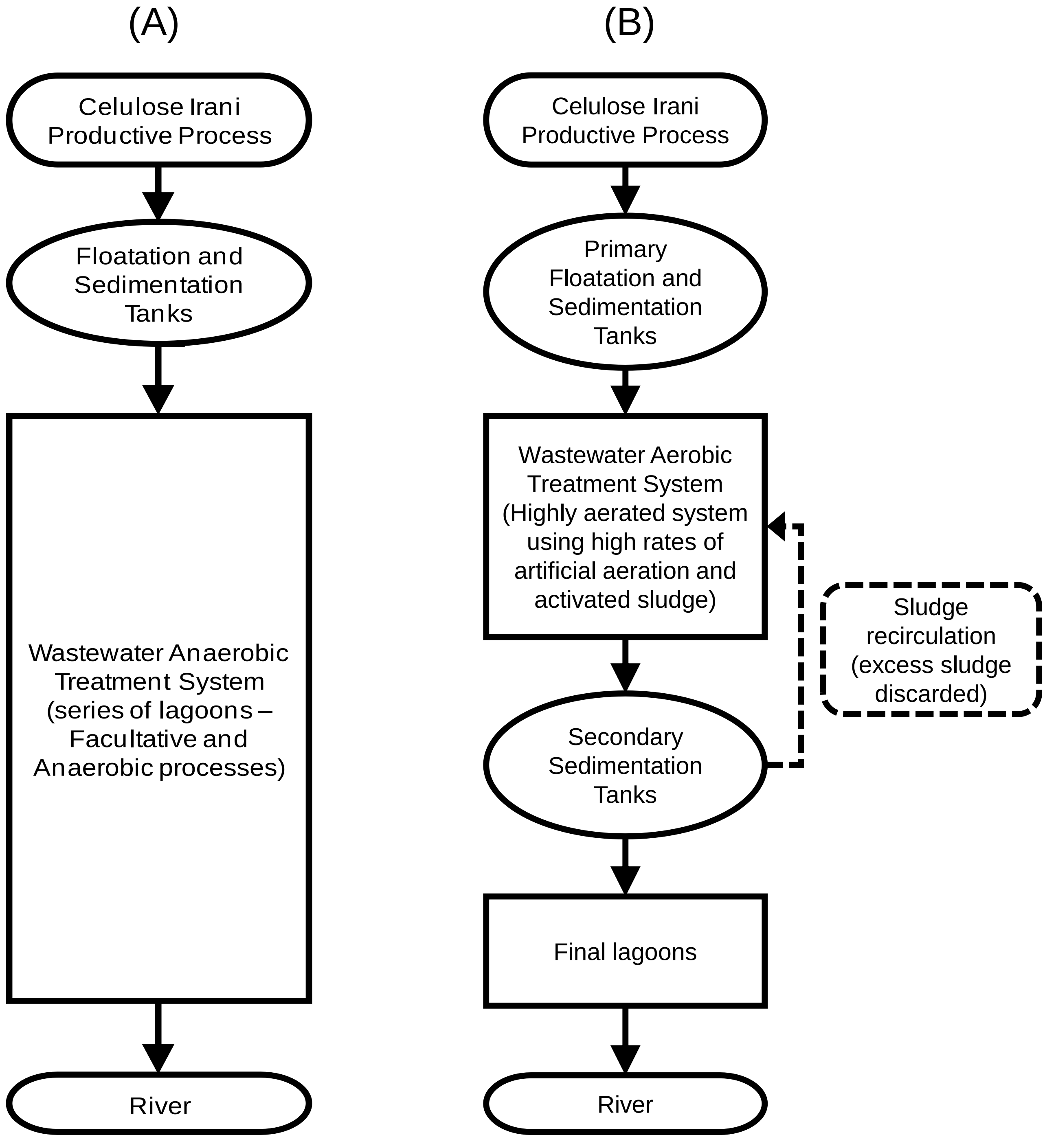
According to the methodology AMS-III.I., the project boundary is the physical, geographical sites where:

(a) The wastewater treatment would have taken place and the methane emission occurred in absence of the project activity;

(b) The wastewater treatment takes place in the project activity;

(c) The sludge is treated and disposed off in the baseline and project situation.

Below can be found a schematic diagram of the Project Developer anaerobic treatment system (A) and aerobic treatment system (B).



B.4. Establishment and description of baseline scenario

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

Assessment of the validity of the original/current baseline

The tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 03.0.1, valid from 02/03/2012 onwards) is used to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, if needed. It consists of two steps, as below:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

There is no regional or sectoral legislation/policy regarding this project activity. The national legislation is the National Council of Environment (*Conselho Nacional do Meio Ambiente* – CONAMA) resolution #357, from 17 March 2005. The main subject of this resolution is the classification of water bodies and environmental directives for this classification, as well as establishes the conditions and patterns for wastewater discharge, among others. Additionally, there is the CONAMA resolution #430, from 13 May 2011, regarding conditions and patterns of wastewater discharge, complementing and altering the resolution #357.

Since the project developer undergo through periodical assessment by the environmental authority and are currently complying with the national and regional environmental licensing process, it shows that the project activity complies with the applicable Brazilian legislation.

Therefore, the current baseline complies with all relevant mandatory national and/or sectoral policies that have come into effect after the submission of the project activity for validation and are applicable at the time of requesting this renewal of the crediting period.

Step 1.2: Assess the impact of circumstances

There is no new circumstance that could be defined as a change in the market characteristics and would affect the baseline scenario. Since this project involves a simple change in the wastewater treatment system, there are no fuels or raw materials involved, and a very small amount of electricity is consumed in the project scenario only. Therefore, there is no major impact in any aspect of the project regarding fuels, raw materials and electricity. The conditions used to determine the baseline emissions in the previous crediting period are still valid. The change of the wastewater treatment system would still have the same barriers as described in section B.5 below.
Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

The baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment.

There is a possibility of projects proponents would undertake an investment later. However, this possibility is not due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology. The equipment lifetime was not near its end – since anaerobic lagoons are very reliable and lasts for a long time[3] – and the technology replacing the former wastewater treatment was already at disposal for a long period before the project started. The main barrier reported in section B.5 below is the investment barrier, meaning that the NPV of the project scenario was negative and carbon revenues alleviated these

[3] The maintenance needed in a concrete anaerobic lagoon is very low and allows this lagoon to be operated for an extremely long time. In case where there is a limitation in the lifetime of the anaerobic technology, the continuation of the baseline scenario would be the most likely course of action. Even in an extreme scenario, where new anaerobic lagoons would have to be constructed (or rebuilt), it would be less expensive and pose less barriers than to build an aerobic treatment system based on the activated sludge technology.

losses. In a supposed new scenario, where the project would be implemented in the present moment, this barrier would still exist and would be proportional to the one described in the PDD. Please see the beginning of section B.4 above for a discussion regarding options to the Baseline Scenario.

Step 1.4: Assessment of the validity of the data and parameters

Data and parameters that were determined at the start of the crediting period and not monitored during the crediting period, based on the monitoring of the company's previous wastewater treatment system and used to evaluate the baseline scenario, are still valid. All parameters, except the ones changed by the methodology itself, IPCC values and emission factors, and thus need to be mandatorily updated, will still be used in order to estimate emissions. Since, as mentioned, the methodology is being updated, all methodology related values, as well as means of calculation, IPCC values and emission factors, will be updated as well whenever needed. However, none of the changes are due to differences in scenarios or new regulations other than the methodological update.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

Since none of the steps above resulted in significant changes to any of the parameters or choices, there will be no update related to the baseline.

Step 2.2: Update the data and parameters

The data and parameters for the second crediting period were updated.

B.5. Demonstration of additionality

The event that marks the starting date of the project activity is the elaboration of the engineering project of the new wastewater treatment system. The referred project was elaborated in 01 January 2006. The Project Developer assumes that the starting date of the project activity is the date that this project was elaborated. As the project developer already had another ongoing CDM project, they were in contact with CDM possibilities before requesting the engineering project. Therefore, this project is in compliance with paragraph 13 of Decision 17/CP.7.

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.

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[4], 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 tables below 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)**

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	**(1,351,751)**

Table: 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)**

[4] 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.

Operational	Unit	Source	NPV 21yr
Hand labour	R$	Irani	0
General expenses	R$	Irani	0
Auxiliary material	R$	Irani	-2,115,852
Operational NPV	R$	calculated	**(2,115,852)**

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

Technological Barrier

According to the Brazilian Science and Technology Ministry[5], 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[6]. 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	**Proposed project activity without CDM**	**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.**

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

[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.

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

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.

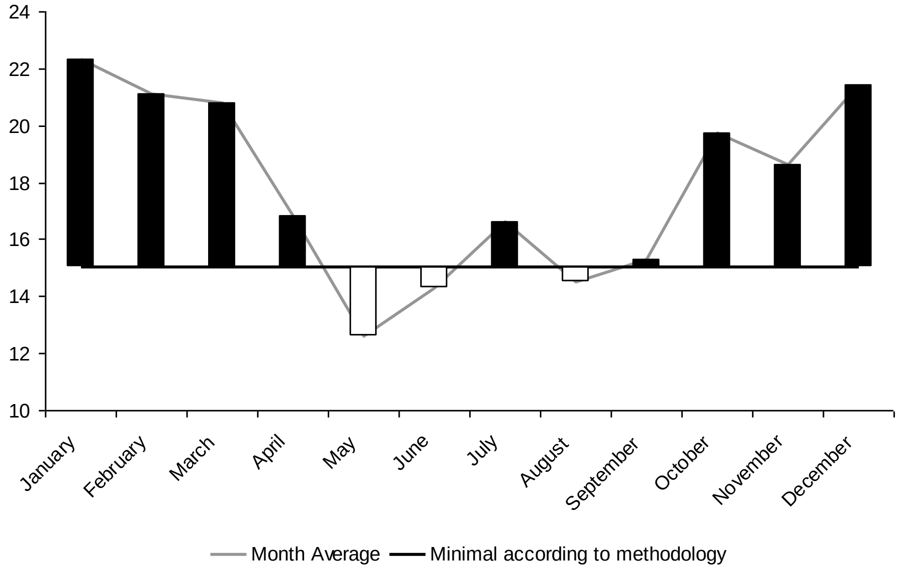


Figure: Graphic showing variation of ambient temperature at Celulose Irani site, on a monthly average basis for the year 2006. The temperature is in ºC. The central black line represents the threshold of 15ºC.

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[7].

$$C_v = \frac{Qméd \times S_a}{V}$$

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)

[7] 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.

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 and fossil fuel used by the project activity facilities;
2. Methane emissions during the treatment of the wastewater in biological aerobic wastewater treatment systems;
3. Methane emissions from degradable organic carbon in treated wastewater discharged in sea/river or lake;
4. Methane emissions from sludge treatment in the project activity;
5. Methane emissions from the decay of the final sludge generated by the project activity, 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 840 KW. However, the electricity consumed will be monitored using electricity meters. Therefore, this minimal amount of electricity consumed will be accounted as project emissions for this component (1 above). Calculation will follow guidance provided by AMS-I.D. as well as the Tool to calculate the emission factor for an electricity system, and Grid Emission Factor will be provided by the Brazilian Designated National Authority (DNA). The Brazilian DNA makes available the information of Dispatch Data Analysis - Operating Margin Emission Factor and the Build Margin Emission Factor through using the tool to calculate the emission factor for an electricity system:

Step 1: Identify the relevant electricity systems

The Interconnected National System is defined as the relevant electric system of the Project Activity, as recommended by Brazilian DNA through the resolution #08.

Step 2: Choose whether to include off-grid power plants in the project electricity systems

The Option I (only grid power plants are included in the calculation) was chosen for project activity, once the OM and BM emission factor is calculated by the Brazilian DNA based in the data from power plants connected to the grid.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on (c) Dispatch data analysis Operation Margin.

Step 4: Calculate the operating margin emission factor according to the selected method

The calculation of the operation margin emission factor follows the dispatch data analysis emission factor ($EF_{grid,OM-DD,y}$) and it is calculated and defined by the Brazilian Designated National Authority in accordance with the dispatch data of the Electric System National Operator – ONS.

The CO_2 emission factors resulting from the power generation in the Brazilian National Interconnected System (SIN) are calculated based on the generation record of plants centrally dispatched by ONS.

According to the “Tool to calculate the emission factor for an electricity system” for the dispatch data analysis (OM) it must be used the year in which the project activity uses grid electricity and it must be updated the emission factor annually during monitoring.

The Emissions Factor Operating Margin is calculated for the Brazilian National Interconnected System hourly from the value of energy exported from each plant, the cost of generation of each plant (scheduling priority), schedules of exchanges with the neighbouring subsystems and emission factors of thermal power plants.

The dispatch order for Brazilian Interconnected System is: hydroelectric power plants, wind, nuclear, imports from other systems in ascending order of cost, thermoelectric power plants in ascending order of generation cost.

Step 5: Calculate the build margin (BM) emission factor

The Option 2 was selected. The build margin emission factor will be updated annually, *ex-post*.

The build margin emission factor is calculated by the Brazilian DNA. The procedure for calculation was elaborated in cooperation between ONS, MME and MCTI and follows the “Tool to calculate the emission factor for an electricity system”.

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on (a) Weighted average CM. The combined margin emission factor is calculated as follows:

$$EF_{grid,\ CM,y} = EF_{grid,\ BM,y} * W_{BM} + EF_{grid,\ OM,y} * W_{OM}$$

Where:

$EF_{grid,\ BM,y}$	=	Build margin CO2 emission factor in year *y* (tCO_2/ MWh)
$EF_{grid,\ OM,y}$	=	Operating margin CO2 emission in year *y* (tCO_2/ MWh)
W_{OM}	=	Weighting of operating margin emissions factor (%)
W_{BM}	=	Weighting of build margin emissions factor (%)

The tool to calculate the emission factor for an electricity system recommends for the second crediting period the values W_{OM} = 25% and W_{BM} = 75%.

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 these components (4 and 5 above) are zero. If in any case the sludge is disposed in any other way, emissions will be accounted as described in the methodology.

Therefore, the only project emissions are the emissions related to the electricity used by the project activity facilities (1 above), methane emissions from aerobic wastewater treatment (2 above) and methane emissions from wastewater discharged in the river (3 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 aerobic systems is used.

Baseline emissions:

According to the methodology, baseline emissions consist of CO_2 emissions from:

1. Methane produced in the anaerobic baseline wastewater treatment system(s) that is/are being replaced with the biological aerobic system(s);
2. Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc;
3. Methane produced in the baseline sludge treatment system(s);
4. Methane emissions from anaerobic decay of the final sludge produced in the baseline situation. If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected.

The anaerobic 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 (1 above), as well as from wastewater discharged in the river (2 above). It is calculated exactly as stated in the methodology. The MCF value used is for anaerobic lagoons deeper than 2 meters.

In the determination of baseline emissions, historical records of two years prior to the project implementation are used (2004 and 2005). The outflow COD and COD removed by the baseline system shall be based on the removal efficiency of the baseline system estimated using this 2-year period data. Sludge will not be landfilled in the project scenario.

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” (*ERy*) 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 neither project emissions nor baseline emissions do not include the sludge component, the following simplified equation will be applied to estimate the emission reductions:

$ER_y = (BE_{ww,treatment,y} + BE_{ww,discharge,y}) – (PE_{y,power} + PE_{y,ww,treatment} + PE_{ww,discharge,y})$

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

B.6.2. Data and parameters fixed ex ante

Data / Parameter	B_o
Unit	kg CH_4/kgCOD
Description	Methane Producing Capacity (industrial wastewater)
Source of data	IPCC 2006
Value(s) applied	0.21
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Baseline and Project emissions
Additional comment	-

Data / Parameter	$MCF_{anaerobic,i}$
Unit	-
Description	Methane Correction Factor for Anaerobic Systems
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) applied	0.8
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Baseline emissions
Additional comment	-

Data / Parameter	GWP_CH_4
Unit	-
Description	Methane Global Warming Potential
Source of data	IPCC 2006
Value(s) applied	25
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Baseline and Project emissions
Additional comment	-

Data / Parameter	UF_{PJ}
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) applied	1.06
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Project emissions
Additional comment	-

Data / Parameter	$MCF_{discharge,k}$
Unit	-

Description	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Project emissions
Additional comment	-

Data / Parameter	UF_{BL}
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) applied	0.94
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Baseline emissions
Additional comment	-

Data / Parameter	$MCF_{ww,discharge,BL}$
Unit	-
Description	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	Value suggested by the methodology
Purpose of data	Baseline emissions
Additional comment	-

Data / Parameter	E_{BL}
Unit	-
Description	Chemical Organic Demand (COD) removal efficiency from the baseline wastewater treatment system
Source of data	Historical value
Value(s) applied	0.6099
Choice of data or Measurement methods and procedures	Reference based on internal monitoring from the company for the years 2004 and 2005.
Purpose of data	Project emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

According to the Methodology, the formula used to calculate project emissions is:

$$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{s,treatment,y} + PE_{s,final,y} \quad \textbf{(1)}$$

Where:

PE_y	Project activity emissions in year *y* (tCO_2e)
$PE_{power,y}$	Emissions on account of electricity or fossil fuel consumption in the year *y* (tCO_2e)
$PE_{ww,treatment,y}$	Methane emissions from the biological aerobic wastewater treatment in the year *y* (tCO_2e)
$PE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the project wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc. (tCO_2e)
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e)
$PE_{s,treatment,y}$	Methane produced in the project sludge treatment system(s) (tCO_2e)

Electricity emissions:

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

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. and Tool to calculate the emission factor for an electricity system (tCO2e/MWh)

For the electricity consumed by the project activity (EC_y) will be used the same estimated electricity consumption obtained during the validation of this project activity, 5,522 MWh/yr. For the electricity emission factor (EF_y), the mandatory value calculated by the Brazilian Designated National Authority (DNA) will be used.

Methane emissions during the biological aerobic treatment of wastewater are determined as follows ($PE_{ww,treatment,y}$):

$$PE_{ww,treatment,y} = \sum_k \left(Q_{ww,k,y} * COD_{removed,k,y} * MCF_{aerobic,k}\right) * B_o * UF_{PJ} * GWP_{CH4} \quad \textbf{(2)}$$

Where:

$Q_{ww,k,y}$	Volume of the wastewater treated by the aerobic system *k* during the year *y* (m^3)
k	Index for project wastewater treatment system
$COD_{removed,k,y}$	Chemical oxygen demand removed by the aerobic system *k* in year *y* (tonnes/m^3)
$MCF_{aerobic,k}$	Methane correction factor for the aerobic wastewater treatment system *k* (MCF value for well managed aerobic biological systems, or for poorly managed or overloaded systems as per table III.I.1 shall be taken)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)[8]

Methane emissions from degradable organic carbon in treated wastewater discharged in sea/river or lake in the project situation are determined as follows ($PE_{ww,discharge,y}$):

[8] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_o * UF_{PJ} * COD_{ww,discharge,y} * MCF_{ww,discharge} \quad (3)$$

Where:

$Q_{ww,y}$	Volume of wastewater treated in the year *y* (m^3)
$COD_{ww,discharge,y}$	Chemical oxygen demand of the final treated wastewater discharged into sea, river or lake in the year *y* (tonnes/m^3)
$MCF_{ww,discharge}$	Methane correction factor based on discharge pathway of the wastewater (fraction) (MCF value in table III.I.1 for sea, river and lake discharge)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)[9]

The other two factors are related to sludge treatment and disposal. Since sludge is expected to be burned in the boilers, emissions from this source is zero and thus these factors can be neglected and will not be used in emissions estimation. However, if in any case the sludge is composted, landfilled, or dealt with in any other way resulting in methane emissions, according to the methodology the calculations below are applicable:

$$PE_{s,treatment,y} = \sum_{l} S_{l,PJ,y} * MCF_{s,treatment,l} * DOC_s * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad (4)$$

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in year *y* (tonne)
l	Index for project sludge treatment system

In case sludge is composted, the following equation shall be applied:

$$PE_{s,treatment,y} = \sum_{l} S_{l,PJ,y} * EF_{composting} * GWP_{CH4} \quad (5)$$

Where:

$EF_{composting}$	Emission factor for composting of organic waste (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default value is 0.01 t CH_4/t sludge treated on a dry weight basis.

In case of sludge is disposed on landfills without methane recovery, project emissions are determined as follows:

$$PE_{s,final,y} = S_{final,PJ,y} * DOC_s * MCF_s * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad (6)$$

Where:

$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in year *y* disposed on a landfill (tonnes)
MCF_s	Methane correction factor of the landfill that receives the final sludge, estimated as described in AMS-III.G
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)[10]

Table – Summary of total yearly project emissions and its components.

[9] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[10] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

PEpower,y	tCO2/year	**2,033**
PEww,treatment,y	tCO2/year	**0**
PEww,discharge,y	tCO2/year	**2,099**
PEs,treatment,y	tCO2/year	**0**
PEs,final,y	tCO2/year	**0**
PEy	tCO2/year	**4,132**

According to the Methodology, the formula used to calculate baseline emissions is:

$$BE_y = BE_{ww,treatment,y} + BE_{ww,discharge,y} + BE_{s,treatment,y} + BE_{s,final,y} \quad \textbf{(7)}$$

Where:

BE_y	Baseline emissions in the year *y* (tCO_2e)
$BE_{ww,treatment,y}$	Methane produced in the anaerobic baseline wastewater treatment system(s) that is/are being replaced with the biological aerobic system(s) (tCO_2e)
$BE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc. (tCO_2e)
$BE_{s,treatment,y}$	Methane produced in the baseline sludge treatment system(s) (tCO_2e)
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced (tCO_2e)

In the determination of baseline emissions, historical records of two years prior to the project implementation were used.

The baseline emissions from the anaerobic wastewater treatment system(s) are estimated as follows:

$$BE_{ww,treatment,y} = \sum_{i,m}\left(Q_{ww,m,y} * COD_{removed,i,m,y} * MCF_{anaerobic,i}\right) * B_o * UF_{BL} * GWP_{CH4} \quad \textbf{(8)}$$

Where:

$Q_{ww,m,y}$	Volume of the wastewater treated during the months m, during year *y*, for the months with ambient average temperature above 15°C (m^3)
i	Index for baseline wastewater treatment system
$MCF_{anaerobic,i}$	Methane correction factor for the anaerobic baseline wastewater treatment system *i* replaced by the project activity, value as per table III.I.1
$COD_{removed,i,m,y}$	Chemical oxygen demand removed[11] by the anaerobic wastewater treatment system *i* in the baseline situation in the year *y* for the months *m* with ambient average temperature above 15° C ($tonnes/m^3$)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[12]
B_o	Methane producing capacity for the wastewater (IPCC default value of 0.21 kg CH_4/kg COD)[13]
GWP_{CH4}	Global Warming Potential for CH_4 (value of 21)

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[11] Difference of inflow COD and the outflow COD.

[12] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[13] The IPCC default value of 0.25 kg CH_4/kg COD was corrected to take into account the uncertainties. Project activities may use the default value of 0.6 kg CH4/kg BOD, in case the parameter $BOD_{5,20}$ is used to determine the organic content of the wastewater. In this case the monitoring shall be based in direct measurements of $BOD_{5,20}$, i.e., the estimation of BOD values based on COD measurements is not allowed.

Methane emissions from degradable organic carbon in treated wastewater discharged in e.g., a river, sea or lake are determined as follows:

$$BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_o * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,discharge,BL} \quad \textbf{(9)}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[14]
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in year *y* (tonnes/m^3)
$MCF_{ww,discharge,BL}$	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater (fraction) (MCF value as per table III.I.1)

To determine $COD_{removed,i,m,y}$ *and* $COD_{ww,discharge,BL,y}$: as the baseline treatment system is different from the treatment system in the project scenario, the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions *ex post*. The COD removed by the baseline system shall be based on the removal efficiency of the baseline system.

The remaining two factors are related to sludge treatment and disposal. The type of sludge treatment considered for baseline will be the same one considered for project. Since sludge is expected to be burned in the boilers, emissions from this source is zero and thus these factors can be neglected and will not be used in emissions estimation. However, if in any case the sludge is composted, landfilled, or dealt with in any other way resulting in methane emissions, according to the methodology the calculations below are applicable:

Methane emissions from the baseline sludge treatment systems *j* are determined as follows:

$$BE_{s,treatment,y} = \sum_j S_{j,BL,y} * MCF_{s,treatment,j} * DOC_s * UF_{BL} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(10)}$$

Where:

$S_{j,,BL,y}$	Amount of dry matter in the sludge that would have been treated by the sludge treatment system *j* in the baseline scenario (tonne)
j	Index for baseline sludge treatment system
DOC_s	Degradable organic content of the untreated sludge generated in the year *y* (fraction, dry basis). It shall be estimated using default values of 0.5 for domestic sludge and 0.257 for industrial sludge.[15]
$MCF_{s,treatment,j}$	Methane correction factor for the baseline sludge treatment system *j* (MCF values as per table III.I.1)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[16]
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

In case sludge is composted, the following equation shall be applied:

$$BE_{s,treatment,y} = \sum_j S_{j,BL,y} * EF_{composting} * GWP_{CH4} \quad \textbf{(11)}$$

[14] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[15] The IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent), were corrected for dry basis.

[16] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

Where:

$EF_{composting}$	Emission factor for composting of organic waste (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default value is 0.01 t CH_4/t sludge treated on a dry weight basis.

Since the baseline wastewater treatment system is different from the treatment system in the project scenario, the sludge generation rate (amount of sludge generated per unit COD removed) in the baseline situation may differ significantly from the project situation. The amount of sludge generated in aerobic wastewater systems is generally larger than that in anaerobic systems, for the same COD removal efficiency. Therefore, the monitored values of the amount of sludge generated during the crediting period shall be used to estimate the amount of sludge generated in the baseline, as follows:

$$S_{j,BL,y} = S_{l,PJ,y} * \frac{SGR_{BL}}{SGR_{PJ}} \quad \textbf{(12)}$$

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in year *y* in the project scenario (tonne)
SGR_{BL}	Sludge generation ratio of the wastewater treatment plant in the baseline scenario (tonne of dry matter in sludge/tonne COD removed). This ratio will be measured *ex ante* through representative measurement campaign, or using historical records of COD removal and sludge generation in the baseline treatment systems.
SGR_{PJ}	Sludge generation ratio of the wastewater treatment plant in the project scenario (tonne of dry matter in sludge/tonne COD removed). Calculated using the monitored values of COD removal and sludge generation in the project scenario.

Methane emissions from anaerobic decay of the final sludge produced in the baseline situation are determined as follows:

$$BE_{s,final,y} = S_{final,BL,y} * DOC_s * UF_{BL} * MCF_{s,BL,final} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(13)}$$

Where:

$S_{final,BL,y}$	Amount of dry matter in final sludge generated by the baseline wastewater treatment in the year *y* (tonnes). It will be estimated using the monitored amount of dry matter in final sludge generated by the project activity ($S_{final,PJ,y}$) corrected for the sludge generation ratios of the project and baseline systems as per equation above.
$MCF_{s,BL,final}$	Methane correction factor of the disposal site that receives the final sludge in the baseline situation, estimated as per the procedures described in AMS-III.G
UF_{BL}	Model correction factor to account for model uncertainties (0.94)

Table – Summary of total yearly baseline emissions and its components.

BEww,treatment,y	tCO2/year	**46,809**
BEww,discharge,y	tCO2/year	**4,990**
BEs,treatment,y	tCO2/year	**0**
BEs,final,y	tCO2/year	**0**
BEy	tCO2/year	**51,799**

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
1	51,799	4,132	0	47,667
2	51,799	4,132	0	47,667
3	51,799	4,132	0	47,667
4	51,799	4,132	0	47,667
5	51,799	4,132	0	47,667
6	51,799	4,132	0	47,667
7	51,799	4,132	0	47,667
Total	362,593	28,924	0	333,669
Total number of crediting years	7			
Annual average over the crediting period	51,799	4,132	0	47,667

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	COD_{in}
Unit	tonnes/m^3
Description	Monthly average Chemical Oxygen Demand entering the aerobic system.
Source of data	Direct measurements from Project Developer
Value(s) applied	0.003
Measurement methods and procedures	The COD of the wastewater entering the boundary of the project activity will be measured using a calibrated spectrophotometer, according to the analytical procedure supplied by the manufacturer.
Monitoring frequency	COD analysis will be carried out twice weekly, at least.
QA/QC procedures	The spectrophotometer will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani’s maintenance procedure. The measuring procedures will follow recommendations by the equipment supplier and/or a documented procedure.
Purpose of data	Baseline and Project emissions
Additional comment	The measurements will take place at Celulose Irani’s own laboratory, whenever possible. If not possible, a properly qualified laboratory will be used.

Data / Parameter	E_{PJ}
Unit	-
Description	Chemical Organic Demand (COD) removal efficiency from the project wastewater treatment system
Source of data	Historical value
Value(s) applied	0.8545
Measurement methods and procedures	Monitoring of this specific parameter will consist of monitoring COD_{in} and COD_{out}.
Monitoring frequency	Monitoring of this specific parameter will consist of monitoring COD_{in} and COD_{out}.
QA/QC procedures	This parameter will not be used in ER calculations.
Purpose of data	Project emissions

Additional comment	Reference based on internal monitoring from the company for the years 2013 and 2014. Data calculated ex ante to estimate project emissions in the PDD. This parameter will not be used in ER calculations. The parameters COD_{in} and COD_{out} will be used instead to evaluate COD removal efficiency.

Data / Parameter	COD_{out}
Unit	tonnes/m^3
Description	Monthly average Chemical Oxygen Demand exiting the aerobic system.
Source of data	Direct measurements from Project Developer
Value(s) applied	Baseline: 0.001170 / Project: 0.000437
Measurement methods and procedures	The COD of the wastewater exiting the boundary of the project activity will be measured using a calibrated spectrophotometer, according to the analytical procedure supplied by the manufacturer.
Monitoring frequency	COD analysis will be carried out twice weekly, at least.
QA/QC procedures	The spectrophotometer will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure. The measuring procedures will follow recommendations by the equipment supplier and/or a documented procedure.
Purpose of data	Baseline and Project emissions
Additional comment	The measurements will take place at Celulose Irani's own laboratory, whenever possible. If not possible, a properly qualified laboratory will be used.

Data / Parameter	$Q_{ww,k,y}$
Unit	m3
Description	Volume of the wastewater treated by the aerobic system k during the year y
Source of data	Direct measurements from Project Developer
Value(s) applied	8,640,000
Measurement methods and procedures	Wastewater flow is monitored using Parshall Flumes coupled with ultrasonic sensors.
Monitoring frequency	Continuously measured.
QA/QC procedures	Equipment will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure..
Purpose of data	Baseline emissions
Additional comment	This value refers to the full amount of wastewater entering the project boundary. In case of any missing data, a correspondent value from $Q_{ww,y}$ will be used.

Data / Parameter	$Q_{ww,y}$
Unit	m3
Description	Volume of the wastewater treated (discharged) during year "y"
Source of data	Direct measurements from Project Developer
Value(s) applied	7,776,000
Measurement methods and procedures	Wastewater flow is monitored using a Parshall Flume coupled with ultrasonic sensor.
Monitoring frequency	Continuously measured.
QA/QC procedures	Equipment will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data	Baseline and project emissions
Additional comment	This value refers to the full amount of wastewater exiting the project boundary, including not only the amount treated during months hotter than 15ºC but also the remaining months as well. In case of any missing data, a correspondent value from $Q_{ww,y}$ will be used.

Data / Parameter	*TEMP*
Unit	Degrees Celsius

Description	Average monthly temperature
Source of data	Project developer historical monitoring
Value(s) applied	3 months below 15ºC
Measurement methods and procedures	The average monthly environmental temperature will be obtained from Thermometers installed in the project developer and/or from qualified weather and climate services.
Monitoring frequency	Monthly
QA/QC procedures	In case thermometer onsite is used, it will be maintained regularly. If third party services used, it will be a qualified and recognizably competent service provider, from the closest meteorological station possible to the project boundary.
Purpose of data	Baseline and Project emissions
Additional comment	For example of a trustworthy third party temperature monitoring can be mentioned the Inmet (National Institution of Meteorology): http://www.inmet.gov.br/portal/index.php?r=estacoes/estacoesautomaticas

Data / Parameter	$COD_{ww,discharge,y}$
Unit	tonnes/m³
Description	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in year *y*
Source of data	Calculated using direct measurements from Project Developer
Value(s) applied	Baseline: 0.001170 / Project: 0.000437
Measurement methods and procedures	Please see COD_{out} above.
Monitoring frequency	Please see COD_{out} above.
QA/QC procedures	Please see COD_{out} above.
Purpose of data	Baseline and project emissions
Additional comment	Since the wastewater treatment system, both in baseline and project scenarios, involves a direct discharge to the river, COD_{out} and $COD_{ww,discharge,y}$ are the same.

Data / Parameter	$COD_{removed,k,y}$
Unit	tonnes/m³
Description	Chemical oxygen demand removed by the aerobic system in year *y*
Source of data	Calculated using direct measurements from Project Developer
Value(s) applied	Baseline: 0.001830 / Project: 0.002564
Measurement methods and procedures	The removal efficiency value was estimated for PDD purposes using the parameters E_{BL} and E_{PJ}. During the crediting period, this parameter will be calculated using monitored values (COD_{in} and COD_{out}).
Monitoring frequency	Please see COD_{in} and COD_{out} above.
QA/QC procedures	Please see COD_{in} and COD_{out} above.
Purpose of data	Baseline and project emissions
Additional comment	-

Data / Parameter	$S_{final,PJ,y}$
Unit	Tonnes
Description	Amount of sludge generated by the wastewater treatment in the monitoring period y
Source of data	Calculated using direct measurements from Project Developer
Value(s) applied	-
Measurement methods and procedures	The volume (m³) of sludge is acquired using a flowmeter. The dry matter content (tonnes/m³) results from a laboratory analysis. Final destinations of sludge will be monitored and treated according to recommendations by the methodology.

Monitoring frequency	The volume will be monitored continuously. The dry matter content will be measured once each work shift (three times per day).
QA/QC procedures	Flowmeter will be calibrated once each two years by an accredited person or institution. Precision scale will be calibrated each six months by an accredited person or institution. Both equipment have calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data	Project emissions.
Additional comment	Since methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled combusted, the end-use of the final sludge will be monitored during the crediting period. If any other use of sludge is applied, it will be dealt with according to the methodology. This parameter was not estimated because it is not needed for emission calculations in the present scenario.

Data / Parameter	EC_y
Unit	MWh
Description	Electricity consumed by the project activity devices in the monitoring period y
Source of data	Direct measurements from Project Developer
Value(s) applied	5,522
Measurement methods and procedures	Electricity will be monitored by electricity meter(s). If more than one meter is used to measure this parameter, all meter readings will be added to represent the total electricity consumption of the project.
Monitoring frequency	Continuously measured.
QA/QC procedures	Meters will be calibrated once each three years by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data	Project emissions.
Additional comment	In case measurements cannot be performed, the theoretical maximum consumption is used, according to the installed capacity of the equipment and a theoretical load factor.

Data / Parameter	$MCF_{aerobic,k}$
Unit	-
Description	Methane Correction Factor for the aerobic wastewater treatment system
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) applied	0
Measurement methods and procedures	Since a MCF value of zero is adopted for the project wastewater treatment system assuming that it is a well-managed aerobic system, its operation will be documented in a quality control program. Therefore, the operating conditions of the treatment system will be monitored to verify if they are within the specified range so as to ensure the aerobic condition of the reactors. The acceptable range of operational parameters are defined for continuous aerobic operation of the treatment system in accordance with the engineering design of the wastewater treatment system and reported in the PDD. The operational parameters are then continuously monitored to ensure that they are always kept in the design range of operating conditions. In case the operational parameters are not within the limits for a period of time, a MCF value of 0.3 shall be taken for that period.
Monitoring frequency	Continuous
QA/QC procedures	All equipment involved will be maintained according to the manufacturer's recommendations and will be calibrated regularly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data	Project emissions
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO2e/MWh
Description	Grid emission factor
Source of data	Brazilian DNA
Value(s) applied	0.36815
Measurement methods and procedures	The Brazilian Designated National Agency (DNA) performs all calculation related to the Brazilian Electricity Grid (Sistema Interligado Nacional – SIN) and demands all CDM projects to use this number. This entity provides an Operational Margin (OM) and a Build Margin (BM), and the Combined Margin (CM) will be calculated according to the formulae described in section B.6.1.
Monitoring frequency	Continuous
QA/QC procedures	The Brazilian DNA is the responsible for the information.
Purpose of data	Project emissions
Additional comment	-

B.7.2. Sampling plan

Not applicable.

B.7.3. Other elements of 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 data from the Parshall flume will be assessed online by an ultrasonic device, and visual monitoring of the Parshall Flume will work as quality assurance whenever needed.

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 a calibrated scale after the dewatering of the sludge. The trucks that carry the sludge to the boiler will be weighted by this scale. 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. All equipment calibration will be performed by an accredited person or institution.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

The baseline study and the monitoring methodology were concluded on 05/04/2007. For the renewal to the second crediting period, the application of the methodology was concluded on 21/10/2015. The entity determining the application of the methodology to the second crediting period is a third party consultant from the company **Viden Projetos Ambientais e Sustentabilidade**. Contact:

Thiago Viana

Associate Diretor and Project Manager

Viden Projetos Ambientais e Sustentabilidade

Rio de Janeiro – Brazil – e-mail: thiago.viana@viden.bio.br

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

01/01/2006

C.1.2. Expected operational lifetime of project activity

More than 21 years

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Renewable

C.2.2. Start date of crediting period

19/01/2015.

C.2.3. Length of crediting period

7 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

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.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

The Local stakeholders consultation was performed for the first crediting period.
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 Forum 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 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 consideration of comments received

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

SECTION F. Approval and authorization

Since all applicable Designated National Authorities (DNAs) already approved this project, the project has already received all Letter of Approvals needed. This document aims a renewal of the crediting period, so there is no need to request DNA approval at this point.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Celulose Irani S.A.
Street/P.O. Box	Rodovia BR 153, km 47 – Campina da Alegria
Building	
City	Vargem Bonita
State/Region	Santa Catarina
Postcode	89600-000
Country	Brazil
Telephone	+55 (49) 441-9225 / 441-9000
Fax	+55 (49) 441-9063
E-mail	odivancargnin@irani.com.br/ ruymichel@irani.com.br
Website	www.irani.com.br
Contact person	
Title	Director
Salutation	Mr.
Last name	Denton
Middle name	
First name	David
Department	
Mobile	
Direct fax	(51) 3221.5661 / 3221.6634 / 3227.5079 / 3221.5902
Direct tel.	(51) 3226.0111
Personal e-mail	david.denton@habitasul.com.br

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Viden Projetos Ambientais e Sustentabilidade
Street/P.O. Box	Av. Almirante Ary Parreiras 110/102, Bl. C, Icaraí
Building	-
City	Niterói
State/Region	Rio de Janeiro
Postcode	24.230-322
Country	Brazil
Telephone	+55 (21) 982.586.486
Fax	-
E-mail	-
Website	www.viden.bio.br

Contact person	-
Title	Associate Director
Salutation	Mr.
Last name	Pimenta Viana
Middle name	Augusto
First name	Thiago
Department	-
Mobile	+55 (21) 982.586.486
Direct fax	-
Direct tel.	-
Personal e-mail	thiago.viana@viden.bio.br

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	EcoSecurities Group Plc.
Street/P.O. Box	40 Dawson Street
Building	
City	Dublin
State/Region	
Postcode	02
Country	Ireland
Telephone	+353 1613 9814
Fax	+353 1672 4716
E-mail	info@ecosecurities.com
Website	www.ecosecurities.com
Contact person	
Title	COO & President
Salutation	Dr.
Last name	Moura Costa
Middle name	
First name	Pedro
Department	
Mobile	
Direct fax	
Direct tel.	+44 1865 202 635
Personal e-mail	cdm@ecosecurities.com

Appendix 2. Affirmation regarding public funding

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

Appendix 3. Applicability of methodology and standardized baseline

Not applicable.

Appendix 4. Further background information on ex ante calculation of emission reductions

Not applicable.

Appendix 5. Further background information on monitoring plan

Not applicable.

Appendix 6. Summary of post registration changes

Not applicable.

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Document information

Version	*Date*	*Description*
08.0	22 July 2016	EB 90, Annex 2 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for small-scale CDM project activities (these instructions supersede the "Guidelines for completing the project design document form for small-scale CDM project activities" (Version 01.1)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and **Erro! Fonte de referência não encontrada.**; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-SSC-PDD-FORM*; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	13 March 2012	EB 66, Annex 9 Revision required to ensure consistency with the “Guidelines for completing the project design document form for small-scale CDM project activities”
03.0	15 December 2006	EB 28, Annex 34 • 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.
02.0	08 July 2005	EB 20, Annex 14 • 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>.

Version	*Date*	*Description*
01.0	21 January 2003	EB 07, Annex 05 Initial adoption.

Decision Class: Regulatory
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