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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Punta Pereira biomass power plant.

Version 01.

01/08/2011.

A.2. Description of the project activity:

The proposed project activity consists in the construction of a new biomass-based cogeneration power plant, built in the context of a new pulp mill (from now on, the Punta Pereira pulp mill), which will have a 43 MW of surplus power capacity to the grid[1]. The new biomass power plant will be located in Punta Pereira, Colonia, Uruguay.

The surplus electric power capacity of the Punta Pereira pulp mill is a result of the following initiatives:

- The construction of a more efficient pulp mill, capable of generating surplus power to the grid.
- The installation of a high-pressure fluidized-bed biomass boiler (from now on, the power boiler), designed to maximize the surplus power generation of the pulp mill to the grid.

The project activity is designed to use black liquor[2] and other biomass residues from the Kraft pulping process (bark, sawdust, primary sludge, etc.) for surplus power generation in the new pulp mill facility. The project activity is carried out by Celulosa y Energía Punta Pereira S.A. (from now on, CEPP)[3], who is also the company presenting this project to the CDM.

The biomass power plant consists of a recovery boiler fuelled with black liquor from the pulping process and a second biomass boiler, the power boiler, fuelled with a mix of bark, sawdust and sludge from the pulping process. There are two turbo generators, one back pressure unit and the other one an extraction and condensing unit. Each turbogenerator has a capacity of 88.9 MW. The high-pressure steam produced in the two biomass boilers (the recovery boiler and the power boiler) will be conducted via a common header to the cogeneration turbines. Both turbo generators will produce electricity for the mill and a surplus for exporting to the grid. The steam extracted from the turbines (process heat) will be used in the pulping process.

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[1] This value is merely referential, as it corresponds to the estimated surplus power capacity that will be available on average in the project plant.

[2] Black liquor is an organic by-product of the pulp production Kraft cycle and falls under the category of "Biomass residues", according to the "Definitions" section, in page 2 of the ACM0006 (Version 11.1).

[3] Celulosa y Energía Punta Pereira S.A. is also referred as by its commercial brand: Montes del Plata.

This new power plant was conceived as a CDM project activity and designed to produce a considerable surplus to the grid, using all the available biomass residues generated in the pulping process. In the absence of the CDM project activity, some of the biomass residues would have been less efficiently used for heat and electric power generation, while others would have been simply discarded in a dedicated landfield to (anaerobic) natural decay.

The baseline scenario in the relevant geographical region consists in the black liquor boiler providing the mill with the necessary heat and power, without any surplus of steam and electric power. In the baseline scenario, wood debarking residues and primary sludge would be left to decay under anaerobic conditions. Likewise, in the absence of the proposed project activity, the projected surplus electricity to be generated at the pulp mill would be generated by other grid-connected power plants.

The project activity will reduce CO_2 emissions by displacing fossil-fuel based electricity that would have otherwise been generated by the operation of grid-connected thermal power plants. It will also reduce CH_4 emissions by avoiding the natural decay of biomass residues in a landfield.

The proposed project activity will contribute to Uruguay's sustainable development by providing electricity to other power consumers through power generation based on a clean and renewable energy source. In addition, the following positive socio-economic and environmental impacts have been identified associated to the proposed project activity:

- The project activity will contribute to improve the energy security of Uruguay through the provision of electricity generated from a national resource otherwise not utilized or underutilized. It will also improve the quality and continuity of the electrical supply, thus reducing the possibility of service fails or blackouts (particularly in the regional grid) and also modulation of the demand.

- The project activity will reduce the imports of electricity and fossil fuels, thus improving the country's electricity trade balance.

- It will promote employment at local and national levels, both in the construction phase and later in the operation of the power plant.

- The project activity will foster the appreciation of biomass residues in the Pulp and Paper and Forest industries for energy generation purposes.

- The project will improve the air quality by reducing the emissions of sulphur dioxide and particulate matter to the atmosphere from the burning of fossil fuels for power generation in the connected electricity system.

- The project activity will contribute positively to the energy efficiency of the power system of Uruguay, through distributed generation of electricity resulting in reduced energy losses due to power transmission.

A.3. Project participants:

Name of Party involved(*) ((host) indicates a host Party)	Private and / or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes / No)
Uruguay (host)	Celulosa y Energía Punta Pereira S.A.	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 of requesting registration, the approval by the Party(ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Uruguay.

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

Department of Colonia.

A.4.1.3. City/Town/Community etc.:

The project activity will be located in Punta Pereira, near the town of Conchillas.

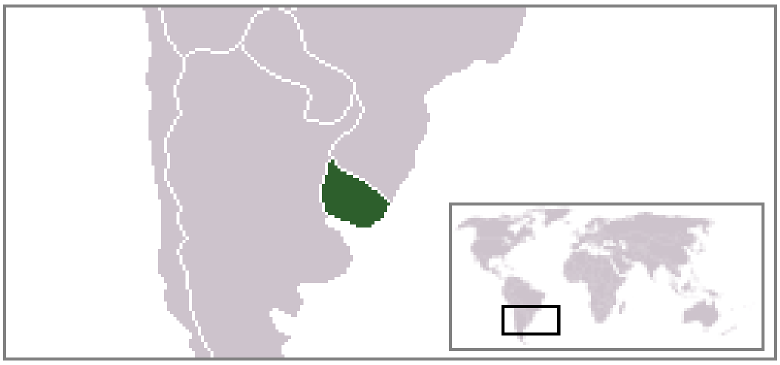
A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

CEPP has selected a 503 has. site approximately 190 km. West of Montevideo and 40 km. west of Colonia del Sacramento for the pulp mill and port (see figures below). This location is on company owned land adjacent to the Río de la Plata and Martín Gracía Channel. The site is within the Department of Colonia. The geographical coordinates of the new pulp mill location are:

- Latitude: -34.2166°
- Longitude: -58.0333°

Colonia del Sacramento is a small city with a current population of about 25,000 and is the administrative center for the Department of Colonia. It is located about 180 km west of Montevideo. Colonia del Sacramento is a historic and tourist destination and has a significant number of vacation homes in the area. While ferry service to Buenos Aires is available, there is no commercial airport. Access to the city is mainly from Montevideo via Route 1 and from the city to the mill site via Route 21. Montevideo is the nearest fully developed (and international) airport.

Smaller communities in the region are Port Inglés, Conchillas and Carmelo. Overall the population density near the site and in the surrounding area is low. The project enjoys strong local support for the Punta Pereira location.



The pulp mill and port facilities are located on the Río de la Plata at Punta Pereira, Uruguay.

The port facility at Punta Pereira, Uruguay is located in close proximity to the Martín García Channel on the Rio de la Plata.

● The Punta Pereira CDM project.

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

The Punta Pereira biomass power plant is a renewable energy supply side grid-connected project activity. It involves reduction of emissions of greenhouse gases in the energy sector; more specifically, a reduction of GHG emissions sources from fuel combustion in energy industries, according to the list of sector/source categories indicated in Annex A of the Kyoto Protocol.

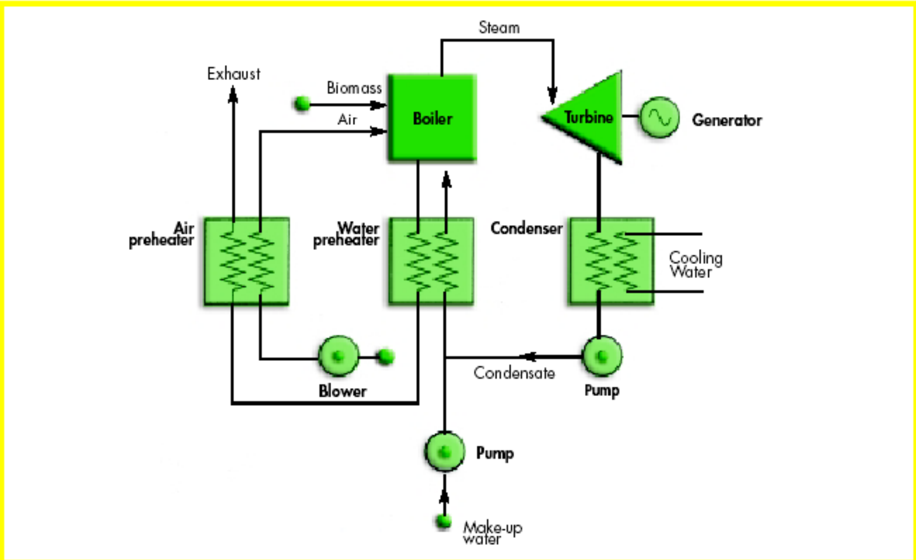
A.4.3. Technology to be employed by the project activity:

The predominant technology in all parts of the world today for generating megawatt (MW) levels of electricity from biomass is the steam-Rankine cycle, which consists of direct combustion of biomass in a boiler to generate steam, which is then expanded through a turbine. The steam-Rankine technology is a mature technology, having been introduced into commercial use about 100 years ago. Most steam cycle plants are located at industrial sites, where the waste heat from the steam turbine is recovered and used for meeting industrial-process heat needs. Such combined heat and power (CHP), or cogeneration systems provide greater levels of energy services per unit of biomass consumed than systems that generate electric power only.

The steam-Rankine cycle involves heating pressurized water, with the resulting steam expanding to drive a turbine-generator, and then condensing back to water for partial or full recycling to the boiler. A heat exchanger is used in some cases to recover heat from flue gases to preheat combustion air, and a deaerator must be used to remove dissolved oxygen from water before it enters the boiler.

Steam turbines are designed as either “backpressure” or “condensing” turbines. CHP applications typically employ backpressure turbines, wherein steam expands to a pressure that is still substantially above ambient pressure. It leaves the turbine still as a vapor and is sent to satisfy industrial heating needs, where it condenses back to water. It is then partially or fully returned to the boiler. Alternatively, if process steam demands can be met using only a portion of the available steam, a condensing extraction steam turbine (CEST) might be used. This design includes the capability for some steam to be extracted at one or more points along the expansion path for meeting process needs (figure 3). Steam that is not extracted continues to expand to sub-atmospheric pressures, thereby increasing the amount of electricity generated per unit of steam compared to the backpressure turbine. The non-extracted steam is converted back to liquid water in a condenser that utilizes ambient air and/or a cold water source as the coolant.

Schematic diagram of a biomass-fired steam-Rankine cycle for cogeneration using a condensing-extraction steam turbine.



Source: Williams & Larson, 1993 apud Kartha & Larson, 2000, p. 101.

Since the Punta Pereira biomass power plant will be built in conjunction with the Punta Pereira pulp mill, the best way to outline and describe the equipments related to the project activity is to describe how the pulp mill would have been designed if it would have maintained the conventional business as usual design, without additional electric power generation capacity. These changes are outlined in the table below:

Detailed description of the Punta Pereira biomass power plant project activity

Department	**Changes**
Recovery Boiler	• The recovery boiler would, in the base line, have been designed for the same amount of black liquor to be burned as in the project activity, however the liquor concentration would have been chosen lower, at 74% instead of 80%. • The high-pressure steam data would have been lower in the base line, 86 bar(a) 480ºC instead of 94,8 bar(a) 494ºC. Higher steam data results in a higher investment cost and higher maintenance costs. Lower steam data also means less power consumption for the feed water pumps. • The feed water temperature would have been reduced from 170ºC to 120ºC in the base line. This would give a smaller and cheaper boiler economizer. The only reason to have a high feed water temperature is to be able to generate more power. • The recovery boiler would not have been equipped with heat recovery from the flue gases in the base line. The reason to have heat recovery is to consume less process steam and by this be able to produce more condensing power.
Biomass power boiler	• No biomass power boiler would be installed in the base line scenario.
Boiler water systems	• The feed water tank would have been slightly smaller in the base line and would have been designed for a lower pressure.
Steam Distribution	• The steam is primarily consumed in two pressures, medium pressure (MP) and low pressure (LP). The middle pressure level would have been somewhat higher in the base line case 12 bar(a) instead of 10 bar(a) at the consumers. Also the low pressures level would have been selected somewhat higher, 5.0 bar(a) instead of 4.5 bar(a) at the consumers. This would have resulted in less expensive equipment by the consumers, especially the evaporation plant and the drying machine would have needed less heat transfer surface. • The steam distribution pipes would have been somewhat smaller in size (i.e. less steam carries the same energy) in the base line.
Evaporator Plant	• The number of effects would have been reduced from 7 to 6 in the base line case. This would have reduced the investment cost. • The outlet concentration would have been reduced from 80% to 74%. This would have resulted in a cheaper plant. • The A and B condensate temperatures would have been around 45-50 °C in the base line case instead of around 70 - 75 °C in the project activity

	case.
Cooking	• In the baseline case no re-boiler for generation of steam for the chip bin would be used. The load on the evaporation plant would be increased with about 4%.
Bleaching	• The use of direct steam would have been increased in the baseline case, which means that a smaller number of heat-exchangers would have been installed.
Drying Machines	• The drying machines of the project activity pulp mill are equipped with an expensive shoe-press. One main reason for the-shoe press is the reduced steam consumption in the dryer, to give more excess steam for condensing power generation. If the electrical power generation had been reduced, the shoe-press would have not been economically justified and would have not been installed. A system without a shoe-press would demand a somewhat larger dryer, but the higher steam pressure would have resulted in a small dryer. • The drying machine of the project activity mill would operate with low pressure steam in the dryer. In the base line mill when power export is not an issue, the drying machine would operate with medium pressure steam.
Electrical Systems	• The total capacity of the electrical system would have been reduced in the base line. The capacity of the transformer against the external grid would also have been reduced, though still allowing the mill to run without the turbogenerator. • The number of variable speed drives would have been reduced in the base line.

It must be noted that the alternative business-as-usual (BAU) pulp mill (or reference mill) would have the same capacity as the project pulp mill (with the implementation of the CDM project activity) and would have contemplated the installation of a recovery boiler dimensioned to generate the exact same amount of pulp per year, assuming self-sufficiency in thermal and electric power generation. The baseline pulp mill would contemplate the installation of the latest and most modern equipment in the pulp industry, just as in the case of the project mill. The differences highlighted above are exclusively related to the surplus power generation capacity of the project pulp mill.

Important note about the baseline pulp mill definition

It must be noted that pulp mills can be equipped with an on-site Chlorate plant[4]. In such case, the Chlorate plant is considered to be part of the pulping process. The Chlorate plant is normally installed when there is no available market for Chlorate in the region where the pulp mill is located.

In the case of the proposed project activity, the option of buying the Chlorate from the local market is available to the Project Proponent. Nevertheless, the Project Proponent would like to have the flexibility of installing a Chlorate plant at a later stage, without affecting the baseline definition of the proposed project activity. As a result, the Project Proponent decided to include a Chlorate plant in the baseline

[4] Chlorate is used as a bleaching agent for the pulp.

pulp mill design from the very beginning. Since the same Chlorate plant would be installed with or without the implementation of the proposed CDM project, the inclusion of the Chlorate plant in the baseline pulp mill has the following implications:

1. It leads to a more conservative emission reduction calculation. The energy / mass balance of the baseline pulp mill with a Chlorate plant will be self-sufficient in electric power generation. Since the Chlorate plant will not be installed right away, without the Chlorate plant, the baseline pulp mill would be able to generate some surplus power to the grid[5]. According to the ACM0006 (Version 11.1), this power must be considered part of the baseline and therefore will be subtracted from the actual power generation of the project plant. This will result in a lower amount of emission reductions and therefore to a more conservative outcome.

2. The inclusion of the Chlorate plant in the baseline pulp mill design ensures the validity of the baseline, in case the Project Proponent decides to install the Chlorate plant at a later stage. The key argument in this case is that the same Chlorate plant would be installed with or without the implementation of the CDM project activity[6].

3. A conservative baseline scenario definition leads to a more conservative baseline pulp mill design[7]. This is very important, since as will be seen in subsequent sections of this PDD, the Project Proponent will have to use some parameters from the baseline pulp mill energy / mass balance for the proposed project emission reduction calculation. Since the baseline pulp mill definition is conservative, the efficiencies, capacities, load factors, etc. parameters derived from the baseline pulp mill definition will also be conservative.

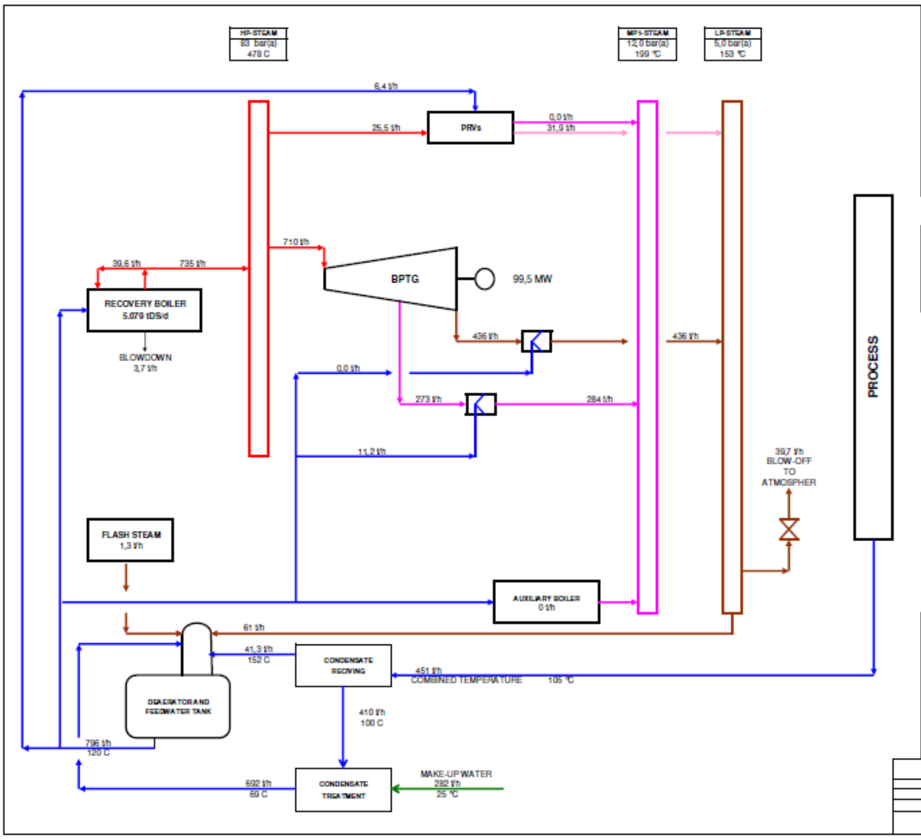
The following diagrams below show the energy/mass balances of the conventional BAU pulp mill and the project pulp mill. It must be noted that these diagrams (and the corresponding energy/mass balance calculations) will be used later in this PDD to determine some parameters that will be used to calculate the emission reductions of this project activity.

[5] It is estimated that the Chlorate plant will represent an electric power consumption of 7.9 MW, on average.

[6] The electricity consumption of the Chlorate plant is associated to the pulp mill's capacity and not to the proposed CDM project activity.

[7] It will be shown later in this PDD, that self-sufficiency in electric power generation is a conservative baseline in the relevant geographical region, since many (modern) pulp mills have to import power from the grid.

Punta Pereira pulp mill with no surplus power generation



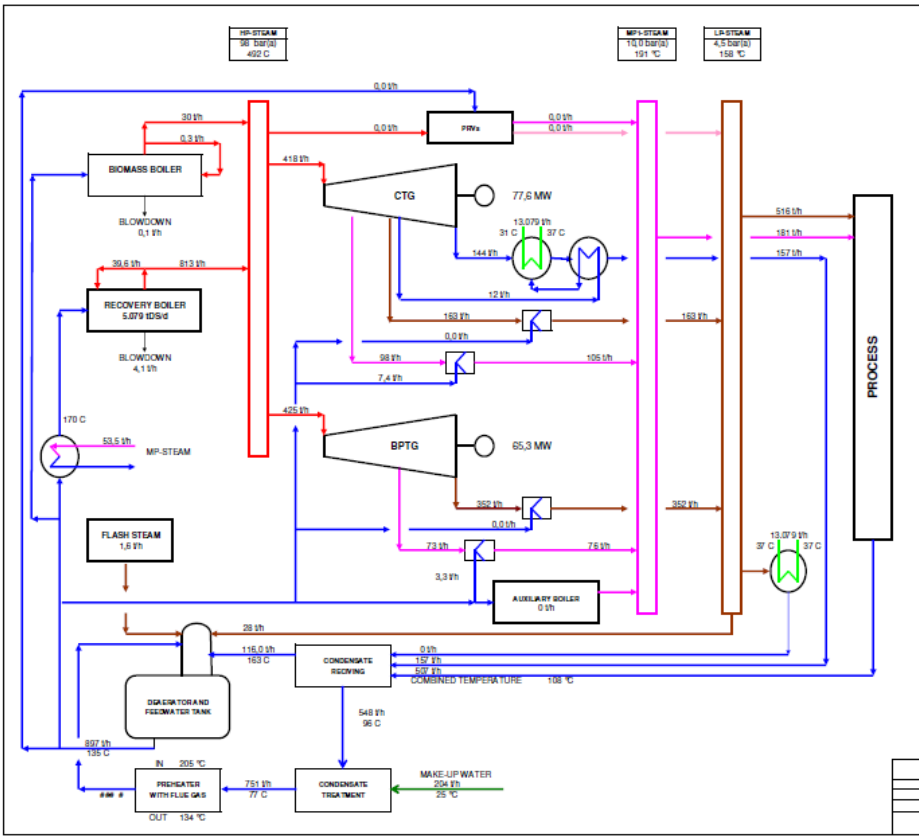
STEAM / FEEDWATER BALANCE			
	FLOW	HEAT	
	T/H	GJ/H	GJ/ADT
TOTAL STEAM GEN.	796,0	2.216	14,48
RECOVERY BOILER	778,5	2.174	14,21
AUXILIARY BOILER		0	0
DESUPERHEATING WATER	17,6	-	-
FEED WATER PUMPS	-	13	0,08
MAKE-UP WATER	-	29	0,19
CONSUMPTION PROCESS	796,0	#REF!	#REF!
SOOT BLOWING	39,6	115,0	0,75
BLOW-DOWN & HP-STEAM LOSSES	3,7	#REF!	#REF!
MP1-STEAM	284,4	718,5	4,70
LP-STEAM	428,7	891	5,82
STEAM BLOW-OFF	39,7	109,1	0,71
CONSUMPTION POWER GEN.		377,0	2,46
BPTG		377,0	2,46
BALANCE	0,0	#REF!	#REF!

FUEL DATA			
	FLOW	LHV	DRY SOLIDS
RECOVERY BOILER	TDS/D	GJ/TDS	%DS
BLACK LIQUOR	5.079	12,34	74
CNCG	54,0	6,12	87,5
METHANOL	44,1	18,93	80,00
AUXILIARY BOILER			
FUEL OIL	0	39	100

POWER BALANCE		
	POWER	SPEC POWER
	MW	kWh/ADT
PULP MILL CONSUMPTION	81,6	533
CHLORAT PLANT	14,9	97,3
PEROXID PLANT	0,0	0,0
OXYGEN PLANT	3,0	19,9
ClO2-PLANT	1,3	8,4
SUM CHEMICAL PLANTS	19,2	125,5
TOTAL CONSUMPTION	99,5	650
BPTG	99,5	650,2
TOTAL POWER GENERATION	99,5	650
EXPORT / IMPORT	0,0	0,0

MONTES DEL PLATA		
STEAM AND POWER BALANCE		
BASE LINE CASE SCENARIO		
OPERATING CONDITIONS	Average	
	Annual production 1.300.000 ADt/a	Production rate 3.672 ADt/d

Punta Pereira pulp mill with surplus power generation



STEAM / FEEDWATER BALANCE	FLOW	HEAT	
	T/H	GJ/H	GJ/ADT
TOTAL STEAM GEN.	897,4	2.466	16,12
RECOVERY BOILER	856,6	2.246	14,68
POWER BOILER	30,1	80	0,52
AUXILIARY BOILER		0	0
DESUPERHEATING WATER	10,7	-	-
FEED WATER PUMPS	-	16	0,10
CONDENSATE PREHEATING	-	31	0,20
MAKE-UP WATER	-	94	0,61
CONSUMPTION PROCESS	740,9	1.620,5	12,5
SOOT BLOWING	39,9	113,2	2,68
BLOW-DOWN	4,2	6,1	0,04
MP1-STEAM	181,0	330,1	2,16
LP-STEAM	515,7	1171,1	7,65
CONSUMPTION POWER GEN.	156,5	744,7	4,9
CTG	156,5	277,5	3,05
BPTG		467,2	1,81
BALANCE	0,0	101,1	-1,3

FUEL DATA	FLOW	LHV	DRY SOLIDS
RECOVERY BOILER	TDS/D	GJ/TDS	%DS
BLACK LIQUOR	5.079	12,59	80
CNCG	54,0	6,47	87,5
METHANOL	44,1	18,93	80,00
BIOMASS BOILER			
BIOMASS RESIDUES	149,31	14,64	47,7
AUXILIARY BOILER			
FUEL OIL	0	0	0

POWER BALANCE	POWER	SPEC POWER
	MW	kWh/ADT
PULP MILL CONSUMPTION	80,9	529
CHLORAT PLANT	14,9	97,3
PEROXID PLANT	0,0	0,0
OXYGEN PLANT	3,0	19,9
ClO2-PLANT	1,3	8,4
SUM CHEMICAL PLANTS	19,2	125,5
TOTAL CONSUMPTION	100,1	654
CTG	77,6	507,0
BPTG	65,3	426,7
TOTAL POWER GENERATION	142,9	934
EXPORT / IMPORT	42,7	279,4

MONTES DEL PLATA
STEAM AND POWER BALANCE
PROJECT CASE

OPERATING CONDITIONS	Average	
	Annual production	Production rate
	1.300.000 ADt/a	3.672 ADt/d

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

Chosen crediting period:	Three 7-year crediting periods (21 years)
Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
2013 2014 2015 2016 2017 2018 2019	85,537 120,804 127,359 133,720 139,893 145,884 151,698
Total estimated reductions (tonnes of CO_2 e)	**904,895**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**129,271**

A.4.5. Public funding of the project activity:

The financial plans for the proposed project activity do not involve public funding.

SECTION B. Application of a baseline and monitoring methodology

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

The name of the approved baseline methodology applicable to the proposed project activity is:

ACM0006 (Version 11.1), "Consolidated methodology for electricity and heat generation from biomass residues".

The proposed project activity also relies on the application of the latest versions of the following methodological tools (referenced in the ACM0006 (Version 11.1)):

- "Tool to determine the baseline efficiency of thermal or electric energy generation systems" (Version 01).
- "Tool to calculate the emission factor for an electricity system" (Version 02.2).
- "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (Version 05).
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02).

- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01).

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

The Punta Pereira biomass power plant project activity is a biomass cogeneration power plant that generates electricity and thermal energy from renewable energy sources.

Paragraph 48 of the Marrakesh Accords stipulates that:

"In choosing a baseline methodology for a project activity, project participants shall select from among the following approaches the one deemed most appropriate for the project activity taking into account any guidance by the executive board, and justify the appropriateness of their choice:

a) Existing actual or historical emissions, as applicable; or,
b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 percent of their category.

Since the project activity will serve to reduce emissions from existing emission sources and that biomass is not normally used to generate surplus electric power to the grid, approach a) seems to be the applicable option in selecting the baseline scenario for the Punta Pereira project activity.

According to the chosen baseline methodology, the Punta Pereira biomass power plant fully complies with the applicability criteria:

- The proposed project activity includes the installation new plants at a site where currently no power and heat generation occurs. Therefore it is a "power greenfield" project.

Further requirements of the baseline methodology are also fulfilled by the proposed project activity:

- **No other biomass types than biomass residues are used in the project plant.** The Punta Pereira biomass power plant will use biomass residues from the Kraft pulping process: black liquor, bark, sawdust, among others.

- **Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 50% of the total fuel fired on an energy basis.** As will be shown in the subsequent sections of this PDD, some fossil fuel will be co-fired for operational reasons (start-up operations, shut-down operations, etc.). To a limited extent, some fossil fuel might also be used in order to enhance the economic performance of the power plant.

- **For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process.** The biomass generated in the Punta Pereira pulp mill is absolutely determined by the processing capacity of the pulp mill. This capacity has already been established and it is 1,300,000 (ADt/yr). This capacity will not change due to the implementation of the project activity.

- **The biomass residues used by the project facility are not stored for more than one year.** The black liquor is a by-product of the Kraft cycle and is normally burned in a dedicated boiler (the recovery boiler) to recover and recycle the inorganic compounds required in the pulping process. For that reason, it is not stored in the pulp mill. The biomass used in the power boiler (bark and sawdust mix and primary sludge) will be stored in a dedicated place in the Punta Pereira pulp mill site. However, the storage time of that biomass will no be higher than (approximately) one week (total biomass stored/consumption rate of biomass). This ensures that these biomass residues do not decompose and generate methane.

- **The biomass residues used by the project facility are not obtained from chemically processed biomass (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical- degradation, etc.) prior to combustion. Moreover, the preparation of biomass-derived fuel does not involve significant energy quantities, except from transportation or mechanical treatment so as not to cause significant GHG emissions.** The proposed project activity contemplates the utilization of the biomass residues that are generated in the Kraft pulping process, in the same condition as they are generated. No bio or chemical treatment is involved whatsoever. In some cases, the proposed project activity involves marginal drying of some of the biomass residues, which is done in order to improve energy efficiency of the biomass power plant.

- **The methodology is only applicable if the most plausible baseline scenario, as identified per the "Selection of the baseline scenario and demonstration of additionality" section hereunder, is:**

  - For power generation: Scenarios P2 to P7, or a combination of any of those scenarios.
  - For heat generation: Scenarios H2 to H7, or a combination of any of those scenarios.
  - For biomass residue use: Scenarios B1 to B8, or any combination of those scenarios. For scenarios B5 to B8, leakage emissions should be accounted for as per the procedures of the methodology.

As will be shown in subsequent sections of this PDD, the corresponding baseline scenarios for power, heat and biomass use are:

- Power: P5 and P7.
- Heat: H5.
- Biomass use: B4 and B2.

According to the above, the proposed project activity fully complies with the applicability conditions of this methodology.

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

	Source	Gas	Included?	Justification / Explanation
Baseline	Electricity generation	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Heat generation	CO_2	Included	Main emission source. It must be noted though, that the proposed project activity does not claim emission reductions due to heat displacement. Heat generation in the new cogeneration facility is accomplished using renewable, carbon-neutral biomass residues.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	All biomass used in the project activity come from renewable sources. It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Included	The additional biomass residues used under the project activity, if not used for power generation, would be dumped in a dedicated landfield for natural decay.
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources.[a]
Project Activity	On-site fossil fuel and electricity consumption due to the project activity (stationary or mobile)	CO_2	Included	In this case it is included; however it is a very minor emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.[b]
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.[b]
	Off-site transportation of biomass residues	CO_2	Excluded	Not included in this case, since there is no transportation of biomass residues due to the project activity.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.[b]
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.[b]
	Combustion of surplus biomass residues for electricity generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Included	This emission source must be included, since CH_4 emission from uncontrolled burning or decay of biomass residues in the baseline scenario are included.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small.

	Storage of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, the emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Waste water from treatment of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF
		CH_4	Excluded	The proposed project activity does not contemplate waste water treatment under anaerobic conditions; therefore this emission source is excluded in this case.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be small.

a. Note that the emission factors for CH_4 and N_2O emissions from uncontrolled burning or decay of dumped biomass residues are highly uncertain and depend on many site-specific factors. Quantification is difficult and may increase transaction costs significantly. Note also that CH_4 and N_2O emissions from the natural decay or uncontrolled burning are in some cases (e.g. natural decay of forest residues) not anthropogenic sources of emission included in Annex A of the Kyoto Protocol and should not be included in the calculation of baseline emissions pursuant to paragraph 44 of the modalities and procedures for the CDM.

b. CH_4 and N_2O emission factors depend significantly on the technology (e.g. vehicle type) and may be difficult to determine for project participants. Exclusion of this emission source is not a conservative assumption; however, it appears reasonable, since CH_4 and N_2O from on-site use of fossil fuels and transportation are expected to be very small compared to overall emission reductions, and since it simplifies the determination of emission reductions significantly.

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

According to the ACM0006 (Version 11.1), project participants shall identify the most plausible baseline scenario and demonstrate additionality using the steps outlined in the “Selection of the baseline scenario and demonstration of additionality” section of the methodology.

Step 1: Identification of alternative scenarios.

Step 1a: Definition of realistic alternative scenarios that are available to the project participants and that provide outputs or services with comparable quality, properties and application areas as the proposed CDM project activity.

According to page 14/72 of the ACM0006 (Version 11.1), in identifying the relevant alternative scenarios, the Project Proponent shall provide an overview of other technologies or practices that provide outputs or services with comparable quality, properties and application areas as the proposed CDM project activity and that have been implemented previously or are currently underway in the relevant geographical area. It is also recommended that the relevant geographical area should include preferably ten facilities (or projects) that provide outputs or services with comparable quality, properties and application areas as the proposed CDM project activity. In case less than ten facilities (or projects) are found in the region/host country, the geographical area may be expanded accordingly.

As will be shown in subsequent sections of this PDD, the Punta Pereira CDM project activity will be located in a Free trade zone in Uruguay. The tax benefit associated to this location is crucial for the viability of the new pulp mill project and therefore, for the proposed project activity. As a result, this constitutes a very relevant and particular circumstance related to the implementation of the proposed project activity.

The host country, Uruguay, is a small country and does not count with ten projects similar to the proposed project activity. Therefore, and only for the purpose of analyzing possible and realistic baseline project options, the Project Proponent decided to expand the relevant geographical area to five countries:

- Uruguay
- Paraguay
- Argentina
- Chile
- Brazil. Due to the size of this country and the different conditions found within, the Project Proponent only considered the states that are in the vicinity of Uruguay: Rio Grande do Sul, Santa Catarina and Parana (south part of the country).

This expanded geographical area does count with more than ten pulp mill facilities (not counting CDM projects) similar and comparable to the Punta Pereira pulp mill. However, it must be noted that due to the particular conditions under which the proposed project will be implemented (e.g. the Free trade zone in Uruguay), strictly speaking, the expanded geographical region is not really adequate for analysing and assessing the effects that each and every barrier presented in this PDD will have to the proposed project in this case. For example, the conditions associated to the Free trade zone in Uruguay impose restrictions that are not the same as in the rest of Uruguay or as in the expanded geographical region. On the other side, some of the barriers that will be presented below are applicable and valid within the entire geographical region.

As previously mentioned, the proposed project activity implies the generation of 43 MW (average) of surplus power capacity to the grid. To achieve this, the following types of biomass residues will be used:

- Black liquor.
- Methanol.
- CNCG (residual gases from the pulping process)[8].

[8] As black liquor, Methanol and the CNCG are also biomass residues generated in the Kraft pulping process. However, Methanol and CNCGs represent less than 2% of the total energy contribution of the biomass fuels used in the power plant. These biomass residues have been considered in the project activity (i.e. are actively monitored) only to fully comply with the requirements of the ACM0006 methodology.

- Fines from chip-screening.
- Combined bark and wood from wood yard.
- Primary sludge.

Given that the proposed project activity implies the construction of a new pulp mill, the tables below present different project alternatives that can be considered plausible baseline scenarios for the proposed project plant. In each option, it is mentioned the feasibility of becoming the baseline scenario for the proposed project activity. It is also described the situation of power and heat generation, biomass consumption and how this situation compares to the one observed in the project plant. Finally, it is addressed what would happen to any differences in power and heat generation and biomass consumption between each alternative and the project plant, in the absence of the proposed project activity.

1. The proposed CDM project activity: a pulp mill with surplus power generation capacity.
This pulp mill would incorporate a series of technological improvements that would allow the facility to inject a considerable amount of surplus power to the grid. Under this configuration, the pulp mill would function as a grid-connected power plant.
<u>Technical assumptions</u> Under this scenario, installed capacities, load factors, energy efficiencies, fuel mixes and equipment configuration correspond to the proposed project activity and are fully described in this PDD. Therefore they will not be presented again in this section.
<u>Power generation:</u> Power would be generated in the new pulp mill. Part of this power would be for self-consumption, while the remaining power capacity would be available to the grid. The applicable baseline for all the power generation would be: P1.
<u>Heat generation:</u> All the process heat required by the pulp mill would be generated in the cogeneration plant inside the pulp mill, using mainly black liquor. The applicable baseline scenario for the heat would be: H1.
<u>Biomass residues:</u> As in the proposed project activity, the same biomass types and amounts would be used as fuel for heat and power cogeneration in the power plant. The applicable baseline scenarios for the biomass types would be: • Black liquor: B4 • Methanol: B4 • CNCG: B4 • Fines from chip-screening: B4 • Combined bark and wood from wood yard: B4 • Primary sludge: B4

2. Conventional pulp mill, with a marginal deficit in power generation.

This is the standard practice in the Pulp and Paper industry in the world. The technology for this type of pulp mill is proven and fully developed in the relevant geographical region and in the world. Under this scenario, the pulp mill would be self-sufficient in heat generation and would present a marginal power deficit, which would be sourced from the external grid. The mill would also rely on the external grid for start-ups and other contingencies.

Technical assumptions

Equipment configuration: Similar to the CDM project case scenario. The pulp mill would have the same power generation capacity of the project pulp mill; however, it would not have a second biomass boiler for burning fines from chip-screening, bark and wood from wood yard and the primary sludge from the effluent treatment plant. The pulp mill would not count either with any of the energy-efficiency improvements that make surplus power generation under the CDM project case scenario possible.

The Project Proponent considers this scenario plausible and credible, since the turbogenerators that could be used under this scenario, were part of the assets acquired by Celulosa y Energy Punta Pereira S.A. from Ence.

Installed capacities

Back-pressure heat engine: 88.65 MW.
Condensing with extraction heat engine: 90.047 MW.

Recovery boiler: Heat to steam capacity 679 MW. Dry solid capacity: 5,710 tDS/d.
Auxiliary fossil fuel boiler: 95 MW (not used in the normal operation).

Load factors:

Heat engines (combined): 54.4%.
Heat generator (recovery boiler): 89%.

Efficiencies:

Heat engines (combined): 0.04642 (MW/GJ).
Heat generator (based on NCV-dry basis): 76.24%.

Fuel mixes:

Recovery boiler:
Black liquor: 1,797,966 (tDS/yr).
Methanol: 15,611 (Dry ton/yr).
CNCG: 19,116 (Dry ton/yr).
Fuel oil: 135.2 (ton/yr).
Diesel: 0 (ton/yr).

Fossil fuel boiler:
Fuel oil: 1,751 (ton/yr).
Diesel: 0 (ton/yr).

The figures above have been obtained from a detailed energy / mass balance carried out specifically for

this pulp mill configuration. In order to clearly and accurately assess the power generation situation of the pulp mill under this scenario, the Project Proponent requested the power generation outputs directly from the turbogenerator manufacturer, Siemens. According to this information, the pulp mill would present a marginal power deficit of approximately 4 MW. This means that without the energy-efficiency improvement initiatives contemplated under the proposed CDM project activity, the Punta Pereira pulp mill would be self-sufficient in heat generation but would present a marginal deficit in power generation. This deficit would be compatible with the normal practice of the Pulp and Paper industry in the relevant geographical region (see barrier analysis section of this PDD); therefore it could be regarded as a credible, plausible and realistic project alternative scenario. The energy / mass balance of the pulp mill under this scenario was duly presented to the DOE, together with all the supporting evidence from Siemens and the corresponding technical consultant appointed for this task, during the validation of the proposed project activity.
Power generation: Part of the power required by the pulp mill would be generated in the cogeneration plant inside the pulp mill, while the rest would have to be sourced power plants in the grid. Since there would be no surplus power generated to the grid, it would also have to be supplied by grid-connected power plants. The applicable baseline for power would be: • The majority of the power required by the pulp mill: P5. • The remaining power generated under the project activity (i.e. slightly higher than the surplus power generated under the proposed project activity): P7.
Heat generation: All the process heat required by the pulp mill would be generated in the cogeneration plant inside the pulp mill, using mainly black liquor. The applicable baseline scenario for the heat would be: H5.
Biomass residues: The same amount of black liquor, methanol and CNCG would be used to cogenerate heat and power. No biomass residues from the wood handling process and primary sludge would be used as fuel in this case. These unused biomass residues would be dumped in a dedicated landfield, near the pulp mill facility. The applicable baseline scenarios for the biomass types would be: • Black liquor: B4 • Methanol: B4 • CNCG: B4 • Fines from chip-screening: B2 • Combined bark and wood from wood yard: B2 • Primary sludge: B2

3. Conventional self-sufficient pulp mill, without surplus power generation capacity.

This is the standard practice in the Pulp and Paper industry in the world. The technology for this type of pulp mill is proven and fully developed. Under this alternative, the pulp mill would be totally self-sufficient in heat and electric power generation and would have to rely on the external grid for start-ups and other contingencies.

Technical assumptions

Equipment configuration: The pulp mill would be equipped with one higher capacity (112.6 MW) back-pressure heat engine, one heat generator (the recovery boiler), the auxiliary fossil fuel boiler, but would not have a second biomass boiler for burning fines from chip-screening, bark and wood from wood yard and the primary sludge from the effluent treatment plant. The pulp mill would not count either with any of the energy-efficiency improvements that make surplus power generation under the CDM project case scenario possible.

The Project Proponent considers this scenario plausible and credible, since the current tendency in the Pulp and Paper industry in the relevant geographical region is 100% self-sufficiency of heat and electric power generation in the pulp mill facility. For that reason, this baseline alternative must be considered.

Installed capacities

Back-pressure heat engine: 112.6 MW.

Recovery boiler: Heat to steam capacity 679 MW. Dry solid capacity: 5,710 tDS/d.
Auxiliary fossil fuel boiler: 95 MW (not used in the normal operation).

Load factors:

Heat engine: 89%.
Heat generator (recovery boiler): 89%.

Efficiencies:

Heat engine: 0.04947 (MW/GJ).
Heat generator (based on NCV-dry basis): 76.24%.

Fuel mixes:

Recovery boiler:
Black liquor: 1,797,966 (tDS/yr).
Methanol: 15,611 (Dry ton/yr).
CNCG: 19,116 (Dry ton/yr).
Fuel oil: 135.2 (ton/yr).
Diesel: 0 (ton/yr).

Fossil fuel boiler:
Fuel oil: 1,751 (ton/yr).
Diesel: 0 (ton/yr).

The figures above have been obtained from a detailed energy / mass balance carried out specifically for this pulp mill configuration. According to this information, the pulp mill would be totally self-sufficient

in heat and electric power generation. This situation is in full compliance with the normal practice of the Pulp and Paper industry in the relevant geographical region (see barrier analysis section of this PDD); therefore it could be regarded as a credible, plausible and realistic project alternative scenario.

As in the previous case, a detailed energy / mass balance of the pulp mill under this scenario was duly presented to the DOE, together with all the supporting evidence from the corresponding technical consultant appointed for this task.

Power generation: Power would be generated in the cogeneration plant inside the pulp mill, but only to the extent of supplying the pulp mill's internal power requirements. Since no surplus power would be generated, in the absence of the proposed project activity this power would be generated by power plants in the grid.

The applicable baseline for power would be:

- The power required by the pulp mill: P5.
- The remaining surplus power to the grid: P7.

Heat generation: All the process heat required by the pulp mill would be generated in the cogeneration plant inside the pulp mill, using mainly black liquor.

The applicable baseline scenario for the heat would be: H5.

Biomass residues: The same amount of black liquor, methanol and CNCG would be used to cogenerate heat and power. No biomass residues from the wood handling process and primary sludge would be used as fuel in this case. These unused biomass residues would be dumped in a dedicated landfield, near the pulp mill facility.

The applicable baseline scenarios for the biomass types would be:

- Black liquor: B4
- Methanol: B4
- CNCG: B4
- Fines from chip-screening: B2
- Combined bark and wood from wood yard: B2
- Primary sludge: B2

4. Conventional self-sufficient pulp mill, with a conventional fossil fuel power unit as a back-up.
This alternative is similar to the previous one, in that the pulp mill would generate 100% of its own heat power internally, but would back its power requirements with a dedicated gas/diesel power unit. This alternative would allow electric power back-up, which can be used under contingencies (i.e. plant stops and maintenances) and would allow the Project Proponent to generate surplus power to the grid under favourable electricity prices.
Technical assumptions

Equipment configuration: The pulp mill configuration would be exactly the same as in the previous case, except that it would count with a conventional fossil fuel power unit as a back-up. The capacity of this power unit could be similar to the surplus power generating capacity of the project pulp mill. Installed capacity: Diesel turbine (open cycle): 50 to 60 MW. Load factor: 25% (considering similar units in the last 3 years). The load factor is determined by how much the fossil fuel power unit was dispatched during the year. Efficiency: 25% to 40%, depending on the technology (industrial v/s aero-derivative turbine). Fuel type: Diesel (with option for natural gas). The amount of fossil fuel is determined by how much the fossil fuel power unit was dispatched during a certain year.
Power generation: Power would be generated in the cogeneration plant inside the pulp mill, but only to the extent of supplying the pulp mill's internal power requirements. The remaining power generated under the project activity would be generated by the fossil fuel power unit. The applicable baseline for power would be: • The power required by the pulp mill: P5. • The remaining surplus power to the grid: P5 and P7 (it is possible that some of the surplus power generated by the project plant would have to be generated by grid-connected power plants, since the electricity generated by the fossil fuel power unit would depend on how much this unit is dispatched, which at the same time depends on the grid electricity price levels).
Heat generation: All the process heat required by the pulp mill would be generated in the cogeneration plant inside the pulp mill, using mainly black liquor. The applicable baseline scenario for the heat would be: H5.
Biomass residues: The same amount of black liquor, methanol and CNCG would be used to cogenerate heat and power. No biomass residues from the wood handling process and primary sludge would be used as fuel in this case. These unused biomass residues would be dumped in a dedicated landfield, near the pulp mill facility. The applicable baseline scenarios for the biomass types would be: • Black liquor: B4 • Methanol: B4 • CNCG: B4 • Fines from chip-screening: B2 • Combined bark and wood from wood yard: B2 • Primary sludge: B2

5. Pulp mill designed to generate additional electric power at a lower efficiency.
This scenario would be similar to the proposed project plant, in that both pulp mills could generate surplus power to the grid. However under this scenario, the pulp mill would have a lower electric efficiency and therefore would generate a lower power surplus to the grid.
Technical assumptions Under this scenario, installed capacities, load factors, fuel mixes and equipment configuration would be the same as in the proposed project activity. Efficiency values (i.e. of the heat generators and heat engines) would be lower than those in the project plant. This would mean that the pulp mill would still be self-sufficient in heat generation but would generate less surplus power to the grid. This could be accomplished by eliminating some of the energy-efficiency improvements considered under the proposed CDM project activity. Each the technical improvement is clearly addressed in subsequent sections of this PDD.
Power generation: The main fraction of the power generated under the project plant would be generated by the pulp mill contemplated in this project option. The remaining power would be generated by power plants in the grid. The applicable baseline for power would be: • The power required by the pulp mill and a fraction of the surplus power to the grid contemplated under the project activity: P5. • The remaining surplus power to the grid: P7.
Heat generation: All the process heat required by the pulp mill would be generated in the cogeneration plant inside the pulp mill, using mainly black liquor. The applicable baseline scenarios for the heat would be: H5.
Biomass residues: The same amount of black liquor, methanol and CNCG would be used to cogenerate heat and power. No biomass residues from the wood handling process and primary sludge would be used as fuel in this case. These unused biomass residues would be dumped in a dedicated landfield, near the pulp mill facility. The applicable baseline scenarios for the biomass types would be: • Black liquor: B4 • Methanol: B4 • CNCG: B4 • Fines from chip-screening: B2 • Combined bark and wood from wood yard: B2 • Primary sludge: B2

To complement the information provided above, the Project Proponent will explicitly refer to the other possible baseline scenarios (i.e. the ones that were not addressed above), proposed by the ACM0006 (Version 11.1) for power and heat:

Power:

P2: If applicable, the continuation of power generation in existing power plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes and equipment configuration) as those observed in the most recent three years prior to the starting date of the project activity.

This scenario is not applicable in this case, since there are no existing power plants in the project activity site.

P3: If applicable, the continuation of power generation in existing power plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the starting date of the project activity.

This scenario is not applicable in this case, since there are no existing power plants in the project activity site.

P4: If applicable, the retrofitting of existing power plants at the project site. The retrofitting may or may not include a change in fuel mix.

This scenario is not applicable in this case, since there are no existing power plants in the project activity site.

P6: The generation of power in specific off-site plants, excluding the power grid.

This scenario is possible but not likely/realistic for the Punta Pereira project activity. If the Project Proponent decided to install an additional power plant (different from the one that would be built under the project activity), it would have to be located within the project activity site, in the free-trade zone. The Project Proponent does not own land outside the free trade zone for the Punta Pereira pulp mill project. Consequently, this would change this scenario to P5, which has already been addressed above.

Heat:

H2: If applicable, the continuation of heat generation in existing plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes and equipment configuration) as those observed in the most recent three years prior to the project activity.

This scenario is not applicable in this case, since there are no existing heat plants in the project activity site.

H3: If applicable, the continuation of heat generation in existing plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the project activity.

This scenario is not applicable in this case, since there are no existing heat plants in the project activity site.

H4: If applicable, the retrofitting of existing plants at the project site. The retrofitting may or may not include a change in fuel mix.

This scenario is not applicable in this case, since there are no existing heat plants in the project activity site.

H6: The generation of heat in specific off-site plants.

This scenario is not applicable in this case, since there are no existing off-site heat plants nearby the project activity site. Furthermore, in the extremely unlikely event the Project Proponent decided to build an additional heat plant, it would have to be in the project site (i.e. on-site heat plant), within the limits of the free-trade zone.

H7: The production of heat from district heating.

This scenario is not applicable in this case, since there is no district heating available in the vicinity of the project site. Furthermore, district heating is not used / available in Uruguay.

According to page 11/72 of the ACM0006 (Version 11.1), when defining plausible and credible alternative scenarios for the use of biomass residues, the baseline scenario for the use of biomass residues should be separately identified for different categories of biomass residues, covering the whole amount of biomass residues supposed to be used in the project activity during the crediting period, and consistent with the alternative scenarios selected for power and heat generation. This analysis is shown below.

B1: "The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields".

Black liquor, methanol and CNCG: These biomass residues are normally used for heat and power generation in pulp mills, so this baseline scenario is not applicable in this case.

Residues from wood handling[9] and primary sludge: According to the Uruguayan law (in this case, it is a proposal for a law[10], but in Uruguay this proposal is actually enforced), dumping these biomass residues in field for natural (aerobic) decomposition would be allowed if the biomass residues were returned to

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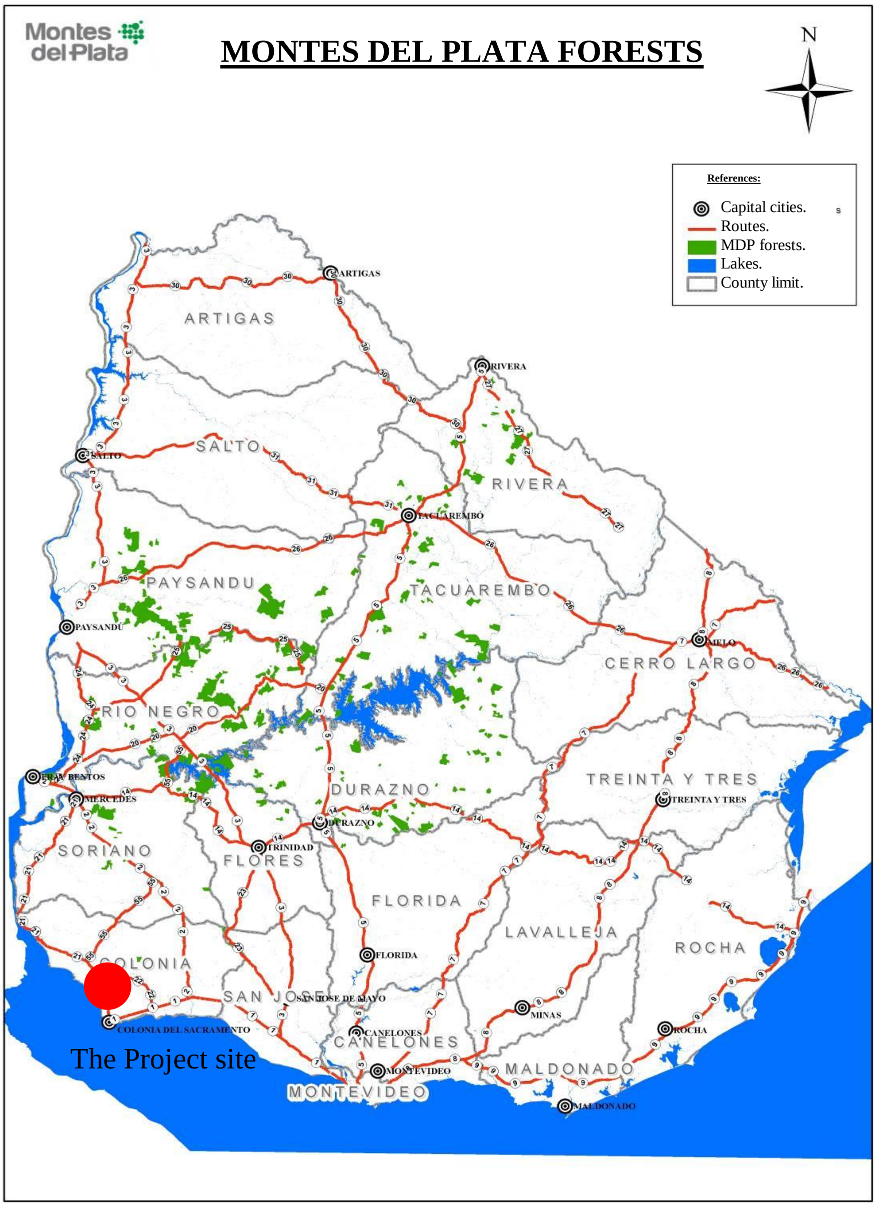
[9] In this case, "Residues from wood handling" refers to "Fines from chip-screening" and "Combined bark and wood from wood yard".

[10] See "Propuesta técnica para la Reglamentación; Gestión integral de Residuos Sólidos Industriales, agroindustriales y de servicios" (Technical proposal for the management of solid wastes in the agricultue and service industries) http://www.dinama.gub.uy/index.php?option=com_docman&task=cat_view&gid=102&Itemid=367

the forest fields from where the wood for the pulp mill was sourced[11]. However, in this case the forest plantations are located so far away from the project plant that it is not economically viable to transport and dispose these residues in this way.

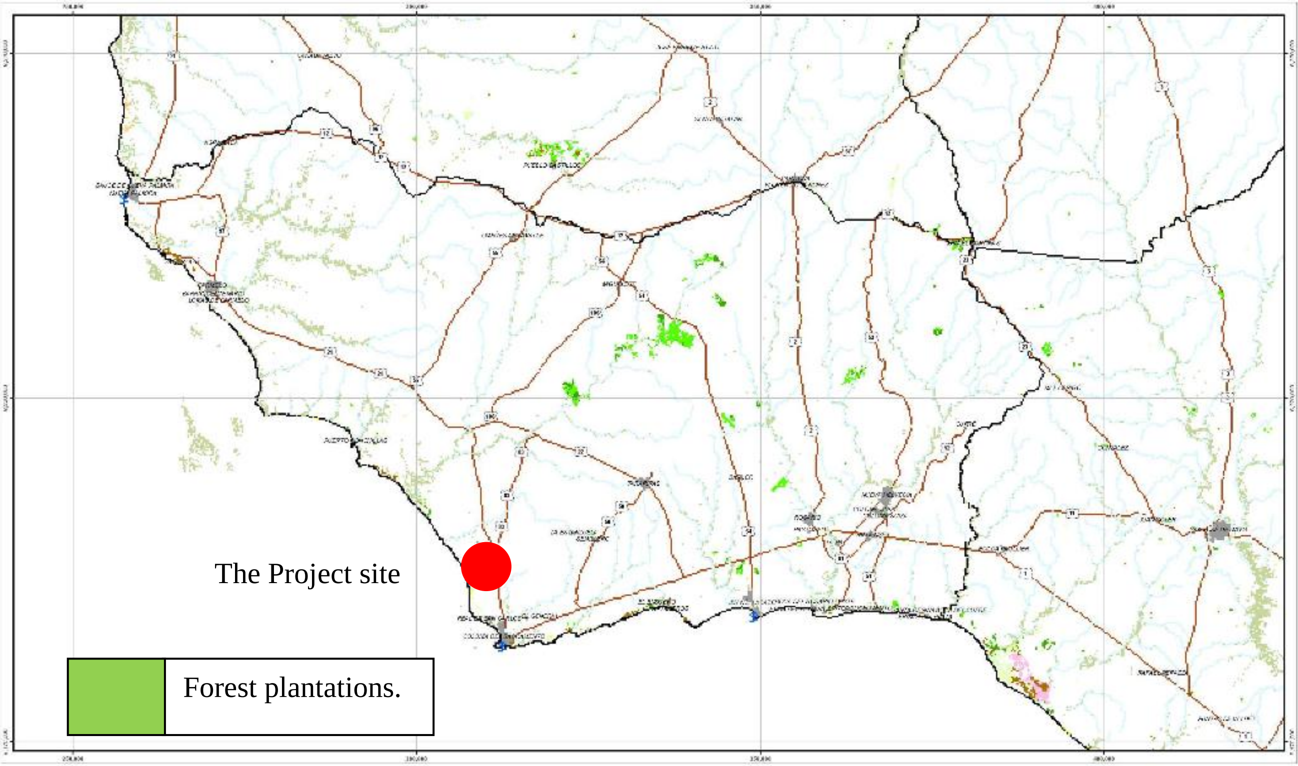
The figure below shows the distribution of the plantations that are property of the company[12] and the distribution of the forested areas in Colonia's Department:



[11] The UPM pulp mill in Uruguay, currently registered as a CDM project activity (Ref. N° 1493) and which is similar to the proposed project activity, does not have a power boiler; therefore it transports these biomass residues back to the forests.

[12] "Análisis de la disponibilidad de material prima y lineamientos para la evaluación ambiental estratégica de las actividades forestales en la región suroeste" (Analysis of the availability of raw material and guidelines for the environmental evaluation of forestry activities in the southwest region"); presented to DINAMA on October 6th , 2010.

FOREST MAPPING OF COLONIA



Source: http://www.mgap.gub.uy/portal/hgxpp001.aspx?7,20,438,O,S,0,

In addition, according to the bibliography consulted, the departments of Colonia, Flores and San José are locations with the least forested areas. This ratifies that it is not feasible or economically realistic to dispose the biomass residues on fields. As a result, this does not seem a likely and realistic baseline scenario for the biomass residues generated under the project plant.

B2: "The biomass residues are dumped and left to decay under clearly anaerobic conditions. This applies, for example to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields".

Black liquor, methanol and CNCG: These biomass residues are normally used for heat and power generation in pulp mills, so this baseline scenario is not applicable in this case.

Residues from wood handling and primary sludge: If the installation of a power boiler were not considered in the project activity, these biomass residues would be dumped in a dedicated landfield near the pulp mill facility.

The Free Trade Zone site in which the pulp mill will be located contemplates a landfield with enough capacity to allocate the biomass residues from wood handling and primary sludge. The near location of the landfill is important due to the fact that it avoids having to transport solid wastes long distances out of the limits of the Free Trade Zone. The disposal of these biomass residues in a landfield is an option that is fully available to the Punta Pereira Project Proponent.

According to the project description of the landfill, drainage and leachate collection systems will be built and the leachate produced will be treated in the effluent treatment plant. Although the landfill project is deeper than 5 meters, it does not consider a system to burn the biogas[13].

According to the above, this appears to be a probable and realistic baseline scenario for these biomass type categories that will be generated in the project plant.

B3: "The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes".

Black liquor, methanol and CNCG: These biomass residues are normally used for heat and power generation in pulp mills, so this baseline scenario is not applicable in this case.

Residues from wood handling and primary sludge: Under the current Uruguayan regulations, uncontrolled burning of biomass residues is not allowed if they are generated in industrial facilities. Though there is no official national approved law that actually regulates industrial solid waste management in Uruguay, there is a proposal draft for the regulation of solid wastes generated from industrial activities. Though this proposal has not been approved yet, it is duly enforced by local authorities.

Sawdust, bark and sludge are solid wastes generated in the pulp production process, which is an industrial activity, so the proposal is applicable in this case. As a result, the producer of such residues is responsible for providing proper handling and final disposal (Please see point N° 3 of the document referred in the footnote below). Consequently, uncontrolled burning of these residues is not considered a feasible option in this case[14].

According to the above, this alternative does not appear to be a probable and realistic baseline scenario for the biomass residues that will be generated in the project plant.

B4: "The Biomass residues are used for power or heat generation at the project site in new and or existing plants".

Black liquor, methanol and CNCG: These biomass residues are normally used for heat and power generation in pulp mills, so this baseline scenario is applicable in this case.

Residues from wood handling and primary sludge: This alternative is not applicable in this case, since in the project site there are no new or existing power plants. The only new plant is the prospective CDM project plant.

[13] "Proyecto de Sitio de disposición final" (Final disposition site Project); presented to DINAMA on August, 21st, 2008 and ratified on September 16th, 2010.

[14] See "Propuesta técnica para la Reglamentación; Gestión integral de Residuos Sólidos Industriales, agroindustriales y de servicios" (Technical proposal for the management of solid wastes in the agricultue and service industries) http://www.dinama.gub.uy/index.php?option=com_docman&task=cat_view&gid=102&Itemid=367

B5: "The biomass residues are used for power or heat generation at other sites in new and/or existing plants"

Black liquor, methanol and CNCG: These residues are normally used for heat and power generation in the same pulp mill facilities where they are generated and not in other facilities. In addition, there are no other pulp mill facilities in the surrounding area where the Punta Pereira pulp mill will be located. As a result, this baseline scenario is not applicable in this case.

Residues from wood handling and primary sludge: According to the present conditions, the biomass residues such as the ones that would be generated under the project plant are not commercial products in Uruguay. Particularly, in the case of sawdust and bark, there is really no market for such residues. In the case of the sludge, it is definitely not a commercial product and therefore there is no market at all. This can be clearly confirmed by consulting the corresponding official statistics in Uruguay[15].

B6: "The Biomass residues are used for other energy purposes, such as the generation of biofuels".

Such option is not available in the case of the proposed project activity. In the case of biofuels, the technology is not developed and / or present in Uruguay. As a result, this baseline scenario is not applicable to any of the biomass types involved in the proposed project activity.

B7: "The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in process (e.g. in the pulp and paper industry)"

Black liquor, methanol and CNCG: These biomass residues are normally used for heat and power generation in pulp mills, so this baseline scenario is not applicable in this case.

Residues from wood handling and primary sludge: These biomass residues could be used as fertilizers, but previously they must be stabilized according to the proposal for regulation applicable to industrial solid wastes. It is also required a specific authorization from DINAMA. In addition, this alternative implies investment costs and the use of technologies that are not readily available in Uruguay for the moment. As a result, this baseline scenario is not a likely or realistic baseline scenario for these types of biomass residues.

B8: "Biomass residues are purchased from a market, or biomass residues retailers, or the primary source for the biomass residues and /or their fate in the absence of the project activity cannot be clearly identified"

As mentioned before, there is no developed market for any of the biomass residues types associated to the proposed project activity in Uruguay. As a result, the expected fate for these biomass residues would have to be in compliance with the outstanding rules and regulations currently enforced in the country, making the fate of these biomass residues reasonably known.

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[15] Please see the following statistics reports from the National Statistics Institute of Uruguay: http://www.mgap.gub.uy/Forestal/exportacionvalor.xls ; http://www.mgap.gub.uy/Forestal/importacionvalor.xls; http://www.mgap.gub.uy/Forestal/extraccionproduccion.xls; http://www.mgap.gub.uy/Forestal/consumo.xls.

As a result, this baseline scenario is not applicable to any of the biomass types associated to the proposed project activity.

Considering the analysis above, the baseline scenarios for the biomass residues can be established as follows:

BIOMASS CATEGORIES AND BASELINES

Biomass residues category k	Biomass residues type	Biomass residues source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (dry tonnes/yr)
1	Black liquor	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	1,797,966
2	Methanol	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	15,611
3	CNCG	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	19,116
4	Fines from chip-screening	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	25,185
5	Combined bark and wood from wood yard	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	20,638
6	Primary sludge	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	5,193

Source: Punta Pereira pulp mill feasibility studies.

As can be seen, only the black liquor, methanol and CNCG would be used for heat and power generation in the baseline scenario. Residues from wood-handling and primary sludge would simply be discarded and properly disposed in a dedicated landfield.

According to the analysis above, for the biomass categories N° 4, N° 5 and N° 6 for which the corresponding baseline scenario is B2, the following can be concluded:

- In the region from which these biomass residues will be obtained (the Punta Pereira pulp mill site and its surroundings), these residues types have not been collected or utilized (e.g. as fuel, fertilizer, or feedstock), but have been dumped in landfields and left to decay, without energy generation.

- In the case of the proposed project activity, the site from which these residues will be sourced can be unequivocally and clearly identified: the Punta Pereira project pulp mill site, inside the Free Trade Zone.

Consequently and according to page 13/72 of the ACM0006 (Version 11.1), there would be no leakage to be accounted for associated to the biomass types N° 4, N° 5 and N° 6: the fines from chip-screening, the combined bark and wood from wood yard and the primary sludge.

<u>Step 1b:</u> Consistency with mandatory applicable laws and regulations.

All project options presented above fully comply with the current regulations in Uruguay, since once the relevant permits are obtained from the corresponding national authorities, they do not face additional restrictions. As a result, all the four options are available for being the baseline scenario in this case.

Step 2: Barrier analysis.

Step 2a: Identification of barriers that would prevent the implementation of alternative scenarios.

The Project Proponent identified the following set of barriers that prevent alternative scenarios to occur:

Investment barriers: The Project Proponent has experience in the Pulp and Paper industry worldwide. However, it does not have any experience in the Power industry in Uruguay. The proposed project activity implies the direct participation of the Project Proponent in the Power Industry in Uruguay and contemplates a series of technological improvements and modifications to the conventional pulp mill design that are not common practice in the Pulp and Paper industry in the relevant geographical region or even, worldwide. These modifications, as will be shown subsequently in this PDD, pose additional (operational) risks that can affect not only the power generation business associated to the proposed CMD project activity but also, to the pulp operation itself.

With this into consideration, the financial institutions addressed by the Project Proponent to finance the Punta Pereira pulp mill project conditioned their willingness to do so provided the associated emission reduction project activity is registered under the CDM. The registration of the proposed project activity in this mechanism would provide the required financial returns that would contribute to mitigate the additional risks faced by the project plant.

The above is consistent with the fact that there are no projects similar to the proposed project activity, not registered in the CDM in Uruguay or in the relevant geographical region:

1. The only project in Uruguay comparable in technology, scale, practices and that takes place in a comparable environment with respect to the regulatory framework is the UPM pulp mill, which is a registered CDM project activity (Ref. N° 1493).

2. Other projects in the relevant geographical region, similar to the Punta Pereira pulp mill project and that are comparable in technology, scale; practices, etc. are all registered CDM project activities.

Technological barriers:

The proposed project activity faces several technological barriers:

- **Skilled and/or properly trained labour to operate (and maintain) power surplus generating pulp mill is not readily available in the relevant geographical region.** This translates into additional risks of underperformance of the investment in additional power generation.

  The more energy-efficient pulp mill requires skilled and trained staff in order to operate the facility in a way that both the pulp production and power generation are optimized. These types of skills are not readily available in the relevant geographical region and more specifically, in Uruguay. This can be

confirmed checking recent official studies by the Ministry of Labour and Social Security of Uruguay[16] that mention that companies in Uruguay are facing serious difficulties in recruiting staff with technical education, particularly in the areas of mechanics and electricity. This problem has also been addressed by the local press in Uruguay[17].

This lack of qualification results in a "trial-and-error" learning process which translates into underperformance not only of the assets related to electric power generation, but of the new pulp mill has a whole. This will be properly substantiated in the following sections of this PDD.

This barrier becomes more relevant, considering the particular context in which the proposed project is developed.

Small industrial sector

Uruguay is a small country (approximately 3.3 million inhabitants) and has a small industrial sector. There are several indicators that show this. For example, Uruguay is member of UNIDO, "United Nations Industrial Development Organization"[18]; an organization aimed at enabling countries to grow their productive sectors, increase their participation in international trade and care for the environment. Another indicator of a low industrial development is the small energy consumption index associated to industrial activities compared to other developing countries in South America.

The above is further illustrated by the fact that Uruguay has lower values for indicators of industrial performance such as MVA (Manufacturing Value Added, in national accounting concept) and GDP (Gross Domestic Product) for the average annual real growth rate (most of them during the period 2000-2005 year), than other developing countries in the region. This is shown in the following table below:

International comparisons of industrial performance

Indicator	Year/Period	Uruguay	Middle income (excl. China)	Developing Countries
Manufacturing Value Added (in national accounting), average annual real growth rate (in %).	2000-2005	2.34	4.52	6.62
	2005-2008	3.84	5.5	8.45
Non-manufacturing GDP, average annual real growth rate (in %).	2000-2005	0.56	3.65	4.93
	2005-2008	11.61	7.49	7.59
Manufacturing Value Added (in national accounting) per capita, at constant 2000 US$ prices.	2000	1051.94	377.48	256.88
	2005	1162.01	431.2	324.85
	2008	1278.74	485.26	395.18
Manufacturing Value Added (in national accounting) as percentage of GDP at constant 2000 prices.	2000	16.89	18.35	19.98
	2005	17.86	18.79	21.09
	2008	14.62	17.87	21.38

Source: Country reports at http://www.unido.org/index.php?id=1000313.

[16] "Preliminary report on the staff qualification needed for companies": Power Point presentation available at http://www.presidencia.gub.uy/sci/noticias/2010/12/presentacion_1312_brunini.pdf, and newspaper article on the presentation of this report available at http://www.ultimasnoticias.com.uy/Edicion%20UN/articulos/prints-14dic2010/eco05.html.

[17] Please see the "Una de cada tres empresas tuvo dificultad para reclutar personal" (One out of three companies had problems in recruiting personnel), available at: http://www.observa.com.uy/actualidad/nota.aspx?id=111671&ex=26&ar=1&fi=16&sec=8

[18] http://www.unido.org/index.php?id=7851

In the particular case of the Pulp and Paper industry, the only other big-scale pulp mill facility that generates a considerable amount of surplus power to the grid in Uruguay is the UPM pulp mill. However this facility was developed as a CDM project activity.

Particular conditions of the site in which the proposed project activity will be located

The Punta Pereira pulp mill will be located in a Free Trade Zone "Zona Franca Punta Pereira". During the operation phase, the pulp mill must comply with Law N° 15,921 "Ley de Zonas Francas" (Free trade Zone Law).

According to Article 18 of this law, the Punta Pereira staff must be composed of at least 75% of Uruguayan citizens in order to be entitled to the tax benefits granted by the law. The remaining 25% can be composed of foreign people. It must be noted that the aforementioned benefit is absolutely crucial for the viability of the Punta Pereira pulp mill project.

The higher level of complexity of the project pulp mill (e.g. a more efficient pulp mill that is capable of producing pulp and operating as a grid-connected power plant) makes it more difficult for the Punta Pereira administration to comply with the 75% - 25% rule required for maintaining the tax benefit of the Free-trade zone. As previously said, Uruguay is a small country with a small industrial sector (i.e. there is only one other pulp mill in Uruguay of comparable type and scale as the Punta Pereira pulp mill) and as a result, there are relatively few highly specialized and qualified personnel in Uruguay to operate a pulp mill that will be involved in both the Pulp and Paper and Power industries.

According to the National Statistics Institute (Instituto Nacional de Estadística, "INE") Colonia's province has diminished its population from the year 1996 to the 2004, when both censuses took place. When comparing the average annual inter-census growth rate, it resulted in -0.6 per thousand.[19] This rate shows a significant trend change in the rate of population growth in relation to what happened in the previous inter-census period. This could be influenced by higher migration flows, which in this area are mainly due to movement of young and adult populations seeking better employment opportunities.

The table below shows the different average annual inter-census growth rate for the cities located within the area of the Punta Pereira project from which most of the labour force will be hired.

[19] http://www.ine.gub.uy/fase1new/Colonia/Cuadro1_05.XLS

Demographic data for the Punta Pereira project

Location	Total population		Growth rate
	1,996	2,004	Inter-census (%)
Colonia del Sacramento	22,200	21,714	-2,7%
Carmelo	16,658	16,866	1,5%
Juan Lacaze	12,988	13,196	2,0%
Tarariras	6,174	6,070	-2,1%
Ombúes de Lavalle	3,189	3,451	9,7%

Source: Census Phase I, 2004 INE[20]

Furthermore, Colonia's department has a relatively aged population, where about 15% of its population is 65 years old or more and half the population is 35 or older. There is a small group of people whose ages are between 20 to 39 years, the young people, who tend to emigrate from this location seeking new employment opportunities[21].

The table below shows the population of the main area, source of labour force, of the project by age group:

Population per age groups in the Punta Pereira influence area

Locations	Age groups				
	0 - 14	15 - 24	25 - 49	50 - 64	65 or more
Colonia del Sacramento	5,089	3,163	6,815	3,288	3,359
Carmelo	4,094	2,558	5,089	2,467	2,658
Juan Lacaze	2,867	2,056	4,215	2,076	1,982
Tarariras	1,351	933	1,923	915	948
Ombúes de Lavalle	850	485	1,112	530	474
Conchillas[1]	284	162	350	189	192
Total population in the influence area	**14,535**	**9,357**	**19,504**	**9,465**	**9,613**

[1] Conchillas includes: Radial Hernández, Los Cerros de San Juan and Puerto Inglés.

Based on 2008 estimations, the Colonia's department average growth rate would achieve a positive value of 0.1 per thousand. The same behaviour could be assumed in the area studied. The growth rate observed for Colonia would still be lower than the growth rate observed in Uruguay of 0.3 per thousand in the same period, which is already very low.

Uruguay has been presenting very low population growth rates in the last decades. The lowest population birth rates registered in Latin America come from Uruguay. This together with the high emigration rate of young and highly qualified people seeking for better employment opportunities, the high age of the population[22] make it very difficult to find young people with high levels of qualification and specialization.

[20] See in the web page of the INE: http://www.ine.gub.uy/fase1new/Colonia/Cuadro5_05.XLS and http://www.ine.gub.uy/biblioteca/CENSO96/censo962008.asp

[21] http://www.ine.gub.uy/fase1new/colonia/colonia_pres.pdf

[22] Informe Total del País: Censo 2004; INE; http://www.ine.gub.uy/fase1new/TotalPais/divulgacion_TotalPais.asp

According to the particular circumstances of the Punta Pereira project, the availability of skilled and qualified labour in Uruguay is clearly a sensitive matter. However, this barrier becomes more critical due to the implementation of the proposed CDM project activity, particularly considering that the investment related to the CDM project is related to a non-core business to Punta Pereira, for which there is not a lot of know-how inside the organization.

- **Risk of technological failure.** The process/technology failure risk in the Punta Pereira project mill is significantly greater than for a standard self-sufficient pulp mill of similar capacity.

  The higher risk is associated to the higher level of sophistication of the project mill compared to the conventional self-sufficient mill. This high level of sophistication (and in some cases, innovation) also makes the Punta Pereira pulp mill unique in the relevant geographical region. The Project Proponent will show the different technological improvements that are contemplated under the proposed project activity under the barrier associated to a lack of prevailing practice barrier in this PDD. As will be seen below, the implementation of the technological improvements associated to the proposed project activity makes the pulp mill:

  - Face higher risks associated to technological failure, particularly in the context in which the proposed project activity is implemented (e.g. lack of skilled labor locally, hiring restrictions, etc.).

  - Face barriers associated to a lack of the prevailing practice in the relevant geographical region. The technological improvements contemplated in the proposed project activity make the Punta Pereira pulp mill be the “first of its kind” in many ways.

- **Lack of prevailing practice barrier**

The Punta Pereira pulp mill does present some particular features that make the plant different from the conventional pulp mill. This is due to the fact that the Punta Pereira pulp mill is specifically designed to generate surplus power to the grid, which implies some modifications and technology improvements over the conventional pulp mill design, that are not standard in the Pulp and Paper industry in the relevant geographical region. These technological improvements make the Punta Pereira pulp mill unique in the region.

To better illustrate the above, the Project Proponent would like first to show that a pulp mill with surplus power generation capacity to the grid is <u>not part of the prevailing practice</u> in the Pulp and Paper industry in the relevant geographical region. This is clearly shown in the table below:

POWER GENERATION OF PULP MILL FACILITIES IN THE RELEVANT GEOGRAPHICAL REGION

Country	Company	Mill	CDM project	Power generation situation
Argentina	Alto Paraná	Celulosa Alto Parana	No	Power importer.
Argentina	Celulosa Argentina	Capitán Bermúdez	No	Power importer.
Argentina	Celulosa Camapana	--	No	Power importer.
Argentina	Papel Prensa	--	No	N.A.
Argentina	Papel Misionero	--	No	N.A.
Brazil	CMPC	Riograndense, RS	No	Import of power
Brazil	Cocelpa	Araucaria, PR	No	Import of power
Brazil	Iguazú Celulose e Papel	Piraí do Sul, PR	No	Import of power
Brazil	Klabin	Correia Pinto, SC	No	Import of power
Brazil	Klabin	Monte Alegre, PR	No	Import of power
Brazil	Klabin	Otacilio Costa, SC	No	Import of power
Brazil	Rigesa	Tres Barras, SC	No	Import of power
Chile	Celulosa Arauco y Constitución S.A..	Arauco	Yes	Marginal power exporter (relies on fossil fuel).
Chile	Celulosa Arauco y Constitución S.A..	Constitución	No	Power exporter. The pulp mill was originally designed to have a bleaching stage, which was never built. This explains the power surplus.
Chile	Celulosa Arauco y Constitución S.A..	Licantén	No	Marginal power exporter (relies on fossil fuels).
Chile	Celulosa Arauco y Constitución S.A..	Nueva Aldea	Yes	Power exporter.
Chile	Celulosa Arauco y Constitución S.A..	Valdivia	Yes	Power exporter.
Chile	CMPC	Laja	No	The CMPC mills listed as well as some other installations are connected to an internal grid which is connected to the national grid in one point. The CMPC grid is a net importer of electrical power from the Chilean national grid.
Chile	CMPC	Santa Fe	No	
Chile	CMPC	Pacifico	No	
Paraguay	No Kraft Pull Mill of any significance.	--	--	--
Uruguay	United Paper Mills (UPM)	Fray Bentos	Yes	Power exporter.
Uruguay	FANAPEL	Centro Industrial Juan Lacaze	No	Power importer.

Sources:
Web page company information and other publicly available documents.

As can be seen from the table above, very few pulp mills in the relevant geographical have surplus power generation capacity to the grid. Those that have surplus power generation capacity, have been developed as CDM project activities and are currently registered under this mechanism. Furthermore, the table above also demonstrates that the baseline scenario chosen for the proposed project activity (self-sufficiency in electric power generation) is indeed conservative, since many of the above pulp mills in the region have to import power from the grid.

The Project Proponent will describe in the following section, the main technological improvements that make the proposed project activity unique in the relevant geographical region (e.g. "lack of prevailing practice barrier) and that also make that the Punta Pereira pulp mill project face higher risks (e.g. "technological barriers).

1. Use of 7-effect evaporation plant.

By increasing the number of effects in the evaporation plant of the project pulp mill, less steam is consumed in the evaporation plant and therefore more steam is available for power generation for condensing power generation.

Depending on the internal power requirements, normally pulp mills in the relevant geographical region (South of Brazil, Argentina, Chile, Paraguay and Uruguay) are equipped with 5 or at most 6 effect evaporators. Below are listed the existing pulp mills in the region and their evaporation plant concept.

N° OF EFFECTS IN THE PULP MILL'S EVAPORATION PLANT

Country	Company	Mill	CDM project	N° of effects in the evaporation plant
Argentina	Alto Paraná	Alto Paraná	No	6 [2, 3]
Argentina	Celulosa Argentina	Capitán Bermúdez	No	6 [3]
Argentina	Celulosa Camapana	--	No	< 7 [4]
Brazil	CMPC	Riograndense, RS	No	6 [5]
Brazil	Cocelpa	Araucaria, PR	No	< 7 [4]
Brazil	Iguazu Celulose e Papel	Pirai do Sul, PR	No	5 [6]
Brazil	Klabin	Correia Pinto, SC	No	7 [5]
Brazil	Klabin	Monte Alegre, PR	No	6 [5]
Brazil	Klabin	Otacilio Costa, SC	No	5 [5]
Brazil	Rigesa	Tres Barras, SC		5 [5]
Chile	Celulosa Arauco y Constitución S.A..	Arauco	No	5+6 (two lines) [2, 3]
Chile	Celulosa Arauco y Constitución S.A..	Constitución	No	6 [2, 3]
Chile	Celulosa Arauco y Constitución S.A..	Licancel	No	6 [2]
Chile	Celulosa Arauco y Constitución S.A..	Nueva Aldea	Yes	7 [2, 3]
Chile	Celulosa Arauco y Constitución S.A..	Valdivia	Yes	6 [2, 7]
Chile	CMPC	Laja	No	6+3 [3, 8]
Chile	CMPC	Santa Fe	No	5+6+7 (three lines) [8]
Chile	CMPC	Pacifico	No	6 [4]
Paraguay	No Kraft Pull Mill of any significance.	--	--	--
Uruguay	United Paper Mills (UPM)	Fray Bentos	Yes	7 [7]
Uruguay	FANAPEL	Juan Lacaze	No	6 [3]

Sources:

(1) See "Fray Bentos Biomass Power Generation Project", Ref. N° 1493 and "Nueva Aldea Biomass Power Plant Phase 2", Ref. N° 346.
(2) Information provided by Alto Paraná.
(3) Information provided by Metso.
(4) Estimated from age and size of the mill.
(5) Information from KSH-CRA files.
(6) Information from the mill.
(6) Information provided by Andritz.
(7) Information provided by CMPC.

According to the table above, there are only four evaporation lines out of 24 with 7 effects. Of these four lines two are registered CDM project activities. Since there are few pulp mills equipped with a 7-effect evaporator plants, there is very little experience with this type of plants and that precisely constitutes a barrier of the prevailing practice in the relevant region.

At a more specific level, the shortcomings associated to having a 7-effect evaporation plant can be summarized as follows:

- Higher investment costs.
- Higher operation difficulty and complexity (more components).
- The total driving force with the same live steam pressure and outgoing cooling water temperature is smaller due to the additional pressure drop on the vapor side from the extra evaporator effect. This results in a more difficult operation and requires more skilled and trained personnel.

- Higher sensitivity to variations in incoming weak black liquor concentration. This results in a more difficult operation and requires more skilled and trained personnel.

As a result of the low utilization of this technology in the relevant region, it is not possible to reliably translate this technological improvement into additional cost.

2. <u>The use of 80% dry solid final liquor concentration from the evaporation plant in the Punta Pereira mill</u>

By increasing the liquor concentration from the evaporation plant, more steam will be consumed in the evaporation plant but even more steam will be generation in the recovery boiler. The overall increased heat available for power generation in around 3.8% in the solid content is increased from 74% as in the baseline pulp mill to 80% as in the project activity pulp mill. In both cases the concentration refers to virgin liquor without ash from the recovery boilers electrostatic precipitator.

The common practice for evaporation plants in the relevant geographical region is lower final concentration than 80% dry solids as it is shown in the table below:

<u>BLACK LIQUOR DRY SOLID CONCENTRATION FROM THE EVAPORATION PLANT</u>

Country	Company	Mill	CDM project	Final liquor concentration
Argentina	Alto Paraná	Alto Paraná	No	72% DS [1]
Argentina	Celulosa Argentina	Capitán Bermúdez	No	72% DS [1]
Argentina	Celulosa Camapana	--	No	<< 80% DS [2]
Brazil	CMPC	Riograndense, RS	No	75% DS [3]
Brazil	Cocelpa	Araucaria, PR	No	<< 80% DS [2]
Brazil	Iguazu Celulosa e Papel	Pirai do Sul, PR	No	<< 80% DS [4]
Brazil	Klabin	Correia Pinto, SC	No	70% DS [3]
Brazil	Klabin	Monte Alegre, PR	No	Design 80% DS. Real operation approx. 76%, see comment below [3]
Brazil	Klabin	Otacilio Costa, SC	No	68% DS [3]
Brazil	Rigesa	Tres Barras, SC	No	72% DS [3]
Chile	Celulosa Arauco y Constitución S.A..	Arauco	No	69% + 72% DS [5]
Chile	Celulosa Arauco y Constitución S.A..	Constitución	No	66% DS [5]
Chile	Celulosa Arauco y Constitución S.A..	Licancel	No	72% DS [5]
Chile	Celulosa Arauco y Constitución S.A..	Nueva Aldea	Yes	Design 80%. Real operation 75% DS. See comment below [1].
Chile	Celulosa Arauco y Constitución S.A..	Valdivia	Yes	76% DS [6]
Chile	CMPC	Laja	No	72% DS [7]
Chile	CMPC	Santa Fe	No	70% + 70% + Design 80% but operating at 77%-78% DS (three lines) [7]
Chile	CMPC	Pacifico	No	75% DS [1, 7]
Paraguay	No Kraft Pull Mill of any significance.	--	--	--
Uruguay	United Paper Mills (UPM)	Fray Bentos	Yes	80% DS [6]
Uruguay	FANAPEL	Juan Lacaze	No	70% DS [1]

<u>Sources:</u>

(1) Information provided by Metso.
(2) Estimated from the age and size of the mill.
(3) Information from KSH-CRA files.
(4) Information provided by the mill.
(5) Information provided by Celulosa Arauco y Constitución S.A.
(6) Information provided by Andritz.

As can be seen in the table above, currently there are only four pulp mills out of 21 designed to operate with 80% black liquor dry solid concentration in the relevant geographical region. Of these four mills, two are registered CDM project activities.

Furthermore, in the case of the Nueva Aldea pulp mill[23], the company has informed that the evaporator plant has never been able to achieve the design value of 80% dry solid concentration in its evaporation plant, and it is currently operating at 75% dry solid black liquor concentration. In the case of the Santa Fe pulp mill, the evaporation plant is operating at 77% - 78% DS, according to the mill information, although the design for that evaporation plant is 80%. The reason for this is unknown. In the case of the Klabin Monte Alegre pulp mill, the reason for the lower concentration is insufficient of evaporation capacity. The only successful experience in the relevant geographical region with operating at 80% dry solid concentration is the Fray Bentos pulp mill.

Considering the above, it is clear that the 80% dry solid black liquor concentration evaporation plant is a technology that is not widely implemented in the relevant geographical region and that still appears to be not fully mature and reliable.

The draw backs of an evaporation plant working with a higher black liquor concentration are the following:

- Using a higher black liquor concentration requires more sophisticated material in the final body of the evaporator as well as in the piping system in order to avoid corrosion. This leads to higher investment costs.

- The higher liquor concentration increases the risk for plugging of the piping system due to mal operation. This requires more skilled and trained personnel to operate the plant.

- In general the risk for scaling and plugging of the final evaporator bodies increases with the higher final black liquor concentration. This requires more skilled and trained personnel to operate the plant.

- Using a higher final black liquor concentration will make the operation of the mill more sensitive to changes in weak liquor properties as well as to changes in the feed flow. This requires more skilled and trained operators to maintain the outgoing concentration at a high stable load without plugging the final bodies in the evaporator plant.

Considering both the utilization of 7-effect evaporation plant and an 80% of dry solid black liquor concentration, there are only four pulp mills using a 7-effect evaporation plant in the relevant geographical region. From these, at most two (if Santa Fe is included) are currently operating with 80% (or near 80%) dry solid black liquor concentration. This means that only two pulp mills out of 21 pulp mills in the relevant geographical region are actually using the configuration proposed in the Punta Pereira CDM project activity. It must be noted that one of these pulp mills was developed as a CDM project activity.

[23] The Nueva Aldea pulp mill is a modern mill, since the construction is dated in 2004.

So it can be concluded that even considering registered CDM project activities, the use of this technological improvement to maximize surplus power generation is clearly marginal (e.g. less than 10%) in the relevant geographical region and clearly faces technological barriers associated to a lack of the prevailing practice in the Pulp and Paper industry. More so, from the information provided above, it can even be concluded that this technological improvement is still not fully tested at a commercial scale. Like in the previous case, as a result of the low (and not always successful) use of this technological improvement in the in the relevant region, it is not possible to reliably translate this technological improvement into additional cost.

3. Feedwater preheating and heat recovery from the flue gases

This item includes a combination of two measures with different purposes:

- Increased feed water temperature to the boiler, which results in higher steam flow from the boiler and higher back pressure power generation without increasing the heat input to the system.

- Heat recovery from the flue gases outside the boilers boundary. This measure does not increase the steam generation but reduce the consumption of low pressure steam and by this increase the possible condensing power generation.

The first item would most likely not been implemented stand alone as the boiler efficiency has a tendency to go down with increased feed water temperature. The second item could be implemented stand alone.

Increased feed water temperature to the boiler:

The common practice in the in the Pulp and Paper industry is the installation of a recovery boiler with heating of the feed water in the deaerator/feed water tank to around 120 – 130 °C with low pressure steam and cool the flue gases in the economizer only (feed water as cooling media).

The proposed project activity contemplates an energy-efficient improvement to this alternative and heats the feed water in the deaerator/feed water tank as much as possible with low pressure steam to 135 °C. In addition to this, the feed water to the recovery boiler is further heated with medium pressure steam to 170 °C in external feed water preheater using medium pressure steam. In this way, more steam is generated in the recovery boiler, more steam circulates through the back-pressure turbine and less steam is used in the condensing turbine. The net result of this improvement is an increased power generation and a lower amount of heat is lost in the condenser of the condensing turbine.

However, the flue gas temperature from the recovery boiler will increase as the feed water temperature is higher. The temperature difference between incoming feed water to the economizer and outgoing flue gas temperature is normally in the range of 35 °C to 40 °C. This means that the increase in feed water temperature from 120 °C to 170 °C will increase the flue gas temperature with 40 °C to 50 °C and consequently the Recovery Boiler’s efficiency would be reduced.

Therefore, additional cooling of the flue gases from the recovery boiler will be implemented in the project case.

Heat recovery from the flue gases:

The flue gases will be cooled indirectly after the electrostatic precipitator with a mixture of condensate and make-up water at about 76 °C. The final temperature will be around 110 °C. The flue gases are cooled to around 130 °C, which is lower than the flue gas temperature in the base line case which would be around 155 – 160 C. This means that the additional cooling will increase the boiler efficiency and less steam will be used in the in the feed water tank. The saved low pressure steam will be used in the condensing turbine and more condensing power will be generated.

The technique described above with external feed water preheating and heat recovery from the flue gases is only implemented in a few (5)[24] pulp mills worldwide, none of them in the relevant geographical region. Other than these five facilities currently in operation, there are other three under construction; however none of them will be installed in the relevant geographical region.

The main risks associated to the implementation of this technology (feed water preheater and flue gas cooling) in a pulp mill is the corrosion on the flue gas coolers heating surfaces and plugging of the fuel gas cooler itself. With the above described heat recovery system using a mixture of condensate and make-up water for cooling of the flue gases, the risk for too high temperature to the deaerator increases and requires the attention of experienced and skilled operators. This makes the normal operation of the pulp mill more sensitive to the operator skills and qualifications.

Since the operating experiences are limited to only five pulp mill facilities worldwide and such information is not publicly available, there is not enough experience to fall back on. As a result, it is not possible to clearly and reliably assess and/or dimension the associated risks and costs related to this technological improvement.

4. Ash treatment

The increase of steam temperature, from 480 °C in the base case to 494 °C in the project case (high steam temperature is meant to increase surplus power generation capacity of the mill), increases the risk for super heater corrosion due to the very high Chlorine and Potassium content in the black liquor. The risk for plugging of the rare wall screen and the boiler bank increases also due to the low sticky temperature due to the high content of Chlorine and Potassium. There are at least three ways to handle the situation:

- Install corrosion resistant super heater. This is an extremely expensive solution and mostly used in Japan.

- Removing ESP ash from the system will reduce the Chlorine and Potassium content in the black liquor but will increase the need for make-up chemicals dramatically. When this method is used it is normally done by solving the ash in water and send to the effluent treatment plant. The risk for negative environmental impact from heavy metals increases due this.

[24] This information was provided by Andritz and Metso, two major equipment suppliers worldwide.

- ESP ash is treated with two different processes, ash leaching and Ash ReCrystallization ARC, to remove Chlorine and Potassium. The recovery of sulfur and sodium is in the range of 80% or better with these processes and are therefore preferred from an operational cost point of view.

The table below shows the implementation of ash treatment technology in the Pulp and Paper industry in the relevant geographical region:

ASH TREATMENT

Country	Company	Mill	CDM project	Ash treatment
Argentina	Alto Paraná	Alto Paraná	No	No
Argentina	Celulosa Argentina	Capitán Bermúdez	No	No
Argentina	Celulosa Camapana	--	No	No
Brazil	CMPC	Riograndense, RS	No	No
Brazil	Cocelpa	Araucaria, PR	No	No
Brazil	Iguazu Celulosa e Papel	Pirai do Sul, PR	No	No
Brazil	Klabin	Correia Pinto, SC	No	No
Brazil	Klabin	Monte Alegre, PR	No	No
Brazil	Klabin	Otacilio Costa, SC	No	No
Brazil	Rigesa	Tres Barras, SC	No	No
Chile	Celulosa Arauco y Constitución S.A..	Arauco	No	Yes (1)
Chile	Celulosa Arauco y Constitución S.A..	Constitución	No	No
Chile	Celulosa Arauco y Constitución S.A..	Licancel	No	No
Chile	Celulosa Arauco y Constitución S.A..	Nueva Aldea	Yes	Yes
Chile	Celulosa Arauco y Constitución S.A..	Valdivia	Yes	No
Chile	CMPC	Laja	No	No
Chile	CMPC	Santa Fe	No	Yes
Chile	CMPC	Pacifico	No	No
Paraguay	No Kraft Pull Mill of any significance.	--	--	
Uruguay	United Paper Mills (UPM)	Fray Bentos	Yes	See remarks below (2).
Uruguay	FANAPEL	Juan Lacaze	No	No

Sources:

(1) Information provided by Arauco.
(2) Information provided by Andritz.

Remark, the UPM mill in Fray Bentos Uruguay was originally installed without ash treatment. However this technological improvement was installed at a later stage. As can be seen above, currently there are only three mills in the region, of which one is a CDM project, operating with treatment of the recovery boiler ESP ash.

The operation of an ash treatment plant is quite complicated and there is a risk that the desired result will not be achieved. The fall back option is to dump the ash with high operational costs and negative environmental impact as a result.

Technical / Lack of prevailing practice barriers summary

Although only one of the measures to improve the power generation above is 100% unique in the region, the complexity of the mill increase dramatically by implementing all four of them or even three of the them.

To show that the Punta Pereira project activity is unique in the region, the combination of barriers has been summarized in a table below:

BARRIER SUMMARY

	CDM project participant	Other mills
All four barriers	0 mills	0 mills
Three barriers	0 (1) mills, see remark 1) below	0 (1) mills, see remark 3) below
Two barriers	2 (1) mills, see remark 2) below	1 (0) mill see remark 3) below
One barrier	0 mills	2 (3) mills, see remark 4) below

Remarks:

1. The UPM mill in Fray Bentos Uruguay was originally installed including two of the technical improvements. However, the ash treatment feature was implemented at a later stage.

2. The Nueva Aldea pulp mill was designed considering three technical improvements, but it is in practice operating with two of them. The mill has never been able to achieve 80% dry solid black liquor concentration.

3. The Santa Fee pulp mill was designed considering three of the technical improvements, but in practice is operating with two of them. For not known reason the mill is operating the evaporation plant at 77% - 78% dry solid black liquor concentration.

4. The Klabin Monte Alegre pulp mill was deigned to operate with a liquor concentration at 80% dry solid black liquor concentration, but it is only operating at around 76% dry solid concentration.

There are a total of three CDM project participants in the region, Frey Bentos, Nueva Aldea and the Valdivia pulp mill. Both Fray Bentos and Nueva Aldea were installed with two technological improvements and Valdivia pulp mill with none of them.

From the analysis presented above, it can be clearly concluded that the Punta Pereira pulp mill CDM project case is unique in the region when it comes to technical barriers and even more so, if none of the CDM project participants are considered. It shall also be noted that 4 pulp mills have evaporation plants designed for 80% dry solid black liquor concentration but only one, the registered CDM project activity mill Fray Bentos has been successful operating at such high black liquor concentration. None of the pulp mills in the relevant geographical region has the suggested feed water preheating and flue gas heat recovery installed.

As a result, the Punta Pereira CDM project activity clearly faces technical barriers and barriers associated to a lack of prevailing practice in the relevant geographical region.

Previous experience of the Project Proponent

According to the "Guidelines for objective demonstration and assessment of barriers" approved in the EB 50, it is suggested that the Project Proponent complement the information provided above with information related to the nature of the company, the organization and its ownership, as well as with its previous experience with similar projects as the proposed project activity.

Punta Pereira is a Uruguayan (50%-50%) joint venture between Celulosa Arauco y Constitución S.A. (Arauco) and Stora Enso.

1. Arauco is a forest company in Chile, fully owned by COPEC, a leading fuel distribution company in Chile. Arauco participates in the following business:

   - Forestry.
   - Pulp.
   - Sawmill.
   - Wood panel.
   - Power[25].

Arauco has two biomass power generation projects in Chile that are similar in concept to the proposed project activity. However, these two projects are registered CDM project activities and as was shown above, from a technical standpoint, the Punta Pereira project still stands out from all the other pulp mills in the relevant geographical region, including the registered CDM projects by Arauco.

2. Stora Enso is a global paper, packaging and wood products company producing newsprint and book paper, magazine paper, fine paper, consumer board, industrial packaging and wood products. The company is a publicly traded company listed in Helsinki and Stockholm. The company is focused on the following business units:

   - Pulp and Paper.
   - Packaging.
   - Wood products.

Stora Enso has no previous experience with surplus power generation in its industrial facilities. Stora Enso's pulp and paper mill facilities are capable of generating 70% of their electric power requirements; the balance is purchased from the grid.

Both companies, Arauco and Stora, have a strong strategic focus on sustainable development and are therefore fully committed to preserving the environment and mitigating the effects of climate change. This is the reason for which these two companies decided to join their efforts and build the new Punta Pereira pulp mill as a CDM project activity.

[25] This business unit was created to provide commercial services to the other business units for selling the surplus power to the grid (from other power generation CDM projects).

The past experience with similar (CDM) pulp mill projects of one of the partners (Arauco) might contribute to mitigate to some degree the technological barriers outlined above. However, it must be noted that the circumstances in which the Punta Pereira pulp mill project is developed are different from the circumstances under which the other CDM pulp mills were developed (e.g. free trade zone restrictions, hiring restrictions, new technical restrictions, power market restrictions, etc.). Some of the barriers are project and country-specific and therefore tend to prevail regardless of the Project Proponent's past experience in other locations.

The significance/relevance of the barriers mentioned above can be further substantiated by considering the marginal use of the biomass power cogeneration technology in the context of the Power and Forest industries in Uruguay. The following table illustrates the extremely low share of biomass power generation technology in Uruguay:

BIOMASS POWER GENERATION CAPACITY IN URUGUAY, 2010

Power generators	Unit	Installed capacity, 2010	(%)
Bioener	(MW)	10.0	0.4%
Fenirol	(MW)	8.9	0.3%
Galofer	(MW)	11.0	0.4%
Liderdat	(MW)	4.9	0.2%
Weyerhaeuser	(MW)	3.0	0.1%
Total biomass capacity	**(MW)**	**37.8**	**1.4%**
Total installed capacity	**(MW)**	**2,682.0**	**100.0%**

Sources:
Statistics from the National Energy Direction. MIEMDNE, Dirección Nacional de Enegía, http://www.miem.gub.uy

According to ADME[26] in October 2010 an assessment was made concerning the biomass generators available in the Uruguayan market. The report stated that during the year 2010 none of the 5 biomass power generators were able to reach 100% of their installed capacity. The main reasons were:

- Impossibility to properly adjust the internal production process in order to achieve full power capacity to the grid.
- Biomass fuel characteristics.

The result of the assessment mentioned above is consistent with the low level of expertise available in Uruguay for this kind of technology.

Regulatory Barriers

The Uruguayan Power industry is new to renewable power generation technologies. Although the law Nº 18.597 declares of national interest the efficient use of power with the purpose of contributing to the competitiveness of the national economy, sustainable development, reduction of the green house gases

[26] ADME stands for "Administradora del mercado eléctrico" (Electric market administrator entity).

emissions, this law constitutes a general framework and does not establish the way the companies should adjust to the electrical market conditions. In terms of renewable power generation, the first attempts to regulate the energy generation activity, contracts, etc started with the wind power generation technology.

However, there is only decree Nº 367/10, approved on the 10th of December 2010 that relates to biomass power generation technology. This decree intends to establish a regulation framework for generators with the capacities lower than 20 MW. According to this decree, UTE is the Uruguayan power company in charged of making contracts for purchasing and selling electricity to the National grid. Though this is not the case of the proposed project activity, since its power surplus will be higher than 20 MW, the lack of a mature regulation framework introduces uncertainties which may translate into operational restrictions to the Punta Pereira pulp mill in the future. This situation makes it impossible for the Project Proponent to reliably translate these uncertainties into additional costs.

Cultural barriers:

A company's culture in the forestry sector is very much influenced by the commodities: wood-products and pulp, which differs from the culture in the electric power sector. This has commercial implications:

- Unlike forestry products, electric power cannot be stored in order to speculate on price. Power Purchase Agreements require different negotiation skills, which are not part of the competencies of companies that sell commodities such as metals, paper, wood, etc. In the case of Punta Pereira, this is quite evident, since the company is new and therefore there is no experience inside the company in dealing with the electricity market in Uruguay.

The cultural barrier can be further substantiated by considering that in Uruguay, there are other players in the forest industry and none of them have developed the biomass power cogeneration technology in a scale comparable to the Punta Pereira pulp mill. All the existing initiatives or the ones currently under development by other players in the forest industry (both big and small) consider the use of the CDM. Evidence supporting this argument can be found in the corresponding PDDs of the new biomass power generation projects that are publicly available.

Finally, as a confirmation of the evidence presented above, the Project Proponent would like to note that the barriers presented in this section have also been addressed by several official documents in Uruguay, carried out by reputed third parties (not the Project Proponent) and explicitly mentioned in public presentations:

1. The presentation "Energías renovables y eficiencia energética en Uruguay" (Renewable power and energy efficiency in Uruguay), October 2006, carried out by a reputed university "Universidad de La República" in Uruguay in the second regional Latin American conference of solar energy (ISES) also mentions the same barriers faced by non-conventional power generation technologies in Uruguay:

    - Lack of regulation and clear procedures for the installation, connection and operation of the renewable power generation power plant (includes grid access and regulation of distributed power generation).
    - Lack of financing alternatives.
    - Low long-term marginal cost for power.

- Little information about the availability of the resources (e.g. wind power technologies).
- Limited institutional capacity to handle non-conventional power generation technologies (e.g. wind power technologies).
- There is no environmental regulation that internalizes the environmental costs of the power sector.

2. An official document from the Uruguayan Government: “Lineamientos de Estrategia Energética: Uruguay 2006” (Guidelines for an energy strategy: Uruguay 2006) explicitly acknowledges a number of barriers for non-conventional renewable power generation projects in Uruguay. The document explicitly mentions biomass power generation projects and refers to the following barriers the projects currently face:

    - There is a lack of funding alternatives for these types of projects.
    - There is little knowledge of each (non-conventional) power generation resource in the country.
    - There a no (or very little) experience with power plants using non-conventional power generation technologies in the country.
    - There is not a proper regulatory framework aimed at promoting new sources of renewable power in the country.
    - There are no (or very few) production chains related to renewable power generation technologies.
    - There is little technology development and therefore availability of skilled labour in the country.
    - There are few (or no) Government institutions that would serve as counterparts to the private sector and the academia on these matters.

Although there has been some progress from 2006 onwards, it has not been enough to overcome all the barriers mentioned above, as they have continue to appear in subsequent studies from official and reputed sources (see below).

3. The presentation “Aplicación para el Mecanismo para un Desarrollo Limpio del Protocolo de Kioto en Uruguay” (Application of the CDM of the Kyoto Protocol in Uruguay) in 2007 by the Climate Change division of DINAMA (a Government institution) directly addresses the barriers faced by non-conventional power generation projects in Uruguay. The presentation explicitly identifies the following barriers:

    - There is a lack of transparent regulation to participate in the power market in Uruguay; there is a lack of incentives that consider the economic, social and environmental benefits of these types of energy sources.
    - There is little knowledge of the benefits associated to renewable power generation technologies and distributed power generation technologies.
    - There is also insufficient dialog between key actors in this industry and lack of information related to the regions and the energy potential of these types of energy sources (e.g. wind power).
    - There is limited development of human resources and institutional capacity, poor information about available technologies, grid connection and protocols.

- Financial barriers: relatively high investment costs while the historic long-term marginal power generation cost from UTE is low.

4. The presentation "Política energética y desarrollo sustentable: tendencias y desafíos de la oferta en la región" (Energy policy and sustainable development: tendencies and challenges of the supply in the region), June 2007, CEPAL (United Nations). The document presents (among other issues) the barriers faced by non-conventional renewable power generation projects in Latin America. In particular mentions the following:

    - There is a failure to acknowledge the benefits of non-conventional power generation technologies in the country.
    - The relevant institutions are still under development.
    - The regulatory framework (in the Power industry) is still under development.
    - There is lack of technical information and support, limited capacity and poor availability of technical resources.
    - Financial barriers: limited access to credit and scarce international cooperation; high transaction costs.

5. The study "Geo Uruguay Informe del estado del medio ambiente" (Geo Uruguay, Environmental status report), 2008; PNUMA, CLAES and DINAMA clearly addresses the following barriers in the Chapter related to Energy.

    - Failure to acknowledge the benefits of non-conventional power generation technologies in Uruguay.
    - Current policy tends to privilege centralized power generation facilities over distributed power generation facilities.

6. The article "Privados reclaman cambios ante escaso desarrollo de la biomasa" (Private sector claims for changes due to low development of biomass). El País newspaper, Economy section, page A11, Tuesday June 7th, 2011. The article clearly addresses the barriers faced by biomass power generation technology in Uruguay. Specifically, the article mentions the following:

    - Under the prevailing conditions in Uruguay, there is a clear lack of interest in the private sector to participate in the Power industry with this technology.
    - The main cause for the low development of this technology in Uruguay is the current <u>lack of local expertise</u>. This is causing project owners to underestimate investments amounts, make construction mistakes and incur in operational mismanagement and underperformance of the facilities.
    - The current barriers faced by this technology are considered to be <u>so extreme</u>, that the Government should consider discarding this technology and replacing it for other renewable technologies such as wind.

As can be seen from the studies, articles and presentations above, the barriers mentioned are structural and inherently related to Uruguay and in many cases, to the relevant geographical region. The significance of the barriers is not altered or diminished by the type/size of the entity/company behind these kinds of projects. Once again, this can be demonstrated by considering:

1. The low share of non-conventional renewable power generation both in Uruguay and in the relevant geographical region. In particular, for biomass power generation technology, this share is less than 2%.

2. The marginal implementation of the cogeneration technology (clearly less than 10% including CDM projects) in the Forest industry in Uruguay.

3. The fact that other relevant players in the forestry industry in Uruguay (comparable to the ones behind the Punta Pereira pulp mill project) have not developed these kinds of projects without the aid of the CDM. All the initiatives currently underway by these companies (and smaller companies as well), consider the CDM to overcome the barriers outlined in this PDD. The same situation happens in the relevant geographical region.

Step 2b of the section related to the demonstration of additionality and determination of the baseline of the ACM0006 (Version 11.1) requires the Project Proponent to eliminate the alternative scenarios that are prevented by the identified barriers. This is done in the table below for all the feasible and possible baseline project options.

Project option	**Barriers that prevent the implementation of the alternative scenarios**	**Likely baseline candidate?**
1. The proposed CDM project activity: a pulp mill with surplus power generation capacity.	• Technological barriers. • Lack of prevailing practice barriers. • Regulatory barriers. • Cultural barriers. The relevance of these barriers in the proposed CDM project activity has already been analyzed.	No.
2. Conventional pulp mill, with a marginal deficit in power generation.	• None. This corresponds to the normal practice of the Pulp and Paper industry in the relevant geographical region and in the world.	Yes.
3. Conventional self-sufficient pulp mill, without surplus power generation capacity.	• None. This corresponds to the normal practice of the Pulp and Paper industry in the relevant geographical region and in the world.	Yes.
4. Conventional self-sufficient pulp mill, with a conventional fossil fuel power unit as a back-up.	• Cultural barriers. It is not the normal practice for the pulp mill to have a fossil fuel power unit with the capacity of generating surplus power to the grid.	No.
5. Pulp mill designed to generate additional electric power at a lower efficiency.	• Technological barriers: The technical barriers in this case would be less stringent, however would still exist. • Lack of prevailing practice barriers: The operation as a grid-connected power plant of a pulp mill facility is not the prevailing practice of the pulp industry in the relevant geographical region. • Regulatory barriers. • Cultural barriers.	No.

According to the above, the project options that would qualify as likely baseline candidates are:

Project options
2. Conventional pulp mill, but with a deficit in electric power generation.
3. Conventional self-sufficient pulp mill, without surplus power generation capacity.

The CDM would alleviate the identified barriers in the following way:

The registration of the Punta Pereira biomass power plant project in the CDM will report significant benefits to the pulp mill. However, these benefits will not only circumscribe to the project itself, but also to the Punta Pereira Company, for overcoming the associated barriers to carry out the proposed project to final completion.

The main areas in which the CDM would alleviate the identified barriers are mentioned below:

- The prospects of the Punta Pereira CDM project activity and the possibility to generate CERs contributed to attract the financial institutions to finance this project. In this case, this is demonstrated by official documents from the prospective financiers of the proposed project.

- The financial benefit derived from the sale of CERs to Annex I countries is a strong incentive to develop CDM project activities for Punta Pereira. The investment related to a biomass electric power generation capacity is about 2 to 3 MMUS$ per installed MW (depending on the project context), which is significant. The barriers that must be overcome to implement such projects are not minor either. As previously mentioned, they cannot be easily/reliably quantified ex-ante and they invariably end up translating into additional costs, deteriorating the financial performance of this type of projects ex-post. In this case, however, the expected revenue that would come from the sale of the CERs would clearly contribute to mitigate these extra risks and costs:

RELEVANCE OF THE CDM IN THE PUNTA PEREIRA PROJECT ACTIVITY

		CER price scenarios	
		Low Price	High Price
Net emission savings (avg.)	(tCO_2eq/yr)	177,289	177,289
CER price	(Euro$/CER)	10.0	20.0
CER price	(US$/CER)	14.3	28.6
Annual income from carbon sales	(KUS$/yr))	2,535	5,069
Relevant discount rate	(%)	10%	10%
Net present value of carbon sales	(KUS$)	21,920	43,840
Investment in the Punta Pereira CDM project activity	(KUS$)	141,989	141,989
Relevance of CDM revenue	**(%)**	**15%**	**31%**

Notes:
The investment in the CDM project activity considers the additional investment with respect to the baseline scenario. The baseline scenario consists in the installation of a self-sufficient Kraft pulp mill in Uruguay.

As can be seen from the table above, the present value of the prospective carbon sales proceeds represent a significant portion of the total investment related to the implementation of the proposed CDM project: an expected 20% of the additional investment associated to the proposed CDM project activity. Though this analysis is not possible considering the additional costs associated to each of the identified barriers in the preceding section of this PDD, it is reasonable to assume that the CDM revenues will tend to compensate the extra costs associated to the barriers in this case.

- The proposed project activity will unquestionably reduce anthropogenic greenhouse emissions by generating electric power via a clean energy source. This is consistent with Arauco and Stora

Enso's policy of sustainable development and its current stand of combating Climate Change[27]. This will strongly and positively contribute to position Punta Pereira as an "environmental friendly" company, not only in Uruguay, but also in the international context. This is not minor to Punta Pereira, since most of the company's pulp sales will come from exports to countries that have a high environmental consciousness and value the use of sustainable technologies. The registration of the proposed project in the CDM will definitely acknowledge Punta Pereira's effort of using high-end environmental-friendly technology, giving the company a competitive edge in this area.

According to the ACM0006 (Version 11.1), if there are more than one possible baseline scenario option, the Project Proponent has the option to select the alternative with the lowest emissions as the baseline scenario. Since that criteria would eliminate the project option that would source part of its electricity from the grid, the most appropriate baseline scenario that would apply in this case would be:

Scenario N° 3: Conventional self-sufficient pulp mill, without surplus power generation capacity.

Step 3: Investment analysis

Not chosen.

Step 4: Common practice analysis

According to page 18/72 of the ACM0006 (Version 11.1), in doing this analysis, the Project Proponent must consider other projects that are of similar scale, take place in a comparable environment with respect to the regulatory framework and are undertaken in the relevant geographical area.

Considering the above, there are no similar projects to the Punta Pereira currently underway in Uruguay. All other biomass cogeneration projects are developed under different contexts (sawmills, panelboard mills, etc.), have much smaller scale and therefore are not comparable to the proposed project activity. In addition, all these projects are being developed under the CDM.

If the relevant geographical region is considered (an area with 10 or more similar projects), the situation is the same as in the previous case. There are no pulp mills with surplus power generation capacity of comparable scale to the Punta Pereira mill. The only 2 similar projects in existence are registered CDM projects activities. Furthermore, in this region there are modern, recently built, pulp mills comparable in scale and technology to the proposed project activity, that have to import part of their electric power requirements from the grid.

According to the analysis above, the following conclusions can be drawn:

- The Punta Pereira project activity is one of the first of its type in Uruguay and in the relevant geographical region.

[27] Please see: http://www.arauco.cl/informacion.asp?idq=1055&parent=1050&ca_submenu=1050&idioma=22 and http://www.storaenso.com/responsibility/performance/Pages/climatechange.aspx.

- Similar biomass cogeneration projects in related industries (i.e. Sawmills, plywood mills and MDF wood panel mills) are equally unique, and therefore, not observed as conventional initiatives either.

For these reasons, the Punta Pereira project activity is not considered to be part of the common practice in the relevant (and comparable) industry(ies), and therefore considered additional from a common practice perspective analysis.

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

The Punta Pereira project activity will reduce anthropogenic GHG emission by:

1. Displacing fossil fuel based electricity from the grid and

2. Preventing the generation of methane emissions from the anaerobic decay of biomass residues in landfields.

To do so, the Project Proponent will build a more efficient pulp mill, which will be capable of generating a considerable amount of surplus power to the grid and therefore, function as a power plant connected to the interconnected system. The additionality of the proposed project is based on these technological improvements, which are not common practice in the Pulp and Paper industry in Uruguay or in the relevant geographical region.

The Project Proponent clearly demonstrated the additionality of the Punta Pereira project activity in the preceding section by following the stepwise approach of the ACM0006 (Version 11.1). For that reason, the Project Proponent will not repeat this analysis in this section of the PDD.

According to EB 62, Annex 13, "Guidelines on the demonstration and assessment of prior consideration of the CDM" (Version 04), paragraph 2, for project activities with a starting date on or after August 2nd, 2008, the Project Participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity, using the standardized form F-CDM-Prior Consideration.

According to this guideline, this communication was duly submitted in the corresponding format to:

1. The local DNA of Uruguay (DINAMA): 15/02/2011. The DINAMA acknowledged the reception of the CDM-Prior Consideration format in 16/02/2011 via email.

2. The UNFCCC Secretariat: 02/03/2011. The UNFCCC acknowledged the reception of the F-CDM-Prior Consideration format and published it in its web page in 02/03/2011.

The evidence of the submission to both parties and the corresponding reception acknowledgement will be made duly available during the validation of the Punta Pereira project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the ACM0006 (Version 11.1) requires in page 5/72 to provide the following information:

For each plant generating power and/or heat that has been operated at the project site within the most recent three years prior to the start of the project activity:	
Type and capacity of the heat generators:	There were no heat and/or power plants operating at the project site before the implementation of the project activity.
The types and quantities of fuels which have been used in the heat generators:	Not applicable, see the answer above.
The types and capacities of heat engines:	Not applicable, see the answer above.
Whether the equipment continues operation after the start of the project activity:	Not applicable, see the answer above.

For each plant generating power and/or heat installed under the project activity:	
The type and capacity of the heat generators:	Recovery boiler: 922 (ton high-pressure steam/hr). Power boiler: 65 (ton high-pressure steam/hr) with biomass, 75 (ton high-pressure steam/hr) with fuel oil. Auxiliary fossil fuel boiler: 75 (ton medium-pressure steam/hr).
The types and quantities of fuels used in the heat generators:	Recovery boiler: • Black liquor: 1,797,966 (tDS/yr). • Methanol: 15,611 (Dry ton/yr). • CNCG: 19,116 (Dry ton/yr). • Fuel oil: 135.2 (ton/yr). • Diesel: 0 (ton/yr). Power boiler: • Fines from chip-screening: 25,185 (tDS/yr). • Combined bark and wood from wood yard: 20,638 (tDS/yr). • Primary sludge: 5,193 (tDS/yr). • Fuel oil: 27.8 (ton/yr). • Diesel: 0 (ton/yr). Auxiliary fossil fuel boiler: • Fuel oil: 876 (ton/yr). • Diesel: 0 (ton/yr).
The type and capacity of heat engines and direct heat extractions:	One back pressure with extractions turbine: • Capacity of the heat engine: 88,650 KW. • Capacity of heat extraction N°1: 65 kg/s (Medium-pressure steam). • Capacity of heat extraction N°2: 124 kg/s (Low-pressure steam). One condensing with extraction turbine: • Capacity of the heat engine: 90,047 KW. • Capacity of heat extraction N°1: 42 (Kg/s), medium-pressure steam.

	• Capacity of heat extraction N°2: 93 (Kg/s), low-pressure steam. • Capacity of heat extraction N°3: 7.5 (kg/s), LLP steam. • Capacity at the tail of the turbine: 61 (kg/s). (Note: In both cases, the capacity of the heat engine must include the electrical output and the thermal output.)

For each plant generating power and/or heat that would be installed in the absence of the project activity:	
The type and capacity of the plant:	Type: Cogeneration biomass power plant. Capacity: Total gross power generation capacity of 112.6 MW.
Type and capacity of heat generators:	Recovery boiler: 679 MW capacity. Power boiler: 0 MW (no biomass power boiler). Auxiliary fossil fuel boiler: 150 (ton medium-pressure steam/hr). Equivalently, 95 MW.
Type and capacity of heat engines:	One backpressure turbine with extractions of 651.7 MW capacity.
Type and capacity of electric power generators:	One electric generator of 112.6 MW capacity.
Types and quantities of fuels which would be used in each heat generator:	Recovery boiler: • Black liquor: 1,797,966 (tDS/yr). • Methanol: 15,611 (Dry ton/yr). • CNCG: 19,116 (Dry ton/yr). • Fuel oil: 135.2 (ton/yr). • Diesel: 0 (ton/yr). Fossil fuel boiler: • Fuel oil: 1,751 (ton/yr). • Diesel: 0 (ton/yr).

The average amounts of electricity and heat import from off-site sources that would happen in the absence of the project activity on a yearly basis and the forecast for the project scenario:	
Average amount of electricity and heat import from off-site sources in the absence of the project activity:	Electricity imports: 4 (GWh/yr) from the grid. The baseline plant is not expected to require power from the grid, since it would be self-sufficient in heat and electric power generation. However, small amounts of power from the grid would be required under certain circumstances (e.g. during start-up operations). This power amount is highly variable, therefore, though it will be monitored and duly accounted for, it will not be considered in the emission reduction calculation in this PDD. Heat imports: 0 (GJ/yr). The baseline plant would be self-sufficient in heat generation. The baseline plant would not receive heat from off-site sources in the absence of the project activity.
Average amount of electricity and heat import from off-site sources under the project activity:	Electricity imports: 3 (GWh/yr) from the grid. The project plant would produce a considerable amount of surplus power to the grid. However, small amounts of power from the grid would be required under certain circumstances (e.g. during start-up operations). This power amount is

	highly variable, therefore, though it will be monitored and duly accounted for, it will not be considered in the emission reduction calculation in this PDD. Heat imports: 0 GJ/yr. The project plant would be self-sufficient in heat generation. The project plant would not receive heat from off-site sources.

As a complement of the information provided above, please see the energy/mass balances diagrams of the project and baseline case scenarios.

Equation used to calculate emission reductions

The net emission reductions of the proposed project activity are calculated through equation 1 of the ACM0006 (Version 11.1):

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER_y = Emissions reductions in year y (tCO_2e/yr).
BE_y = Baseline emissions in year y (tCO_2e/yr).
PE_y = Project emissions during the year y (tCO_2/yr).
L_y = Leakage emissions during the year y (tCO_2/yr).

Project emissions

Project emissions for the proposed project activity are calculated using equation 37 of the ACM0006 (Version 11.1):

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y}$$

Where:

PE_y = Project emissions in year y (tCO_2/yr).
$PE_{FF,y}$ = Emissions during the year y due to fossil fuel consumption at the project site (tCO_2/yr).
$PE_{GR1,y}$ = Emissions during the year y due to grid electricity imports to the project site (tCO_2/yr).
$PE_{GR2,y}$ = Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year y (tCO_2/yr).
$PE_{TR,y}$ = Emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/yr).
$PE_{BR,y}$ = Emissions from the combustion of biomass residues during the year y (tCO_2e/yr).
$PE_{WW,y}$ = Emissions from waste water generated from the treatment of biomass residues in year y (tCO_2e/yr).
$PE_{BG2,y}$ = Emissions from the production of biogas in year y (tCO_2e/yr).

Considering the particular circumstances of the proposed project activity, the following simplifications apply in this case:

$PE_{GR2,y} = 0$ The amount of electricity generated on-site in the baseline will not exceed the amount of electricity generated in the project scenario.

$PE_{TR,y} = 0$ There will be no transportation of biomass residues to the project plant.

$PE_{WW,y} = 0$ There will be no anaerobic treatment of waste water generated from the treatment of biomass residues (if any).

$PE_{BG2,y} = 0$ The proposed project activity does not imply the production of biogas.

As a result, equation 37 simplifies and reduces to the following:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{BR,y}$$

a) Carbon dioxide emissions from on-site consumption of fossil fuels ($PE_{FF,y}$)

According to the ACM0006 (Version 11.1), the Project Proponent must use the last version of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”. According to this tool and considering the availability of information in the country in which the proposed project activity is implemented, the Project Proponent will use the following approach for determining CO_2 emissions:

$$PE_{FC,j,y} = \sum_i (FC_{i,j,y} * COEF_{i,y})$$

Where:

$PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr).
$FC_{i,j,y}$ = Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);
$COEF_{i,y}$ = CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit);
i = are the fuel types combusted in process j during the year y.

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using approach B of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”, which consists in calculating the coefficient based on the net calorific value and CO_2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}$$

Where:

$COEF_{i,y}$ = CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit);

$NCV_{i,y}$ = Weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit);
$EF_{CO2,i,y}$ = Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ);
i = Fuel types combusted in process j during the year y.

For $NCV_{i,y}$ and $EF_{CO2,i}$ monitoring, the Project Proponent will use IPCC default values for the emission reduction calculation in this PDD. For subsequent monitoring, the Project Proponent may use other sources, in accordance to the guidance of the ACM0006 (Version 11.1) monitoring methodology and the corresponding tool.

Project emissions from on-site fossil fuel consumption must be accounted for the following situations:

- Emissions from on-site fossil fuel consumption for the generation of electric power and heat: In the case of the proposed project activity, these emissions correspond to those related to fossil fuel consumption in the heat generators (e.g. boilers) at the project site.

- Emissions from on-site fossil fuel consumption of auxiliary equipment and systems related to the generation of electric power and heat: In the case of the proposed project activity, these emissions correspond to those related with the transportation of biomass residues from wood handling and primary sludge to the power boiler. The project activity might also contemplate the mechanical preparation of the biomass residues as well. If so, this emission source will also be considered.

b) Emissions due to grid electricity imports to the project site ($PE_{GR1,y}$)

On a general basis, the proposed project activity is designed so that the power plant will generate surplus power to the grid. However, under some particular conditions, the proposed project (a surplus power generating pulp mill) might require to import some electricity from the grid (maintenance periods, start-up operations and other exceptional circumstances). In such cases, this parameter will be monitored and accounted for in the emission reduction calculation, as specified in equation 38 of the ACM0006 (Version 11.1).

$$PE_{GR1,y} = EF_{EG,GR,y} * EL_{PJ,imp,y}$$

Where:

$PE_{GR1,y}$ = Emissions during the year y due to grid electricity imports to the project site (tCO_2/yr).
$EL_{PJ,imp,y}$ = Project electricity imports from the grid in year y (MWh/yr).
$EF_{EG,GR,y}$ = Grid emission factor in year y (tCO_2/MWh).

c) Emissions from the combustion of biomass residues ($PE_{BR,y}$)

Since this source is included in the project boundary, emissions are calculated using equation 43 of the ACM0006 (Version 11.1):

$$PE_{BR,y} = GWP_{CH4} * EF_{CH4,BR} * \sum_{k} BR_{PJ,n,y} * NCV_{BR,n,y}$$

Where:

$PE_{BR,y}$ = Emissions from the combustion of biomass residues during the year y (tCO_2e/yr).
GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2/tCH_4).
$EF_{CH4,BR}$ = CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ).
$BR_{PJ,n,y}$ = Quantity of biomass residues of category n used in the project activity in year y (tonnes on dry-basis).
$NCV_{BR,n,y}$ = Net calorific value of biomass residue of category n in year y (GJ/tonne on dry-basis).

The methodology provides in Tables 4 and 5 of the ACM0006 (Version 11.1) default values and conservativeness factors for the methane emission factor. The selection and justification of these factors is explained in the following subsection of this PDD.

Baseline emissions

Baseline emissions are calculated based on the most plausible baseline scenario identified in the section “Selection of the baseline scenario and demonstration of additionality” of this PDD. This calculation is performed taking into account how power and heat would be generated and how the biomass residues would be used in the absence of the proposed project activity.

According to the ACM0006 (Version 11.1), baseline emissions are calculated using equation 2 as follows:

$$BE_y = EL_{BL,GR,y} * EF_{EG,GR,y} + \sum_{f} FF_{BL,HG,y,f} * EF_{FF,y,f} + EL_{BL,FF/GR,y} * \min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

Where:

BE_y = Baseline emissions in year y (tCO_2/yr).
$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year y (MWh/yr).
$EF_{EG,GR,y}$ = Grid emission factor in year y (tCO_2/MWh).
$FF_{BL,HG,y,f}$ = Baseline fossil fuel demand for process heat in year y (GJ/yr).
$EF_{FF,y,f}$ = CO_2 emission factor for fossil fuel type f in year y (tCO_2/GJ).
$EL_{BL,FF/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site in year y (MWh/yr).
$EF_{EG,FF,y}$ = CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y (tCO_2/MWh).
$BE_{BR,y}$ = Baseline emissions due to disposal of biomass residues in year y (tCO_2e/yr).
y = Year of the crediting period.
f = Fossil fuel type.

The Project Proponent will use the algorithm presented in page 21/72 of the ACM0006 (Version 11.1) to calculate the baseline emissions. The algorithm has the following steps:

Step 1: Determine the biomass availability, generation and capacity constraints, efficiencies and power emission factors.

Step 2: Determine the minimum baseline electricity generation in the grid;

Step 3: Determine the baseline biomass-based heat and power generation;

Step 4: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation;

Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues;

Step 6: Calculate baseline emissions.

In the following section, the Project Proponent will state the methodological choices and equations that will be used in the calculation of the baseline emissions for the proposed project activity.

Step 1: Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors in the baseline

Step 1.1: Determine total baseline process heat generation

The amount of process heat that would be generated in the baseline in year y ($HC_{BL,y}$) will be determined as the difference of the enthalpy of the process heat (steam) supplied to process heat loads in the project activity minus the enthalpy of the feed water, the boiler blow-down and any condensate return to the heat generators.

The respective enthalpies will be determined based on the mass flows, temperatures and, in case of superheated steam, the pressure. Steam tables and/or appropriate thermodynamic equations will be used to calculate the enthalpy as a function of temperature and pressure. The process heat will be calculated net of any parasitic heat used for drying of the biomass residues[28].

Step 1.2: Determine total baseline electricity generation

The amount of electricity that would be generated in the baseline in year y is calculated using equation 3 as follows:

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp,y} - EL_{PJ,aux,y}$$

[28] It must be noted that in the case of the proposed project activity, this is applicable only to biomass residues used in the power boiler: fines from chip-screening, combined bark and wood from wood yard and primary sludge. Heat used for black liquor concentration in the pulp mill's evaporators is an intrinsic part of the Kraft pulping cycle, and therefore will not be considered as "parasitic" heat in this case.

Where:

$EL_{BL,y}$ = Baseline emissions generation in year y (MWh/yr).
$EL_{PJ,gross,y}$ = Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y (MWh/yr).
$EL_{PJ,imp,y}$ = Project electricity imports from the grid in year y (MWh/yr).
$EL_{PJ,aux,y}$ = Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh/yr).
y = Year of the crediting period.

In the case of the proposed project activity, $EL_{PJ,aux,y}$ will include all electricity required for the operation of:

- Ash treatment
- Recovery boiler
- Power boiler
- Cooling towers (part of)
- Turbine plant
- Air compressors (part of)

The rest of the power consumption in the pulp mill is more related to pulp production than to power generation.

Step 1.3: Determine the baseline capacity of electricity generation

The total capacity of electricity generation available in the baseline will be calculated using equation 4 below:

$$CAP_{EG,total,y} = LOC_y * \left[\sum_i (CAP_{EG,CG,i} * LFC_{EG,CG,i}) + \sum_j (CAP_{EG,PO,j} * LFC_{EG,PO,j}) \right]$$

Where:

$CAP_{EG,total,y}$ = Baseline electricity generation capacity in year y (MWh/yr).
$CAP_{EG,CG,i}$ = Baseline electricity generation capacity of heat engine i (MW).
$CAP_{EG,PO,j}$ = Baseline electricity generation capacity of heat engine j (MW).
$LFC_{EG,CG,i}$ = Baseline load factor of heat engine i (ratio).
$LFC_{EG,PO,j}$ = Baseline load factor of heat engine j (ratio).
LOC_y = Length of the operational campaign in year y (hour).
i = Cogeneration-type heat engine in the baseline scenario.
j = Power-only-type heat engine in the baseline scenario.
y = Year of the crediting period.

Note that in the baseline scenario, there would only be one cogeneration-type heat engine and no power-only-type heat engine. The corresponding load factors for the heat engines in the baseline will be chosen according the common practice of the Pulp industry.

Step 1.4: Determine the baseline availability of biomass residues

Since in the case of the proposed project activity, there would be biomass residues that would be used for heat and/or power generation in the baseline. These biomass residues are identified below:

There are three types of biomass residues[29] that would be used for heat and power generation in the baseline scenario:

1. Black liquor
2. Methanol
3. CNCG

All the biomass residues identified under the baseline scenario would be burned in the recovery boiler, exclusively. The other (additional) biomass residues that would be used as fuel in a biomass power boiler under the project scenario would be discarded in landfields under the baseline scenario.

Step 1.5: Determine the efficiencies of heat generators and efficiencies and heat-to-power ratio of heat engines

1.5.1 Efficiencies of heat generators and heat engines

Considering that the proposed project activity is a greenfield power generation project (e.g. no previous operational history), the Project Proponent will choose:

Option 1: Default values. Use option F in the latest approved version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems" Since in this case a suitable default value is not provided for the technology used in the project case, the Project Proponent will request for a revision of the corresponding methodological tool.

The default value suggested by the ACM0006 (Version 11.1) for the losses linked to the electricity generator group (i.e. turbine/engine, couplings and electricity generator), $GGL_{default}$, is 5%.

The Project Proponent will use this option for both, heat generators and heat engines that would operate in the baseline.

1.5.2 Heat-to-power ratio of cogeneration-type heat engines (e.g. backpressure and heat-extraction steam turbines)

Considering that the proposed project activity is a greenfield power generation project (e.g. no previous operational history), the Project Proponent will choose:

Case 2: For heat engines without a minimum three-year operational history prior to the project activity, the heat-to-power ratio should be determined as per the design conditions of the plant, for the

[29] It must be noted that in this case, the relevant biomass fuel that is used in the baseline is the black liquor. Methanol and CNCG are not relevant in terms of the energy contribution to the process. The Project Proponent decided to consider them in the calculations in order to follow the ACM0006 (Version 11.1) in a rigorous way.

configuration identified in the baseline scenario. The Project Proponent will use the information provided by the consultant for the baseline pulp mill design.

Step 1.6: Determine the emission factor of on-site electricity generation with fossil fuels

In the case of the proposed project, there is no fossil fuel based power generation identified as part of the baseline scenario. As a result the Project Proponent will do:

$$EF_{EG,FF,y} = EF_{EG,GR,y}$$

Where:

$EF_{EG,FF,y}$ = CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y (tCO_2/MWh).

$EF_{EG,GR,y}$ = CO_2 emission factor of the fossil fuel type that would be used for power generation at the project site in the baseline (tCO_2/GJ).

Step 1.7: Determination of the emission factor of grid electricity generation

According to the ACM0006 (Version 11.1), the Project Proponent will determine the parameter $EF_{EG,GR,y}$ as the combined margin CO_2 emission factor for grid to which the project activity is connected in year y. The combined margin will be calculated using the latest approved version of the “Tool to calculate the emission factor for an electricity system”.

Determination of $EF_{EG,GR,y}$

According to the latest version of the “Tool to calculate the emission factor for an electricity system (Version 02.2)” the following steps must be followed:

Step 1: Identify the relevant electricity systems.

The tool establishes that the Project Proponent should use the electricity system to which the proposed project activity is connected, provided there are no significant transmission constraints. The following criteria can be used to determine the existence of significant transmission constraints:

1. In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of more than 5% between the systems during 60% or more of the hours of the year;

2. The transmission line is operated at 90% or more of its rated capacity during 90% or more of the hours of the year.

The proposed project activity is connected to the "Sistema Interconectado Nacional de Uruguay"[30] (SINU):

URUGUAY NATIONAL INTERCONNECTED SYSTEM

In this case, there is a spot market for electricity. ADME is the national entity in charge of supervising the operation of this market. The spot prices are periodically published by ADME in its web page[31]. There, it can be clearly seen that at all time, there is only one node electricity price for the whole transmission system in the SINU. According to this, the first criteria would be fulfilled. As a result, it can be concluded that there are no significant transmission constraints in the transmission system to which the proposed project is connected.

[30] The English translation for this would be: "National Interconnected System of Uruguay".

[31] Please see: http://www.adme.com.uy. Or more specifically: http://www.adme.com.uy/mmee/sancionado.php, where it is possible to verify that there is only one spot price for the entire system.

According to the above, the relevant transmission system would be the "Sistema Interconectado Nacional de Uruguay" (SINU).

The SINU is interconnected to two interconnected systems:

1. The interconnected system of Argentina and
2. The interconnected system of the south of Brazil.

For the purpose of determining the operating margin emission factor for the net electricity imports from each of these systems, the Project Proponent will choose 0 (tCO_2/MWh).

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional).

In this case, the Project Proponent will choose Option I; include only grid-connected power plants in the calculation.

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

The "Tool to calculate the emission factor for an electricity system" offers four options to calculate the Operating Margin emission factor:

a) Simple OM,
b) Simple adjusted OM
c) Dispatch data analysis OM
d) Average OM

Considering the characteristics of the SINU system (e.g. low-cost/must run power generation), the Project Proponent will choose option b) to calculate the Operating Margin (OM): the simple adjusted OM.

The simple adjusted OM method requires identifying low cost/must run resources (*k*) from other power sources (m):

$$EF_{grid,OM-adj,y} = (1-\lambda_y)\cdot\frac{\sum_m EG_{m,y}\cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y\cdot\frac{\sum_k EG_{k,y}\cdot EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where:

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh).
λ = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y.
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh).

$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh).
$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh).
$EF_{EL,k,y}$ = CO_2 emission factor of power unit k in year y (tCO_2/MWh).
m = All grid power units serving the grid in year y except low-cost/must run power units.
k = All low-cost/must-run grid power units serving the grid in year y.
y = The relevant year as per the data vintage chosen in Step 3.

The procedures for determining the λ, are stated in the "Tool to calculate the emission factor for an electricity system" (equation N° 9 of the tool, Version 02.2.0) and will not be presented in this section.

According to the corresponding tool, it is possible to calculate the Operating Margin using the following data vintages for year(s) y:

- *Ex-ante option:* The emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required, or

- *Ex-post option:* The emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The Project Proponent will use the *Ex-ante option* to calculate the OM; that is, the OM will be calculated once at the validation stage. As a result, no monitoring and recalculation of the emissions factor during the crediting period is required.

<u>Step 4:</u> Calculate the operating margin emission factor according to the selected method.

For the calculation of the operating margin, the Project Proponent will use:

- Option A to calculate the $EF_{grid,OM\text{-}adj,y}$: Use information based on the net electricity generation and a CO_2 emission factor for each power unit.

For the determination of the emission factor of each power unit m, $EF_{EL,m,y}$ the Project Proponent will choose:

- Option A1: Use information based on fuel consumption and electricity generation for each power unit m.

Note that in this case, the information that is directly available from the Dispatch Centre is the net generation of each power unit m and the corresponding fossil fuel consumption rate.

<u>Step 5:</u> Calculate the build margin (BM) emission factor.

In terms of data vintage, the Project Proponent will choose Option 2:

<u>Option 2:</u> For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units build up to the year of registration of the project activity or, if information up

to the year of registration is not yet available, including those units build up to the latest year for which information is available, For the second crediting period, the build margin emission factor shall be calculated *ex ante*, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Step 6: Calculate the combined margin emission factor.

In this case, the proposed project activity is not located in a Least Developed County (LDC), therefore, according to the corresponding tool for grid emission factor calculation, the combined margin emission factor is calculated according to the following option:

a) Weighted average CM

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh).
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh).
w_{OM} = Weighting of operating margin emission factor (%).
w_{BM} = Weighting of build margin emission factor (%).

According to the guidance provided by the tool for calculating the grid emission factor, in this case the Project Proponent will use the following default values for w_{OM} and w_{BM}:

- Weights: w_{OM} = 0.5 = w_{BM} = 0.5 for the first crediting period and
- Weights: w_{OM} = 0.25 = w_{BM} = 0.75 for the second and third crediting periods.

The values for w_{OM} and w_{BM} applied by the Project Proponent will be fixed for a crediting period and may be revised at the renewal of the crediting period.

Step 2: Determine the minimum baseline electricity generation in the grid

The calculation of this parameter is accomplished using equation 13 of the ACM0006 (Version 11.1):

$$EL_{BL,GR,y} = \max[0, EL_{BL,y} - CAP_{EG,total,y}]$$

Where:

$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year y (MWh/yr).
$EL_{BL,y}$ = Baseline electricity generation in year y (MWh/yr).
$CAP_{EG,total,y}$ = Baseline electricity generation capacity in year y (MWh/yr).
y = Year of the crediting period.

Step 3: Determination of the baseline biomass-based heat and power generation

Step 3.1: Determination of the baseline biomass-based heat generation

According to the general principles suggested by the ACM0006 (Version 11.1), the Project Proponent will calculate the baseline biomass-based heat generation taking the following project-specific conditions:

The use of biomass residues for which scenario B4 has been identified as the baseline scenario ($BR_{B4,n,y}$) will be prioritized over the use of any fossil fuels in the baseline. From this assumption, the equivalent amount of heat that would be generated with biomass residues ($HG_{BL,BR,y}$) will be determined.

According to the baseline pulp mill design (see section A.4.3 of this PDD), there is only one biomass boiler identified in the baseline:

- Recovery boiler: This boiler generates high-pressure steam for heat and power generation and operates on biomass residues. Small amounts of fossil fuels can also be used (co-fired).

This heat generator will run on the biomass residues for which the B4 baseline scenario has been identified: black liquor, methanol and CNCG. These biomass residues can only be burned in this heat generator.

Due to technical constraints (operational reasons: start-ups, low production loads, etc.), some fossil fuels must also be used. However, the fossil fuel amounts are expected to be very small:

- Fuel oil: 26.6 (kg/ADt of pulp).

According to the ACM0006 (Version 11.1), these fossil fuel quantities will be accounted for in the parameter $FF_{BL,HG,y,f}$ and the corresponding heat generation considered in the monitoring of the parameter $HG_{BL,BR,y}$.

Allocation of biomass residues and fossil fuels:

According to the information provided above, the Project Proponent will allocate 100% of the biomass types for which the B4 baseline scenario applies to the recovery boiler. Since fossil fuels can be used in the recovery boiler, the Project Proponent will determine fossil fuel consumption by installing proper measurement systems.

Equation 14 is used to calculate the amount of heat generated with biomass residues based on the allocation rules established above:

$$HG_{BL,BR,y} = \sum_{h} \sum_{n} (BR_{B4,n,h,y} * NCV_{BR,n,y} * \eta_{BL,HG,BR,h})$$

Subject to the following conditions:

1. The biomass residues used in each heat generator should not exceed the total amount of biomass residues available. This is stated in equation 15 as follows:

$$\sum_{h}\sum_{n} BR_{B4,n,h,y} = \sum_{n} BR_{B4,n,y}$$

2. The heat generation in each heat generator should not exceed the total capacity of the heat generator. This is stated in equation 16 as follows:

$$\sum_{n}(BR_{B4,n,h,y} * NCV_{BR,n,y} * \eta_{BL,HG,BR,h}) \leq LOC_{y} * CAP_{HG,h} * LFC_{HFG,h}$$

Where:

$HG_{BL,BR,y}$ =	Baseline biomass-based heat generation in year y (GJ/yr).
$BR_{B4,n,h,y}$ =	Quantity of biomass residues of category n used in heat generator h in year y with baseline scenario B4 (tonne on dry basis).
$NCV_{BR,n,y}$ =	Net calorific value of biomass residue of category n in year y (GJ/tonne on dry basis).
$\eta_{BL,HG,BR,h}$ =	Baseline biomass-based heat generation efficiency of heat generator h (ratio).
$BR_{B4,n,y}$ =	Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B4 (tonne on dry basis).
LOC_{y} =	Length of the operational campaign in year y (hour).
$CAP_{HG,h}$ =	Baseline capacity of heat generator h (GJ/h).
$LFC_{HG,h}$ =	Baseline load factor of heat generator h (ratio).
y =	Year of the crediting period.
h =	Heat generator in the baseline scenario.

Step 3.2: Determination of the baseline biomass-based cogeneration of process heat and electricity and heat extraction

As indicated in the ACM0006 (Version 11.1), it is assumed that cogeneration of process heat and power using biomass-based heat ($HG_{BL,BR,y}$) is prioritized over the use of fossil fuels for the generation of process heat and power on-site. From that assumption the equivalent amount of electricity ($EL_{BL,BR,CG,y}$) and process heat ($HC_{BL,BR,CG,y}$) that would be generated are determined.

In the case of the proposed project activity, the baseline scenario only considers one heat engine: a 112.6 MW back-pressure extracting turbine; in which heat and power can be cogenerated.

<u>Allocation of biomass-based heat $HG_{BL,BR,y}$:</u>

According to the above, the Project Proponent will allocate the maximum amount of heat to the identified heat engine that would operate in the baseline scenario. With this allocation, the Project Proponent will determine the amount of electricity and process heat that would be cogenerated in the baseline scenario.

The amount of electricity that would be cogenerated in the baseline scenario is determined by equation 17 as follows:

$$EL_{BL,BR,CG,y} = \frac{1}{3.6} * \sum_i \left(\frac{1}{(HPR_{BL,i} + 1 + GGL_{default})} * HG_{BL,BR,CG,y,i} \right)$$

The amount of process heat that would be cogenerated in the baseline scenario is determined by equation 18 as follows:

$$HC_{BL,BR,CG,y} = \sum_i \left(\frac{HPR_{BL,i}}{(HPR_{BL,i} + 1 + GGL_{default})} * HG_{BL,BR,CG,y,i} \right)$$

<u>Subject to the following conditions:</u>

1. The biomass-based heat used in cogeneration mode should not exceed the total biomass-based heat generated. This is stated in equation 19 as follows:

$$\sum_i HG_{BL,BR,CG,y,i} \leq HG_{BL,y}$$

2. The process heat co-generated should not exceed the total process heat demand. This is stated in equation 20 as follows:

$$HC_{BL,BR,CG,y} \leq HC_{BL,y}$$

3. The electricity generation in each heat engine should not exceed the total capacity of the heat engine. This is stated in equation 21 as follows:

$$(\eta_{BL,EG,CG,i} * HG_{BL,BR,CG,y,i}) \leq LOC_y * CAP_{EG,CG,i} * LFC_{EG,CG,i}$$

Where:

$EL_{BL,BR,CG,y}$ =	Baseline biomass-based co-generated electricity in year y (MWh/yr).
$\eta_{BL,EG,CG,i}$ =	Baseline electricity generation efficiency of heat engine i (MWh/GJ).
$HG_{BL,BR,CG,y,i}$ =	Baseline biomass-based heat used in heat engine i in year y (GJ/yr).
$HC_{BL,BR,CG,y}$ =	Baseline biomass-based process heat co-generated in year y (GJ/yr).
$HPR_{BL,i}$ =	Baseline heat to power ratio of the heat engine i (ratio).
$GGL_{Default}$ =	The default value for the losses linked to the electricity generator group (turbine, couplings and electricity generator. Set at 0.05 (ratio).
$HG_{BL,BR,y}$ =	Baseline biomass-based heat generation in year y (GJ/yr).
$HC_{BL,y}$ =	Baseline process heat generation in year y (GJ/yr).
LOC_y =	Length of the operational campaign in year y (hours/yr).
$CAP_{EG,CG,i}$ =	Baseline electricity generation capacity of heat engine i (MW).
$LFC_{EG,CG,i}$ =	Baseline load factor of heat engine i (ratio).
i =	Cogeneration-type heat engine in the baseline scenario.

y = Year of the crediting period.

According to the ACM0006 (Version 11.1), the next step to be followed depends on the outcomes of the calculations above. The methodology states that four cases are possible.

The Project Proponent will apply the monitoring methodology algorithms according to the different outcomes that might happen, given the design of the baseline scenario and the actual monitored data. However and for the sake of presenting the methodological choices in this section of the PDD, the Project Proponent will choose the cases (and corresponding algorithms) that are most likely to occur once the project starts operating.

Case 3.2.4

In this case, there would be biomass-based heat in the baseline that could still be used and process heat demand to be met. It is assumed then that this balance of biomass-based heat would be extracted from the heat header and used to meet the process heat demand without co-generation of power. The following equations reflect this situation:

$$HG_{BL,BR,y} > \sum_i HG_{BL,BR,CG,y,i}$$

and

$$HC_{BL,y} > HC_{BL,BR,CG,y}$$

According to the ACM0006 (Version 11.1), there are three possible outcomes that can happen, however the Project Proponent expects that the most likely outcome is case 3.2.4.3.

Case 3.2.4.3

The following situation happens:

$$HC_{BL,y} - HC_{BL,BR,CG,y} < \frac{h_{LOW,y}}{h_{HIGH,y}} * (HG_{BL,BR,y} - \sum_i HG_{BL,BR,CG,y,i})$$

In this case, the balance of biomass-based heat (right-hand side of the equation) is greater than the remaining demand for process heat (left-hand side of the equation).

Then the balance of heat produced with biomass residues is greater that the balance of process heat demand, which means that there is some biomass-based heat to be used after the demand for process heat was met. It is assumed that this heat would be used to generate electricity in power-only mode (without co-generation of process heat).

As a result, the Project Proponent must make the following definitions:

- $HG_{balance,BR,PO,y} = (HG_{BL,BR,y} - \sum_{i} HG_{BL,BR,CG,y,i}) - \frac{h_{HIGH,y}}{h_{LOW,y}} * (HC_{BL,y} - HC_{BL,BR,CG,y})$
- $EL_{balance,PO,y} = EL_{BL,y} - EL_{BL,GR,y} - EL_{BL,BR,CG,y}$
- Proceed to Step 3.3: Determine the baseline biomass-based electricity generated in power-only mode.

Step 3.3: Determine the baseline biomass-based electricity generated in power-only mode

If power-only type heat engines, i.e. heat engines that produce only electricity without cogeneration of process heat, have been identified in the baseline scenario, it is assumed that the balance of heat produced using biomass residues, if any, would be used in power-only mode.

According to this, equations 22, 23 and 24 apply:

$$EL_{BL,BR,PO,y} = \sum_{i} (HG_{BL,BR,PO,y,j} * \eta_{BL,EG,PO,j})$$

Subject to:

$\sum_{i} HG_{BL,BR,PO,y,j} \leq HG_{balance,BR,PO,y}$ The biomass-based heat used in the heat engines should not exceed the biomass-based heat balance.

$(HG_{BL,BR,PO,y,j} * \eta_{BL,EG,PO,j}) \leq LOC_y * CAP_{EG,PO,j} * LGC_{EG,PO,j}$ The electricity generation in each heat engine should not exceed the total capacity of the heat engine.

Where:

$EL_{BL,BR,PO,y}$ = Baseline biomass-based electricity (power-only) in year y (MWh).
$HG_{BL,BR,PO,y,j}$ = Baseline biomass-based heat used in heat engine j in year y (GJ).
$\eta_{BL,EG,PO,j}$ = Average electric power generation efficiency of heat engine j (MWh/GJ).
$HG_{balance,BR,PO,y}$ = Baseline biomass-based heat balance after cogeneration in year y (GJ).
LOC_y = Length of the operational campaign in year y (hours/yr).
$CAP_{EG,PO,j}$ = Baseline capacity of heat generator j (GJ/hr).
$LFC_{EG,PO,j}$ = Baseline load factor of heat generator j (ratio).

According to the design of the baseline scenario, the most likely outcome from the equations above is case 3.3.1. As a result, the following equation applies:

$$EL_{balance,PO,y} \geq EL_{BL,BR,PO,y}$$

This means that the amount of electricity generated on-site in the baseline is equal or less than the amount of electricity generated in the project scenario. In that case, the following definitions must be made:

- $EL_{BL,FF/GR,y} = EL_{balance,PO,y} - EL_{BL,BR,PO,y}$
- $EL_{PJ,offset,y} = 0$
- $FF_{BL,HG,y,f} = 0$ [32]
- Proceed to Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues.

Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

In the case of the proposed project activity, the Project Proponent will consider the baseline emissions due to uncontrolled decay of biomass residues. The corresponding emissions are calculated using equation 35 as follows:

$$BE_{BR,y} = BE_{BR,B1/B3,y} + BE_{BR,B2,y}$$

Where:

$BE_{BR,y}$ = Baseline emissions due to disposal of biomass residues in year y (tCO_2e/yr).
$BE_{BR,B1/B3,y}$ = Baseline emissions due to aerobic decay or uncontrolled burning of biomass residues in year y (tCO_2e/yr).
$BE_{BR,B2,y}$ = Baseline emissions due to anaerobic decay of biomass residues in year y (tCO_2/yr).

Since in this case, the biomass residues that would be used for heat and power generation due to the implementation of the project activity would decay under clearly anaerobic conditions, the equation above simplifies to the following:

$$BE_{BR,y} = BE_{BR,B2,y}$$

According to the above, we proceed to step 5.2.

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[32] Note that according to step 3.1, some fossil fuels must be used in the baseline due to technical constraints. According to the methodology, this amount of fossil fuel must be considered (added) in this parameter. As a result, this parameter will most likely be small, but not zero. This will be fully illustrated in the ex-ante emission reduction calculation section of this PDD.

Step 5.2: Determine $BE_{BR,B2,y}$.

For the biomass residues categories for which the most likely baseline scenario is that the biomass residues would decay under clearly anaerobic conditions (case B2), Project Proponents must calculate the corresponding baseline emissions using the latest approved version of the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”.

According to this tool, the amount of methane produced in the year y is calculated using the following equation:

$$BE_{CH4,SWDS,y} = \varphi * (1-f) * GWP_{CH4} * (1-OX) * \frac{16}{12} * F * DOC_f * MCF * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j * e^{-kj*(y-x)} * (1-e^{-kj})$$

Where:

$BE_{CH4,SWDS,y}$ = Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e/yr).
φ = Model correction factor to account for model uncertainties (0.9).
f = Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
GWP_{CH4} = Global Warming Potential (GWP) of methane, valid for the relevant commitment period.
OX = Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste).
F = Fraction of methane in the SWDS gas (volume fraction) (0.5).
DOC_f = Fraction of degradable organic carbon (DOC) that can decompose.
MCF = Methane correction factor.
$W_{j,x}$ = Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons/yr).
DOC_j = Fraction of degradable organic carbon (by weight) in the waste type j.
k_j = Decay rate for the waste type j.
j = Waste type category (index).
x = Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emission are calculated (x=y).
y = Year for which methane emission are calculated.

In the case of the proposed project activity, there will be different waste types j that are prevented from disposal. As a result, the Project Proponent will determine the different waste types ($W_{j,x}$) through sampling and calculate the mean from the samples, as follows:

$$W_{j,x} = W_x * \frac{\sum_{n=1}^{z} P_{n,j,x}}{z}$$

Where:

$W_{j,x}$ = Amount of organic waste type j prevented from disposal in the SWDS in year x (tons/yr).
W_x = Total amount of organic waste prevented from disposal in year x (tons/yr).
$P_{n,j,x}$ = Weight fraction of the waste type j in the sample n collected during the year x.
z = Number of samples collected during the year x.

According to the ACM0006 (Version 11.1), the following adjustments must be made to the equations above:

$$BE_{CH4,SWDS,y} = BE_{BR,B2,y}$$

and

$$W_{j,x} = BR_{n,B2,y}$$

The determination of $BR_{n,B2,y}$ will be based on the monitored amounts of biomass residues used in the power plant included in the project boundary. Since in the case of the proposed project activity all the biomass residues with the baseline scenario B2 come from one particular source (inside the project plant site), the monitored quantities of biomass residues used from that source in the project plant will be directly used.

Step 6: Calculate baseline emissions

The Project Proponent will calculate the baseline emissions according to equation 2 above.

Leakage

According to the ACM0006 (Version 11.1), the baseline scenarios for biomass residues for which potential leakage is relevant are B5, B6, B7 and B8. Since the proposed project activity contemplates the utilization of biomass residues for which the applicable baseline scenarios are B2 (biomass residues from wood handling and primary sludge from the effluent treatment plant) and B4 (black liquor), leakage emissions are not relevant in this case.

Default values

In this section, the Project Proponent will provide the default values that will be used in the emission reduction calculation of the proposed project activity.

According to Step 1.5 for baseline emissions, the Project Proponent will use default values for determining the efficiencies of heat generators and heat engines.

Default value type	Name	Unit	Value	Justification / comment
Heat efficiency of the recovery boiler (heat generator)	$\eta_{BL,HG,BR,Rec.boiler}$	(%)	76.24	This efficiency value was not available under option F (use of default values) of the latest approved version of the "Tool to determine the

				baseline efficiency of thermal or electric energy generation systems" at the date of the validation of the proposed project activity. As a result, the Project Proponent obtained this value from the baseline pulp mill energy / mass balance. The Project Proponent will request the consideration of the proposed efficiency for the proposed project activity (not a revision of the corresponding tool).
Heat efficiency of the auxiliary fossil fuel boiler (heat generator)	$\eta_{BL,HG,BR,Auxiliary\ boiler}$	(%)	90	The Project Proponent used the 90% default value provided by option F (use of default values) of the latest approved version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems".
Baseline electricity generation efficiency of heat engine i	$\eta_{BL,EG,CG,i}$	(MWh/GJ)	0.05784	This efficiency value was not available under option F (use of default values) of the latest approved version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems" at the date of the validation of the proposed project activity. As a result, the efficiency parameter was calculated from the energy / mass balance of the baseline pulp mill. The Project Proponent will request the consideration of the proposed efficiency for the proposed project activity (not a revision of the corresponding tool).
Baseline heat-to-power ratio of heat engine i	$HPR_{BL,EG,CG}$	(Number)	4.518	Chosen according to Case 2, efficiency for heat engines, Step 1.5 of the ACM0006 (Version 11.1). According to this option, HPR should be determined as per the design conditions of the plant for the configuration identified as baseline scenario: the baseline plant.
Losses linked to the electricity generator group	$GGL_{default}$	(%)	5	Default value suggested by the ACM0006 (Version 11.1) in Step 1.5.

According to Step 5 for baseline emissions, the Project Proponent will use default values for calculating the baseline methane emissions from biomass anaerobic decay. These values are already presented in section B.6.2 of this PDD, therefore will not be presented again in this section.

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

Non-monitored parameters for the "ACM0006 (Version 11.1)":

Data / Parameter:	**Biomass residues categories and quantities used for the selection of the baseline scenario selection and assessment of additionality**
Data unit:	- Type: bagasse, rice husks, empty fruit branches, etc. - Source: produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc. - Fate (in the absence of the project activity): scenarios B. - Quantity: tonnes on dry-basis.

Description:	The biomass quantities provided in the table below were determined ex-ante in accordance with the pulp mill project studies.
Source of data used:	On-site assessment of biomass residues categories and quantities.
Value applied:	See table below:
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Project Proponent hired reputed consultants for the development of the new pulp mill project and therefore, the estimation ex-ante of the biomass types and quantities.
Any comment:	This parameter is related to the procedure for the selection of the baseline scenario selection and assessment of additionality.

Biomass residue category k	Biomass residues type	Biomass residue source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (dry tonnes/yr)
1	Black liquor	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	1,797,966
2	Methanol	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	15,611
3	CNCG	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	19,116
4	Fines from chip-screening	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	25,185
5	Combined bark and wood from wood yard	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	20,638
6	Primary sludge	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	5,193

Data / Parameter:	**$CAP_{HG,h}$**
Data unit:	(GJ/hr)
Description:	Baseline capacity of heat generator h (GJ/hr).
Source of data used:	Reference plant design parameters.
Value applied:	Recovery boiler: 2,445 (GJ/hr).
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter reflects the design maximum heat generation capacity (in GJ/hr) of the baseline heat generator h. It is based on the installed capacity of the heat generator. In the case of the proposed project activity, this parameter was obtained from the pulp mill plant design for the baseline situation. The baseline pulp mill design was performed by reputed consultants in the Pulp and Paper industry.
Any comment:	According to the ACM0006 (Version 11.1), this parameter only refers to biomass heat generators, not fossil fuel heat generators.

Data / Parameter:	**$CAP_{EG,CG,i}$** **$CAP_{EG,PO,i}$**

Data unit:	(MW)
Description:	$\mathbf{CAP_{EG,CG,i}}$ = Baseline electricity generation capacity of heat engine i (MW). $\mathbf{CAP_{EG,PO,i}}$ = Baseline electricity generation capacity of heat engine j (MW).
Source of data used:	On-site measurements or reference plant design parameters.
Value applied:	$\mathbf{CAP_{EG,CG,i}}$ = 112.6 (MW). $\mathbf{CAP_{EG,PO,i}}$ = 0 (MW). There would be no condensing-type heat engines in the baseline scenario.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter reflects the design maximum electricity generation capacity (in MW) of the baseline heat engines i and j. It is based on the installed capacity of the heat engines. In the case of the proposed project activity, this parameter was obtained from the pulp mill plant design for the baseline situation. The baseline pulp mill design was performed by reputed consultants in the Pulp industry.
Any comment:	--

Data / Parameter:	$\mathbf{LFC_{HG,h}}$
Data unit:	(Ratio)
Description:	$\mathbf{LFC_{HG,h}}$ = Baseline load factor of heat generator h (ratio).
Source of data used:	On-site measurements or reference plant design parameters.
Value applied:	$\mathbf{LFC_{HG,h}}$ = 89%.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter reflects the maximum load factor (i.e. the ratio between the “actual heat generation” of the heat generator and its “design maximum heat generation” along one year of operation) of the baseline heat generator h, taking into account downtime due to maintenance, seasonal operational patterns and any other technical constraints. In the case of the proposed project activity, this parameter was obtained from the pulp mill plant design for the baseline situation. The baseline pulp mill design was performed by reputed consultants in the Pulp industry.
Any comment:	In this case, the load factor is defined as the ratio between the average generation and the maximum capacity. This definition is in accordance to the Pulp and Paper industry.

Data / Parameter:	$\mathbf{HPR_{BL,i}}$
Data unit:	(Ratio)
Description:	Baseline heat-to-power ratio of the heat engine i (ratio).
Source of data used:	On-site measurements or reference plant design parameters.
Value applied:	4.518 (ratio)
Justification of the choice of data or description of measurement methods and procedures actually applied :	In the case of the proposed project activity, this parameter was calculated from the pulp mill plant design for the baseline situation. The baseline pulp mill design was performed by reputed consultants in the Pulp industry.
Any comment:	The Project Proponent chose “Case 2” in step 1.5 to determine the HPR for the

	heat engine that would be installed in the baseline. The proposed project is a greenfield project; therefore under Case 2, the HPR should be determined as per the design conditions of the plant, for the configuration identified as baseline scenario in the "Selection of the baseline scenario and demonstration of additionality". As a result, the HPR was determined from the energy / mass balance provided for the baseline pulp mill design.

Data / Parameter:	**$LFC_{EG,CG,i}$** **$LFC_{EG,CG,i}$**
Data unit:	(Ratio)
Description:	**$LFC_{EG,CG,i}$** = Baseline load factor of heat engine i (ratio). **$LFC_{EG,CG,j}$** = Baseline load factor of heat engine j (ratio).
Source of data used:	On-site measurements or reference plant design parameters.
Value applied:	**$LFC_{EG,CG,i}$** = 0.9 (ratio). **$LFC_{EG,CG,j}$** = 0 (ratio). There would be no condensing-type heat engines in the baseline scenario.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter reflects the maximum load factor (i.e. the ratio between the "actual electricity generation" of the heat engine and its "design maximum electricity generation" along one year of operation) of the baseline heat engine i or j. The actual electricity generation of the heat engine should be determined taking into account downtime due to maintenance, seasonal operational patterns and any other technical constraints. In the case of the proposed project activity, this parameter was obtained from the pulp mill plant design for the baseline situation. The baseline pulp mill design was performed by reputed consultants in the Pulp industry.
Any comment:	The load factor has been chosen to be 90%. This value corresponds to the ration between the average output and the MCR output. This is in accordance to the normal practice in the Pulp and Paper industry.

Data / Parameter:	**GWP_{CH4}**
Data unit:	(tCO_2e/tCH_4)
Description:	Global Warming Potential for CH_4.
Source of data used:	IPCC
Value applied:	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Justification of the choice of data or description of measurement methods and procedures actually applied:	Until the next COP/MOP decision, it is the accepted value for emission reduction calculations in CDM project activities.
Any comment:	--

<u>Non- monitored parameters from the "Tool to determine methane emissions avoided from disposal of waste at a solid disposal site (Version 05)":</u>

Data / Parameter:	φ
Data unit:	--
Description:	Model correction factor to account for model uncertainties.
Source of data used:	Specified in the corresponding tool.
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied:	--
Any comment:	Oonk et al. (1994) have validated several landfield gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.

Data / Parameter:	**OX**
Data unit:	--
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste).
Source of data used:	Conduct a site visit at the solid waste disposal site in order to assess the type of cover of the solid waste disposal site. Use IPCC 2006 Guidelines for National Greenhouse Gas Inventories for the choice of the value to be applied.
Value applied:	Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites. In the case of the proposed project activity, the landfield will be a managed solid waste disposal site that will be covered with oxidizing material such as soil or compost; therefore the Project Proponent will choose 0.1.
Justification of the choice of data or description of measurement methods and procedures actually applied:	The chosen value is in accordance with the criteria established by the baseline methodology and the tool applied in this case. The corresponding project design document for the landfield is available to support the chosen values.
Any comment:	--

Data / Parameter:	**F**
Data unit:	--
Description:	Fraction of methane in the SWDS gas (volume fraction).
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.5
Justification of the	--

choice of data or description of measurement methods and procedures actually applied:	
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by the IPCC.

Data / Parameter:	**DOC_f**
Data unit:	--
Description:	Fraction of degradable organic carbon (DOC) that can decompose.
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied:	--
Any comment:	--

Data / Parameter:	**MCF**
Data unit:	--
Description:	Methane correction factor.
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	Use the following values for MCF: • 1.0 for **anaerobic managed solid waste disposal sites**. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste; • 0.5 for **semi-aerobic managed solid waste disposal sites**. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and(iv) gas ventilation system; • 0.8 for **unmanaged solid waste disposal sites – deep and/or with high water table.** This comprises al SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high water table at near ground level. Latter situation corresponds to filling inland water, such pond, river or wetland, by waste; • 0.4 for **unmanaged-shallow solid waste disposal sites**. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 meters.

	In the case of the proposed project activity and according to the description above, the Project Proponent will choose 1.0.
Justification of the choice of data or description of measurement methods and procedures actually applied:	The selection of the value in this case is in accordance with the criteria established by the baseline methodology and the applicable tool for this case. According to the landfield project description for the Punta Pereira pulp mill, the landfield that will be used in this case falls under the first category provided by the corresponding tool: an anaerobic managed waste disposal site.
Any comment:	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

Data / Parameter:	**DOC_j**
Data unit:	--
Description:	Fraction of degradable organic carbon (by weight) in the waste type j.
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5).
Value applied:	Apply the following values for the different waste types j: (see table below)

Waste type j	**DOCj (% wet waste)**	**DOCj (% dry waste)**
Wood and wood products	43	50
Pulp, paper and cardboard (other than sludge)	40	44
Food, food waste, beverages and tobacco (other than sludge)	15	38
Textiles	24	30
Garden, yard and park waste	20	49
Glass, plastic, metal, or other inert waste	0	0

If a waste type, prevented from disposal by the proposed CDM project activity, cannot clearly be attributed to one of the waste types in the table above, project participants should choose among the waste types that have similar characteristics that waste type where the values of DOC_j and k_j result in a conservative estimate (lowest emissions), or request a revision of / deviation from this methodology.

In the case of empty fruit branches (EFB), as their characteristics are similar to garden waste, the parameter value correspondent of garden shall be used. In the case of industrial sludge, a value of 9% (% wet sludge) shall be used assuming an organic dry matter content of 35 percent[33]. In the case of domestic sludge, a value of 5% (wet sludge) shall be used, assuming an organic dry matter content of 10 percent[34].

[33] This value must be adjusted for other percentages of organic dry matter content as follows: DOC (% wet sludge) = 9 * (% organic dry matter content/35).

[34] This value, for domestic sludge, must be adjusted for other percentages of organic dry matter content as follows: DOC (% wet sludge) = 5 * (% organic dry matter content/10).

	For the proposed project activity and according to the information provided above, the Project Proponent will choose the following values for this parameter: **Waste type j** — **DOC_j (% wet waste)** Fines from chip-screening — 43% Combined bark and wood from wood yard — 43% Primary sludge (70% of humidity, wet basis) — 7.7%
Justification of the choice of data or description of measurement methods and procedures actually applied:	The Project Proponent used the studies for the project plant (pulp mill) performed by reputed consulting companies to select the values for this parameter.
Any comment:	--

Waste type j	DOC_j (% wet waste)
Fines from chip-screening	43%
Combined bark and wood from wood yard	43%
Primary sludge (70% of humidity, wet basis)	7.7%

Data / Parameter:	**k_j**
Data unit:	--
Description:	Decay rate for the waste type j.
Source of data used:	IPCC 2006 Guideline for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3).
Value applied:	Apply the following default values for the different waste types j:

Waste type j		**Boreal and Temperate (MAT≤20°C)**		**Tropical (MAT>20°C)**	
		Dry (MAP/PET<1)	Wet (MAP/PET>1)	Dry (MAP<1000mm)	Wet (MAP>1000mm)
Slowly degrading	Pulp, paper, car board (other than sludge), textiles	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.0 5	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

NB: MAT – mean annual temperature, MAP – Mean annual precipitation, PET – potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.

If a waste type, prevented from disposal by the proposed CDM project activity, can not clearly be attributed to one of the waste types in the table above, project participants should choose among the waste types that have similar characteristics that waste type where the values of DOCj and kj result in a

	conservative estimate (lowest emissions), or request a revision of / deviation from this methodology. In the case of empty fruit branches (EFB), are their characteristics are similar to garden waste, the parameter values correspondent of garden waste shall be used. In case of sludge from pulp and paper industry, a conservative value of 0.03 shall be used for all precipitation and temperature combinations. In the case of the proposed project activity and considering the information above, the Project Proponent chose the following values for this parameter: **Waste type j** — **k_j** Fines from chip-screening — 0.03 Combined bark and wood from wood yard — 0.03 Primary sludge — 0.03
Justification of the choice of data or description of measurement methods and procedures actually applied:	The Project Proponent also used long-term climate statistics and / or official statistics to select the proper k values for each biomass type. According to these statistics, the Uruguayan climate presents a MAT of 17.3° C and a MAT/TEP index of 1.342. As a result, the chosen values for this parameter are in accordance with the criteria established by the applicable tool.
Any comment:	Document in the CDM-PDD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long-term averages based on statistical data, where available. Provide references.

<u>Non- monitored parameters from the "Tool to calculate the emission factor for an electricity system (Version 02.2)":</u>

Data / Parameter:	**$EF_{grid,OM-adj,y}$**
Data unit:	(tCO_2/MWh)
Description:	Simple adjusted operating margin CO_2 emission factor in year y.
Source of data used:	Utility or government records or official publications. Also, IPCC data.
Value applied:	0.66904 (tCO_2/MWh)
Justification of the choice of data or description of measurement methods and procedures actually applied:	The Operating Margin is calculated according to the last version of the "Tool to calculate the emission factor for an electricity system", which must be used in this case.
Any comment:	In this case, since the *ex-ante* option is chosen, this emission factor is determined once at the validation stage, thus no monitoring and recalculation of this emission factor during the crediting period is required.

B.6.3. Ex-ante calculation of emission reductions:

Notes:

1. According to the ACM0006 (Version 11.1), the way in which the emission reduction calculation is carried out can present several variations depending on the operational behaviour of the project plant. As a result, the Project Proponent will present the emission reduction calculation of the proposed project activity assuming the most likely operational scenario and considering average production quantities (pulp, electricity, etc.). These calculations, then, must be considered only as a (likely) reference, provided the project plant behaves as expected.

2. Following on what was noted in 1, in case the operation of the project plant departs from the expected scenario, the Project Proponent will apply the ACM0006 (Version 11.1) and follow all the indications and guidelines provided by the methodology accordingly. As previously mentioned, all the possible scenarios and cases will not be covered in the calculations below.

3. The Project Proponent will use design parameters of the project plant and the baseline plan to perform the emission reduction calculations that will be presented in this section. These design parameters were determined by a reputed consulting company in the Pulp and Paper industry hired by the Project Proponent for the development of the new Pulp mill project.

4. The energy / mass balances of the project and baseline plants from which this emission reduction calculation draws information have been done for the average operation condition of the plants (baseline and project) in one year. They do not correspond to the MCR[35] operation condition, which is normally used in the Pulp and Paper Industry to specify operation capacities of the equipment.

5. Baseline and project emissions calculations below may present some minor imprecision due to decimal rounding. For exact calculations, please refer to the corresponding Excel spreadsheets that support the calculations below.

Calculation of Baseline Emissions (BE_y)

The Project Proponent will follow the steps presented in the ACM0006 (Version 11.1) for the average operational condition of the project plant.

Step 1.1: Determine total baseline process heat generation.

According to the ACM0006 (Version 11.1), the amount of process heat that would be generated in the baseline in year y ($HC_{BL,y}$) is determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. From the energy / mass balance of the project plant, the calculation of the process heat is as follows:

Data:

[35] MCR stands for “Maximum Continuous Rate”.

(1) Process heat enthalpy	2,088 (GJ/hr)
(2) Feed and make up-water, boiler blow-down and condensate enthalpy	328 (GJ/hr)
(3) Operational hours per year	8,496 (hr)

Calculations:

(4) Total baseline process heat generation	**$HC_{BL,y}$**	**[(1)-(2)]*(3)**	**14,949,155 (GJ/yr)**

Step 1.2: Determine total baseline electricity generation.

According to the project plant energy / mass balance and to equation 3, this parameter is determined as follows:

Data:

(1) Gross quantity of electricity generated in the project plant	$EL_{PJ,gross,y}$	1,214,078 (MWh/yr)
(2) Project electricity imports from the grid	$EL_{PJ,imp,y}$	3,000 (MWh/yr)
(3) Total auxiliary electricity consumption required for the operation of the power plants at the project site	$EL_{PJ,aux,y}$	107,899 (MWh/yr)

Calculations:

(4) Baseline electricity generation capacity in year y	**$EL_{BL,y}$**	**(1)-(2)-(3)**	**1,109,179 (MWh/yr)**

Step 1.3: Determine the baseline capacity of electricity generation.

According to the baseline plant design, there would only be one cogeneration type heat engine and no power-only-type heat engine in the baseline scenario. The calculation is done using equation 4 as follows:

Data:

(1) Baseline electricity generation capacity of heat engine i	$CAP_{EG,CG,1}$	112.6 (MW)
(2) Baseline load factor of heat engine i	$LFC_{EG,CG,1}$	90%
(3) Length of the operational campaign in year y	LOC_y	8,496 (hr/yr)

Calculations:

(4) Baseline electricity generation in year y	**$CAP_{EG,total,i}$**	**(1)*(2)*(3)**	**860,985 (MWh/yr)**

Step 1.4: Determine the baseline availability of biomass residues.

The baseline scenario includes the use of biomass residues for the generation of power and heat. According to the baseline pulp mill design study, the amount of biomass of category n that would be available in the baseline in year y ($BR_{B4,n,y}$) are the following:

Biomass residue		Units	Average amounts
(1) Black liquor	$BR_{B4,1,y}$	(tDS/day)	5,079
		(tDS/yr)	1,797,966
(2) Methanol	$BR_{B4,2,y}$	(tDS/day)	44.1
		(tDS/yr)	15,611
(3) CNCG	$BR_{B4,3,y}$	(tDS/day)	54
		(tDS/yr)	19,116

The Project Proponent would like to note the following:

- Since in the baseline plant, there would only be one biomass heat generator; the Recovery Boiler, then all the biomass residues identified above can be completely allocated to this boiler.
- According to normal (and modern) practice in the Pulp and Paper Industry, there is normally one fate for the biomass residues identified above: the cogeneration of heat and power.

Step 1.5: Determine the efficiencies of heat generators and efficiencies and heat-to-power ratios of heat engines.

1.5.1 Efficiencies of heat generators and heat engines

According to Option 1, the use of default values from option F of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems", if there are no default efficiency values available for a specific generation technology, the Project Proponent may propose a revision of the tool in order to incorporate new default efficiency values. Alternatively, the Project Proponent may propose a particular deviation to the baseline methodology in order to use a more project-specific efficiency values.

In this case, the Project Proponent will use efficiency values proposed by the consulting company for the Recovery boiler and for the Cogeneration type heat engine, which are consistent with the baseline pulp mill design established for the Punta Pereira project activity[36].

The efficiencies of the heat generators in the baseline plant are the following:

Heat generators in the baseline		Value
(1) Recovery boiler	$\eta_{BL,HG,BR,Rec.boiler}$	76.24%
(2) Auxiliary boiler[37]	$\eta_{BL,HG,BR,Auxiliary\ boiler}$	90.0%

[36] The reason for presenting project-specific efficiency values instead of a modification to the corresponding tool is that the required efficiency values must be consistent with the baseline pulp mill design and therefore might not necessarily be valid in other contexts and / or baseline project scenarios.

[37] This boiler will only be used for start-up / shut-down operations. It will not operate on a normal basis.

The efficiency of the cogeneration-type heat engine i identified in the baseline scenario is the following:

Heat engine in the baseline		Value
(1) Cogeneration-type heat engine i	$\eta_{BL,EG,CG,i}$	0.05784 (MWh/GJ)

1.5.2 Heat-to-power ratio of heat engines in the baseline

According to the ACM0006 (Version 11.1), for heat engines without a minimum three-year operational history prior to the project activity, the heat-to-power ratio must be determined as per the design conditions of the plant, for the configuration identified as the baseline scenario. Consequently, in this case the HPR was determined based on the baseline plant design study (energy / mass balance) carried out by the consultant.

Heat engine in the baseline		Value
(1) Cogeneration-type heat engine i	$HPR_{BL,EG,CG}$	4.518 (ratio)

The Project Proponent will duly present the corresponding request for deviation to the baseline methodology, in order to validate the efficiency values proposed for the Punta Pereira project activity.

Step 1.6: Determination of the emission factor of on-site electricity generation with fossil fuels.

Since in this case no fossil fuel based power generation is identified as part of the baseline scenario[38], according to the ACM0006 (Version 11.1), the Project Proponent must make:

$$EF_{EG,FF,y} = EF_{EG,GR,y}$$

The calculation of $EF_{EG,GR,y}$ is performed below.

Step 1.7: Determination of the emission factor of on-site electricity generation with fossil fuels.

According to the ACM0006 (Version 11.1), the parameter $EF_{EG,GR,y}$ should be determined as the combined margin CO_2 emission factor for grid to which the project activity is connected in year y, calculated using the latest approved version of the “Tool to calculate the emission factor for an electricity system”. This calculation is presented in this section, below.

Data:

(1) Operating Margin (OM)	$EF_{grid,OM,y}$	(tCO_2/MWh)	669.04
(2) Build Margin (BM)	$EF_{grid,BM,y}$	(tCO_2/MWh)	238.99
(3) Weighting of Operating Margin	w_{OM}	(%)	0.5
(4) Weighting of Build Margin	w_{BM}	(%)	0.5

[38] As in the project case, the fossil fuel auxiliary boiler that would be installed in the baseline plant would only be capable of supplying process heat.

Calculations:

(5) Combined Margin calculation (CM)	$EF_{grid,CM,y}$	**(1)*(3)+(2)*(4)**	**0.45401 (tCO_2/MWh)**

For more details regarding the calculation of the OM and BM, please refer to Annex 3 of this PDD.

Step 2: Determine the minimum baseline electricity generation in the grid.

According to equation 13 of the ACM0006 (Version 11.1), this parameter is calculated as follows:

Data:

(1) Baseline electricity generation in year y	$EL_{BL,y}$	(MWh)	1,109,179
(2) Baseline electricity generation capacity in year y	$CAP_{EG,total,y}$	(MWh)	860,985

Calculations:

(3) Baseline minimum electricity generation in the grid in year y	$EL_{BL,GR,y}$	**Max[0,(1)-(2)]**	**248,195 (MWh)**

Step 3: Determine the baseline biomass-based heat and power generation.

Step 3.1: Determine the baseline biomass-based heat generation.

According to the procedures established by the ACM0006 (Version 11.1):

1. There would be only one heat generator (the recovery boiler) that would use biomass residues in the baseline scenario.

2. Such heat generator would combust all the biomass residues for which the baseline scenario $BR_{B4,n,y}$ has been identified.

3. As a technical constraint, the identified heat generator (the recovery boiler) does require using a minimum (marginal) amount of fuel oil to be co-fired with the biomass fuels under certain circumstances during the year. Such amounts of fossil fuels are shown below:

Recovery boiler	Units	Amount
Annual maintenance (1 per year)		
Fuel oil consumption for shut-down	(ton/yr)	49.2
Fuel oil consumption for start-up	(ton/yr)	64.8
Boiler trip (1 per year)		
Fuel oil consumption during start-up	(ton/yr)	21.2

Total fossil fuel consumption	**(ton/yr)**	**135.2**

According to the methodology, this amount of fossil fuel must be accounted in the total heat generation of the biomass boiler and is also considered in the baseline emission calculation of the project.

According to the ACM0006 (Version 11.1), the amount of heat generated with biomass residues is determined according to equation 14. However, the calculation must comply with the following restrictions:

Restriction associated to equation 15: The biomass residues used in each generator should not exceed the total amount of biomass residues available.

Restriction associated to equation 16: The heat generation in each heat generator should not exceed the total capacity of the heat generator.

Considering the above, the calculation of the baseline biomass-based heat generation is performed steps below:

Step 1: Determine the total heat generated in the recovery boiler considering all the biomass residues available in the baseline:

Since in this case, there would be only one heat generator in the baseline scenario, the calculation of the biomass-based heat contribution in the recovery boiler would be as follows:

Data:

(1) Quantity of black liquor	$BR_{B4,1,y}$	1,797,996 (tDS/yr)
(2) Net calorific value of black liquor	$NCV_{B4,1,y}$	13.2 (GJ/tDS)
(3) Methanol	$BR_{B4,2,y}$	15,611.4 (tDS/yr)
(4) Net calorific value of methanol	$NCV_{B4,2,y}$	19.5 (GJ/tDS)
(5) CNCG	$BR_{B4,3,y}$	19,116 (tDS/yr)
(6) Net calorific value of CNCG	$NCV_{B4,3,y}$	6.5 (GJ/tDS)
(7) Baseline biomass based heat generation efficiency of the recovery boiler	$\eta_{BL,HG,BR,Rec.boiler}$	76.24%

Calculations:

(8) Baseline biomass-based heat generation of RB in year y (without FF)	**$HG_{BL,BR,y}$ without FF**	**[(1)*(2)+(3)*(4)+(5)*(6)]*(7)**	**18,420,540 (GJ/yr)**

Step 2: Determine the heat contribution due to fossil fuel consumption in the recovery boiler:

This is accomplished considering the total fuel oil consumption in the recovery boiler due to technical constraints.

Data:

(1) Total fuel oil consumption due to restriction in year y	$FF_{Restriction,y}$	(ton/yr)	135.2
(2) Net calorific value of fossil fuel	$NCV_{F.O.}$	(GJ/ton)	39.8
(3) Recovery boiler efficiency	$\eta_{BL,HG,BR,Rec.boiler}$	(%)	76.24

Calculations:

(4) Fossil fuel heat contribution in year y	**$HG_{BL,\Delta FF,y}$**	**(1)*(2)*(3)**	**4,102 (GJ/yr)**

Step 3: Determine the total biomass-based heat generation in the recovery boiler, including fossil fuel heat contribution:

Data:

(1) Fossil fuel heat contribution in year y	$HG_{BL,\Delta FF,y}$	4,102 (GJ/yr)
(2) Baseline biomass-based heat generation of RB in year y (without FF)	$HG_{BL,BR,y}$ without FF	18,420,540 (GJ/yr)

Calculations:

(3) Baseline biomass-based heat generation of RB in year y	**$HG_{BL,BR,y}$**	**(1)+(2)**	**18,424,643 (GJ/yr)**

Step 4: Check whether this heat generation is compatible with the capacity of the recovery boiler.

The capacity of heat generation of the recovery boiler is calculated below:

Data:

(1) Length of the operational campaign in year y	LOC_y	8,496 (hr/yr)
(2) Baseline capacity of heat generator h	$CAP_{HG,h}$	2,445 (GJ/hr)
(3) Baseline load factor of heat generator h	$LFC_{HG,h}$	89%

Calculations:

(4) Total capacity of heat generation of the recovery boiler	**(1)*(2)*(3)**	**18,484,389 (GJ/yr)**

Step 5 evaluate the restrictions and perform the proper adjustments if needed.

In this case, the restrictions are fulfilled, so no adjustments are needed:

Restriction associated to equation 15: All the biomass residues available in the baseline are used in the recovery boiler, which is the only biomass boiler that would be available in the baseline scenario.

Restriction associated to equation 16: In this case, the biomass-based heat generation of the recovery boiler is less than the total capacity of the boiler.

According to the above, the baseline biomass-based heat generation in the recovery boiler, considering the technical restrictions is:

Baseline biomass-based heat generation of the R.B. in year y	$\mathbf{HG_{BL,BR,y}}$	**18,424,643 (GJ/yr)**

Step 3.2: Determine the baseline biomass-based cogeneration of process heat and electricity and heat extraction.

Since in this case, there would be only one heat engine in the baseline scenario, all the biomass-based heat ($HG_{BL,BR,y}$) generated in the recovery boiler would be allocated to this heat engine.

According to the ACM0006 (Version 11.1), the biomass-based cogeneration of process heat and electricity and heat extraction are determined according to equations 17 and 18. However, this calculation must comply with the following restrictions:

Restriction associated to equation 19: The biomass-based heat used in cogeneration mode should not exceed the total biomass-based heat generated.

Data:

(1) Total biomass-based heat used in cogeneration mode	$\Sigma\ HG_{BL,BR,CG,y,i}$	17,185,540 (GJ/yr)
(2) Total biomass-based heat generated	$HG_{BL,BR,y}$	18,424,643 (GJ/yr)

Calculations:

(3) Condition associated to equation 19	**(1) < (2)**	**OK**

Restriction associated to equation 20: The process heat co-generated should not exceed the total process heat demand.

Data:

(1) The baseline biomass-based process heat cogenerated in year y	$HC_{BL,BR,CG,y}$	13,944,881 (GJ/yr)
(2) Total biomass-based heat generated (heat demand)	$HC_{BL,y}$	14,949,155 (GJ/yr)

Calculations:

(3) Condition associated to equation 20	**(1) < (2)**	**OK**

Restriction associated to equation 21: The electricity generation in each heat engine should not exceed the total capacity of the heat engine. Since in the baseline there would only be one cogeneration-type heat engine i, the restriction is as follows:

Data:

(1) Electricity generation in the cogeneration-type heat engine i	$\eta_{BL,EG,CG,i}$ * $HG_{BL,BR,CG,y,i}$	994,012 (MWh/yr)
(2) Total capacity of the cogeneration-type heat engine i	LOC_y * $CAP_{EG,CG,i}$ * $LFC_{EG,CG,i}$	860,985 (MWh/yr)

Calculations:

(3) Condition associated to equation 21	**(1) > (2)**	**Not OK**

In this case, the electricity generation in the cogeneration-type heat engine i surpasses its maximum capacity. As a result, the baseline biomass-based co-generated electricity in year y is no longer calculated from equation 17, but is set at the maximum capacity of the corresponding heat engine:

Baseline biomass-based co-generated electricity in year y	$EL_{BL,BR,CG,y}$	860,985 (MWh/yr)

The baseline biomass-based process heat co-generated in year y is calculated using equation 18 as follows:

Data:

(1) Heat-to-power ratio of the heat engine i	$HPR_{BL,i}$	4.52 (number)
(2) Baseline biomass-based heat generation in year y	$HG_{BL,BR,CG,y,i}$	17,185,540 (GJ/yr)
(3) Default value for the losses linked to the electricity generator group	$GGL_{default}$	5%

Calculations:

(4) Baseline biomass-based process heat co-generated in year y	$HC_{BL,BR,CG,y}$	**[(1)*(2)/((1)+1+(3))]**	13,944,881 (MWh/yr)

So, according to the above calculations:

Baseline biomass-based co-generated electricity in year y	$EL_{BL,BR,CG,y}$	860,985 (MWh/yr)
Baseline biomass-based process heat co-generated in year y	$HC_{BL,BR,CG,y}$	13,944,881 (GJ/yr)

According to the ACM0006 (Version 11.1), the Project Proponent must choose the next step based on the outcome of the calculation performed above. In this case, the situation is as follows:

Baseline biomass-based heat generation in year y	$HG_{BL,BR,y}$	18,424,643 (GJ/yr)
Total baseline biomass-based heat used in heat engine i in year y	$\sum HG_{BL,BR,CG,y,i}$	17,185,540 (GJ/yr)

Baseline process heat generation in year y	$HC_{BL,y}$	14,949,155 (GJ/yr)
The baseline biomass-based process heat cogenerated in year y	$HC_{BL,BR,CG,y}$	13,944,881 (GJ/yr)

As a result:

$$HG_{BL,BR,y} > \sum_i HG_{BL,BR,CG,y,i}$$

and

$$HC_{BL,y} > HC_{BL,BR,CG,y}$$

According to the above, the case that applies is 3.2.4. This means that there would be biomass-based heat in the baseline that could still be used and process heat demand to be met. It is assumed then that this balance of biomass-based heat would be extracted from the heat header and used to meet the process heat demand without co-generation of power.

Within case 3.2.4, there are 3 sub-cases that could apply. To assess this, the following calculations must be done:

Data:

Total baseline process heat generation	$HC_{BL,y}$	14,949,155 (GJ/yr)
The baseline biomass-based process heat cogenerated in year y	$HC_{BL,BR,CG,y}$	13,944,881 (GJ/yr)
Specific enthalpy of the heat carrier at the process heat demand side	h_{LOW}	2.7759 (GJ/ton)
Specific enthalpy of the heat carrier at the heat generator side	h_{HIGH}	3.3607 (GJ/ton)
Baseline biomass-based heat generation in year y	$HG_{BL,BR,y}$	18,424,643 (GJ/yr)
Total baseline biomass-based heat used in heat engine i in year y	$\Sigma HG_{BL,BR,CG,y,i}$	17,185,540 (GJ/yr)

Calculations:

The remaining demand for process heat	$HC_{BL,y} – HC_{BL,BR,CG,y}$	1,004,274 (GJ/yr)
The balance of biomass-based heat	$(h_{LOW}/h_{HIGH})*(HG_{BL,BR,y} - \Sigma HG_{BL,BR,CG,y,i})$	1,023,462 (GJ/yr)

According to the above, it results that:

$$HC_{BL,y} - HC_{BL,BR,CG,y} < \frac{h_{LOW}}{h_{HIGH}} * \left(HG_{BL,BR,y} - \sum_i HG_{BL,BR,CG,y,i} \right)$$

Therefore, sub-case 3.2.4.3 applies. In this sub-case, the following definitions and calculations apply:

Calculation of the baseline biomass-based heat balance after cogeneration in year y, $HG_{balance,BR,PO,y}$:

$HG_{balance,BR,PO,y}$	$(HG_{BL,BR,y} - \Sigma HG_{BL,BR,CG,y,i}) – (h_{HIGH}/h_{LOW})*(HC_{BL,y} - HC_{BL,BR,CG,y})$	23,231 (GJ/yr)

Calculation of the electricity in power-only mode assumed to be generated in the baseline in year y, $EL_{balance,PO,y}$:

Data:

Baseline electricity generation capacity in year y	$EL_{BL,y}$	1,109,179 (MWh/yr)
Baseline minimum electricity generation in the grid in year y	$EL_{BL,GR,y}$	248,195 (MWh/yr)
Baseline biomass-based co-generated electricity in year y	$EL_{BL,BR,CG,y}$	860,985 (MWh/yr)

Calculation:

$EL_{balance,PO,y}$	$EL_{BL,y} - EL_{BL,GR,y} - EL_{BL,BR,CG,y}$	0 (MWh/yr)

With the above definitions and calculations, the Project Proponent must proceed to step 3.3.

Step 3.3: Determine the baseline biomass-based electricity generated in power-only mode.

Since in the baseline scenario there are no identified power-only-type heat engines, i.e. heat engines that produce only electricity without cogeneration of process heat, then the baseline biomass-based electricity (power-only) in year y (MWh) would be zero:

$EL_{BL,BR,PO,y}$	$\Sigma\ (HG_{BL,BR,PO,y,j} * \eta_{BL,EG,PO,j})$	0 (MWh/yr)

As a result and considering that:

The electricity in power-only mode generated in the baseline in year y	$EL_{balance,PO,y}$	0 (MWh/yr)
The baseline biomass-based electricity (power only) in year y	$EL_{BL,BR,PO,y}$	0 (MWh/yr)

With this outcome, the applicable case would be 3.3.1. This would imply the following definitions:

The baseline uncertain electricity generation in the grid or on-site in year y, ($EL_{BL,FF/GR,y}$) is:

$EL_{BL,FF/GR,y}$	$EL_{balance,PO,y} - EL_{BL,BR,PO,y}$	0 (MWh/yr)

The ($EL_{PJ,offset,y}$) is:

$EL_{PJ,offset,y}$	0 (MWh/yr)

The baseline fossil-fuel demand for process heat in year y ($FF_{BL,HG,y,f}$) is:

$FF_{BL,HG,y,f}$	4,102 (GJ/yr)

According to the calculations above, the baseline emissions due to electricity displacement in the year y can be calculated as follows:

Data:

(1) Baseline minimum electricity generation in the grid in year y	$EL_{BL,GR,y}$	248,195 (MWh/yr)
(2) Grid emission factor in year y	$EF_{EG,GR,y}$	0.45401 (tCO_2/MWh)
(3) Baseline fossil fuel demand for process heat in year y	$\Sigma FF_{BL,HG,y,f}$	4,102 (GJ/yr)
(4) CO_2 emission factor for fossil fuel type f in year y	$EF_{FF,y,f}$	0.0774 (tCO_2/GJ)
(5) Baseline uncertain electricity generation in the grid or on-site in year y	$EL_{BL,FF/GR,y}$	0 (MWh/yr)
(6) CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y	$EF_{EG,FF,y}$	0.45401 (tCO_2/MWh)

<u>Calculation:</u>

(7) Baseline emissions due to minimum grid electricity displacement	(1)*(2)	112,684 (tCO_2/yr)
(8) Baseline emissions due to fossil fuel demand for process heat generation in year y	(3)*(4)	318 (tCO_2/yr)
(9) Baseline emissions due to uncertain electricity generation in the grid in year y	(5)*(6)	0 (tCO_2/yr)
Electricity-related baseline emissions	**(7) + (8) + (9)**	**113,001 (tCO_2/yr)**

Note that for the sake of the emission reduction calculations in this section of the PDD, the Project Proponent will consider the same amount of emission reductions per year associated to the electricity displacement for the entire crediting period.

Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues.

Step 5.1: Determine $BE_{BR,B1/B3,y}$.

Since in the proposed project activity there are no biomass residues categories for which the baseline scenario is B1 or B3, this step is not applicable in this case.

Step 5.2: Determine $BE_{BR,B2,y}$.

According to the latest approved version of the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”, the calculation of the emission reductions is done according to the equation:

$$BE_{CH4,SWDS,y} = \varphi * (1-f) * GWP_{CH4} * (1-OX) * \frac{16}{12} * F * DOC_f * MCF * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j * e^{-kj*(y-x)} * (1-e^{-kj})$$

The parameters and calculation results used in this PDD are presented below.

<u>Data and parameters:</u>

Parameter description	Units	Value
Fines from chip-screening	(tDS/yr)	25,185
Combined bark and wood from wood yard	(tDS/yr)	20,638

Primary sludge	(tDS/yr)	5,193

Parameter description	**Parameter**	**Units**	**Value**
Model correction factor to account for model uncertainties.	φ	--	0.9
Fraction of methane captured at the SWDS and flared, combusted or used in another manner.	f	--	0.0
Global Warming Potential (GWP) of methane, valid for the relevant commitment period.	GWP_{CH4}	(tCO_2/tCH_4)	21.0
Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste).	OX	--	0.1
Fraction of methane in the SWDS gas (volume fraction).	F	--	0.5
Fraction of degradable organic carbon (DOC) that can decompose.	DOC_f	--	0.5
Methane correction factor.	MCF	--	1.0
Waste type category (index).	j	--	--
Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which the avoided emissions are calculated (x=y).	x	--	--
Year for which methane emissions are calculated.	y	--	--

Decay rate for the waste type j:	k_j	**(Units)**	
Fines from chip-screening		--	0.03
Combined bark and wood from wood yard		--	0.03
Primary sludge		--	0.03

Fraction of degradable organic carbon (by weight) in the waste type j:	DOC_j	**(Units)**	
Fines from chip-screening		--	0.43
Combined bark and wood from wood yard		--	0.43
Primary sludge		--	0.077

Biomass residues humidity (wet basis) for which the baseline scenario is B2	--	**(Units)**	
Fines from chip-screening		(%)	55%
Combined bark and wood from wood yard		(%)	45%
Primary sludge		(%)	70%

Amount of organic waste type j prevented from disposal in the SWDS in the year x:	$W_{j,x}$	**(Units)**	
Fines from chip-screening		(wet t/yr)	55,967
Combined bark and wood from wood yard		(wet t/yr)	37,524
Primary sludge		(wet t/yr)	17,311

Calculation results using the equation above are presented in the following table:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Year for which the methane emissions are calculated, y	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Year during the crediting period, x																					
1	6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573	4,438	4,307	4,180	4,056	3,936	3,820
2		6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573	4,438	4,307	4,180	4,056	3,936
3			6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573	4,438	4,307	4,180	4,056
4				6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573	4,438	4,307	4,180
5					6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573	4,438	4,307
6						6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573	4,438
7							6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713	4,573
8								6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856	4,713
9									6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004	4,856
10										6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156	5,004
11											6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313	5,156
12												6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475	5,313
13													6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642	5,475
14														6,960	6,755	6,555	6,361	6,173	5,991	5,814	5,642
15															6,960	6,755	6,555	6,361	6,173	5,991	5,814
16																6,960	6,755	6,555	6,361	6,173	5,991
17																	6,960	6,755	6,555	6,361	6,173
18																		6,960	6,755	6,555	6,361
19																			6,960	6,755	6,555
20																				6,960	6,755
21																					6,960
Total avoided emissions	6,960	13,715	20,270	26,632	32,805	38,796	44,610	50,252	55,727	61,041	66,197	71,201	76,057	80,770	85,343	89,781	94,089	98,268	102,324	106,261	110,081

According to the calculations above, the total baseline emissions for the proposed project activity are calculated using equation 2:

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Grid emission savings	(tCO_2/yr)	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001
Methane emissions savings	(tCO_2eq/yr)	6,960	13,715	20,270	26,632	32,805	38,796	44,610	50,252	55,727	61,041	66,197
TOTAL BASELINE EMISSIONS	(tCO_2eq/yr)	119,962	126,717	133,272	139,633	145,806	151,797	157,611	163,253	168,729	174,042	179,198

		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Grid emission savings	(tCO_2/yr)	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001	113,001	2,373,027
Methane emissions savings	(tCO_2eq/yr)	71,201	76,057	80,770	85,343	89,781	94,089	98,268	102,324	106,261	110,081	1,331,181
TOTAL BASELINE EMISSIONS	(tCO_2eq/yr)	184,202	189,059	193,771	198,345	202,783	207,090	211,270	215,326	219,262	223,082	3,704,209

Calculation of Project Emissions (PE_y)

As presented in the preceding section of the PDD, the project emissions are calculated according to the equation:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{BR,y}$$

a) Carbon dioxide emissions from on-site consumption of fossil fuels ($PE_{FF,y}$)

Though the Punta Pereira biomass power plant is not meant to consume fossil fuels for heat and electric power generation on a normal basis, some fossil fuel consumption is required due to operational reasons: start-up operations, shut-down operations, boiler instability, low pulp production levels, etc. As a result, this fossil fuel consumption may present a significant variation from year to year. As a reasonable (average) estimate, the Project Proponent considers a total fuel oil consumption of 1,039 tons per year.

The Project Proponent also considers a consumption of 351 tons per year of diesel for on-site biomass transportation to the power boiler.

According to the fossil fuel amounts mentioned above, the calculation of the emissions is as follows:

Data:

(1) Fuel oil consumption	1,039 (ton/yr)
(2) Diesel consumption	351 (ton/yr)
(3) Fuel oil net calorific value	43.3 (GJ/ton)
(4) Diesel net calorific value	41.7 (GJ/ton)
(5) Fuel oil CO_2 emission factor	0.07880 (tCO_2/GJ)
(6) Diesel CO_2 emission factor	0.07480 (tCO_2/GJ)

Calculations:

According to this, the total GHG emissions from this source are:

(7) Total emissions	**(1)*(3)*(5) + (2)*(4)*(6)**	**4,551 (tCO_2/yr)**

$$PE_{FF,y} = 4{,}551 (tCO_2 / yr)$$

b) Emissions due to grid electricity imports to the project site ($PE_{GR1,y}$)

As previously mentioned in this PDD, the proposed project activity is designed so that the power plant will generate surplus power to the grid on a general basis. However, under some particular conditions (e.g. start-up operations, maintenance periods, etc.), the power plant might require to import some electricity from the grid.

The Project Proponent estimated a total electricity consumption of 3,000 (MWh/yr), however it must be noted that this electricity consumption is subject to a high variability.

According to this estimate, the corresponding project emissions are calculated as follows:

Data:

(1) Electricity consumption	3,000 (MWh/yr)
(2) Grid emission factor	0.45401 (tCO_2/MWh)

Calculations:

(3) Total emissions	**(1)*(2)**	**1,362 (tCO_2/yr)**

c) Emissions from the combustion of biomass residues ($PE_{BR,y}$)

The proposed project activity considers the consumption of biomass residues BR,y, in a fluidized-bed boiler that is installed as a result of the project activity. According to the monitoring experience in other similar CDM projects in the region, the fluidized-bed combustion technology is so efficient that the resulting measured methane emission factor is zero[39].

As a result, the Project Proponent will assume that the resulting emissions from burning the biomass residues in the fluidized-bed boiler are zero.

$$PE_{BR,y} = 0(tCO_2 / yr)$$

According to the monitoring plan, the methane emission factor of the controlled burning of the biomass residues $BE_{BR,y}$ will be duly monitored during the year. In case it results to be greater than zero, the Project Proponent will calculate the corresponding project emissions.

Total project emissions

Emission sources	PE_y	(tCO_2eq/yr)

[39] Normally, the CH_4 concentration in the flue gases is lower than the CH_4 in the clean air.

Carbon dioxide emissions from on-site consumption of fossil fuels	$PE_{FF,y}$	4,551
Carbon dioxide emissions from electricity consumption	$PE_{GR1,y}$	1,362
Methane emissions from combustion of biomass residues	$PE_{BR,y}$	0
Total project emissions		**5,913**

Leakage

As previously stated in this PDD, the proposed project activity does not consider biomass residues for which potential leakage is relevant. As a result:

$$L_y = 0(tCO_2 / yr)$$

According to the calculations above and to equation 1, the expected net emission savings of the Proposed Project activity are:

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Total baseline emissions	(tCO_2eq/yr)	119,962	126,717	133,272	139,633	145,806	151,797	157,611	163,253	168,729	174,042	179,198	184,202	189,059	193,771	198,345	202,783	207,090	211,270	215,326	219,262	223,082	**3,704,209**
Total project emissions	(tCO_2eq/yr)	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	5,913	**124,173**
NET EMISSION SAVINGS	**(tCO_2eq/yr)**	**114,049**	**120,804**	**127,359**	**133,720**	**139,893**	**145,884**	**151,698**	**157,340**	**162,816**	**168,129**	**173,285**	**178,289**	**183,146**	**187,858**	**192,432**	**196,870**	**201,177**	**205,357**	**209,413**	**213,349**	**217,169**	3,580,036

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

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2013	4,435	89,971	0	85,537
2014	5,913	126,717	0	120,804
2015	5,913	133,272	0	127,359
2016	5,913	139,633	0	133,720
2017	5,913	145,806	0	139,893
2018	5,913	151,797	0	145,884
2019	5,913	157,611	0	151,698
Total (tonnes of CO_2 e)	**39,913**	**944,807**	**0**	**904,895**

Note that this table is consistent with the calculations of the preceding section; however the table above shows an adjustment for the 1st year and for the 22nd year of the crediting period, given that the starting date of the crediting period of the proposed project activity is not expected to be January 1st of 2013. For simplicity, this adjustment was not made in the tables of the preceding section.

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

B.7.1 Data and parameters monitored:

Monitored parameters for the "ACM0006 (Version 11.1)":

Data / Parameter:	**Biomass residues categories and quantities used in the project activity**
Data unit:	- Type: bagasse, rice husks, empty fruit branches, etc. - Source: produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc. - Fate (in the absence of the project activity): scenarios B. - Quantity: tonnes on dry-basis.
Description:	The biomass quantities provided in the table below were determined ex-ante in accordance with the pulp mill project studies. All these amounts (as well as the ones that eventually might be incorporated later on) will be continuously monitored in the project plant, according to proper industry standards.
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below:

Biomass residue category k	Biomass residues type	Biomass residue source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario	Biomass residues quantity (dry tonnes/yr)
1	Black liquor	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	1,797,966
2	Methanol	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	15,611
3	CNCG	On-site production	Heat and power generation on-site	Heat and power generation on-site	19,116

			(B4)	(biomass-only boiler)	
4	Fines from chip-screening	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	25,185
5	Combined bark and wood from wood yard	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	20,638
6	Primary sludge	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	5,193

Description of measurement methods and procedures to be applied:

See table below:

Biomass residue category k	Biomass residues type	Biomass residue measurement system description	Comments
1	Black liquor	This biomass type will be measured using 4 dedicated flow meters in combination with 2 refractometers. The wet flow will be the sum of the 4 flow meters measurement. The accuracy level of these types of flow meters is 0.2% of MV + 1mm/s. To determine the dry biomass flow, the total wet flow will be multiplied by the average concentration measured with the refractometers. The measurement will be on-line and fully integrated with the Distributed Control System (DCS) of the pulp mill. It must be noted that the measurement procedure described above is the normal practice for measuring black liquor flows in the Pulp and Paper industry worldwide. The meters will receive periodic maintenance, in accordance with the specifications of the manufacturer and the best practices of the Pulp and Paper Industry in the region. This parameter will be monitored continuously.	The department responsible for the monitoring of this parameter is the Recovery Boiler department.
2	Methanol	The wet flow will be measured using a dedicated flow meter. The accuracy level of this type of meter is 0.5% of MV + Zero Stability (+/-0.015% max. flow). The measurement will be on-line and fully integrated with the Distributed Control System (DCS) of the pulp mill. The meter will receive periodic maintenance, in accordance with the specifications of the manufacturer and the best practices of the Pulp and Paper Industry in the region. In order to determine the quantity of dry biomass, the dry flow will be calculated as the wet flow multiplied by the concentration. The concentration will be determined from flow samples. This parameter will be monitored continuously.	The department responsible for the monitoring of this parameter is the Recovery Boiler department.
3	CNCG	The wet flow will be measured after the scrubber using a dedicated flow meter. The accuracy level of this type of meter is 0.5% of MV + Zero Stability. The measurement will be on-line and fully integrated with the Distributed Control System (DCS) of the pulp mill. A proper adjustment will be made, in order to determine the quantity of dry biomass. This parameter will be monitored continuously.	The department responsible for the monitoring of this parameter is the Recovery Boiler department.
4	Fines from chip-screening	This biomass type will be measured using a dedicated meter installed in the corresponding conveyor belt. The accuracy level of this type of meter is +/- 5%. The dry flow of biomass will be determined adjusting for the corresponding moisture content of the biomass. The moisture content will be determined by measuring the humidity of a representative number of biomass samples taken from the conveyor belt.	The department responsible for the monitoring of this parameter is the Recovery Boiler department.

		This parameter will be monitored continuously.	
5	Combined bark and wood from wood yard	These residues will be measured using a dedicated meter installed in the corresponding conveyor belt. The accuracy level of this type of meter is +/- 5%. The dry flow of biomass will be determined adjusting for the corresponding moisture content of the biomass. The moisture content will be determined by measuring the humidity of a representative number of biomass samples taken from the conveyor belt. This parameter will be monitored continuously.	The department responsible for the monitoring of this parameter is the Recovery Boiler department.
6	Primary sludge	The primary sludge will be transported from effluent treatment area to wood-handling area in containers. The amount of wet sludge will be measured by weighting all the containers transported to the wood-handling in a dedicated scale. The accuracy level of this type of instrument is +/- 5%. The dry flow of biomass will be determined adjusting for the corresponding moisture content of the biomass. The moisture content will be determined by measuring the humidity of a representative number of samples taken from the containers used for the transportation of the biomass to the power plant. This parameter will be monitored continuously.	The department responsible for the monitoring of this parameter is the Recovery Boiler department.

QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	--

Data / Parameter:	**For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants shall demonstrate that this is a realistic and credible alternative scenario.**
Data unit:	Tonnes
Description:	- Quantity of available biomass residues of type n in the region. - Quantity of biomass residues of type n that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region. - Availability of a surplus of biomass residues type n (which cannot be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region.
Source of data to be used:	Surveys or statistics.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable in this case. The Project Proponent will use the second approach to support the selection of the baseline scenario B2 for the additional biomass residues used under the project activity (see page 13/72 of the ACM0006 (Version 11.1)). See comment below.
Description of measurement methods and procedures to be applied:	--
QA/QC procedures to be applied:	--
Any comment:	As can be seen in section B.4 of the PDD, the project activity will imply the utilization of additional biomass residues coming from one clearly identifiable source: the project plant site. It is also explained in the PDD that in the baseline

	scenario, those biomass residues would be disposed in a landfield, near the project plant. This is the fate of these types of residues according to the normal practice in the region and also, to the Uruguayan law.

Data / Parameter:	**$BR_{PJ,n,y}$**
Data unit:	(tonnes on dry-basis)
Description:	**$BR_{PJ,n,y}$** = Quantity of biomass residues of category n used in the project activity in year y (tonnes on dry-basis).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below: (table follows)
Description of measurement methods and procedures to be applied:	See table describing measurement procedures under variable "**Biomass residues categories and quantities used in the project activity"**.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	The biomass residue quantities used under the project activity will be monitored separately for each type and each source, just as described above.

Biomass residue category k	**Biomass residues type**	**Biomass residue source**	**Biomass residues fate in the absence of the project activity**	**Biomass residues use in project scenario**	**Biomass residues quantity (dry tonnes/yr)**
1	Black liquor	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	1,797,966
2	Methanol	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	15,611
3	CNCG	On-site production	Heat and power generation on-site (B4)	Heat and power generation on-site (biomass-only boiler)	19,116
4	Fines from chip-screening	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	25,185
5	Combined bark and wood from wood yard	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	20,638
6	Primary sludge	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	5,193

Data / Parameter:	**$BR_{B4,n,y}$**
Data unit:	(tonnes on dry-basis)
Description:	**$BR_{B4,n,y}$** = Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B4: (tonnes on dry-basis).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in	See table below:

<table>
<tr><td>section B.5</td><td>
<table>
<tr><th>Biomass residue category k</th><th>Biomass residues type</th><th>Biomass residue source</th><th>Biomass residues fate in the absence of the project activity</th><th>Biomass residues use in project scenario</th><th>Biomass residues quantity (dry tonnes/yr)</th></tr>
<tr><td>1</td><td>Black liquor</td><td>On-site production</td><td>Heat and power generation on-site (B4)</td><td>Heat and power generation on-site (biomass-only boiler)</td><td>1,797,966</td></tr>
<tr><td>2</td><td>Methanol</td><td>On-site production</td><td>Heat and power generation on-site (B4)</td><td>Heat and power generation on-site (biomass-only boiler)</td><td>15,611</td></tr>
<tr><td>3</td><td>CNCG</td><td>On-site production</td><td>Heat and power generation on-site (B4)</td><td>Heat and power generation on-site (biomass-only boiler)</td><td>19,116</td></tr>
</table>
</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>See table describing measurement procedures under variable “Biomass residues categories and quantities used in the project activity”.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.</td></tr>
<tr><td>Any comment:</td><td>According to Step 1.4 of the ACM0006 (Version 11.1), all these biomass residue types are used in the recovery boiler (heat generator), exclusively. As a result, the monitored quantities of biomass residues used in the project will be directly allocated to that heat generator in the baseline scenario. Furthermore, in the Pulp and Paper Industry, these biomass residues are normally used for heat and power generation, regardless of the amount of the residues generated in the pulping process, therefore there is only one possible fate for these residues: on-site heat and power generation.</td></tr>
</table>

Data / Parameter:	**$BR_{B1/B3,n,y}$**
Data unit:	(tonnes on dry-basis)
Description:	**$BR_{B1/B3,n,y}$** = Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B1 or B3 (tonnes on dry-basis).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (tonnes). It is not foreseen that these types of biomass residues will be used in the project activity in the future. However, the Project Proponent will include this parameter in the monitoring plan, in case the situation changes in the future.
Description of measurement methods and procedures to be applied:	The Project Proponent will use proper weight or volume meters, as appropriate. Measurements will be adjusted for moisture content in order to obtain dry biomass. The expected accuracy of the biomass meters will be in accordance with the proper industry standards. This parameter will be monitored continuously.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.

Any comment:	Biogas will be included as appropriate, if applicable (in which case, convenient units will be used).

Data / Parameter:	**$BR_{B2,n,y}$**
Data unit:	(tonnes on dry-basis)
Description:	**$BR_{B2,n,y}$** = Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B2: (tonnes on dry-basis).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below: (table follows)
Description of measurement methods and procedures to be applied:	See table describing measurement procedures under variable "**Biomass residues categories and quantities used in the project activity**".
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	According to Step 1.4 of the ACM0006 (Version 11.1), all these biomass residue types are used in the power boiler (heat generator), exclusively. As a result, the monitored quantities of biomass residues used in the project will be directly allocated to that heat generator in the baseline scenario.

Biomass residue category k	**Biomass residues type**	**Biomass residue source**	**Biomass residues fate in the absence of the project activity**	**Biomass residues use in project scenario**	**Biomass residues quantity (dry tonnes/yr)**
4	Fines from chip-screening	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	25,185
5	Combined bark and wood from wood yard	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	20,638
6	Primary sludge	On-site production	Dumped in landfields (B2)	Heat and power generation on-site (biomass-only boiler)	5,193

Data / Parameter:	**$BR_{B5/B8,n,y}$**
Data unit:	(tonnes on dry-basis)
Description:	**$BR_{B5/B8,n,y}$** = Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B5:, B6:, B7: or B8: (tonnes on dry-basis).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (tonnes). It is not foreseen that these types of biomass residues will be used in the project activity in the future. However, the Project Proponent will include this parameter in the monitoring plan in case the situation changes in the future.
Description of measurement methods and procedures to be	The Project Proponent will use proper weight or volume meters, as appropriate. Measurements will be adjusted for moisture content in order to obtain dry biomass.

applied:	This parameter will be monitored continuously.
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	Biogas will be included as appropriate, if applicable (in which case, convenient units will be used).

Data / Parameter:	**$EF_{CH4,BR}$**
Data unit:	(tCH_4/GJ)
Description:	**$EF_{CH4,BR}$** = CH_4 emission factor for the combustion of biomass residues in the project plant (tCH_4/GJ).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (tCH_4/GJ) This value was obtained from EF_{CH4} measurements performed by the Project Proponent in other biomass heat generators of similar technology (i.e. fluidized bed boiler) to the one that will be used in the proposed project activity.
Description of measurement methods and procedures to be applied:	The CH_4 emission factor will be determined based in a stack gas analysis using calibrated analyzers. The Project Proponent will hire reputed consultants in the industry to carry out this analysis. This parameter will be measured at least quarterly, taking at least three samples per measurement.
QA/QC procedures to be applied:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.
Any comment:	Monitoring of this parameter for project emissions is required in this case, since CH_4 emissions from biomass combustion are included in the project boundary. A conservative value will be applied, as specified in the baseline methodology.

Data / Parameter:	**$HC_{BL,y}$**
Data unit:	(GJ)
Description:	**$HC_{BL,y}$** = Baseline process heat generation in year y (GJ).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	14,949,155 (GJ) This value is estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be	This parameter will be determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any

applied:	condensate return to the heat generators. The respective enthalpies will be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamics equations may be used to calculate the enthalpy as a function of temperature and pressure. For superheated steam, condensates and feedwater, the level of accuracy of the temperature measurement is estimated as 0.02 % of calibrated span; of pressure measurement is estimated as 0.075 % of calibrated span and of flow meters measurement is estimated as 0.065% of calibrated span. This parameter will be calculated based on continuously monitored data and aggregated as appropriate, to calculate the emission reductions.
QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	**$EL_{PJ,gross,y}$**
Data unit:	(MWh)
Description:	**$EL_{PJ,gross,y}$** = Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y (MWh).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,214,078 (MWh) This value is estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be applied:	This parameter will be measured using calibrated electricity meters. The level of accuracy of these meters is estimated as 0.5%. The Recovery Boiler department will be in charge of collecting and aggregating the data. The data will be monitored continuously and aggregated as appropriate, to calculate emission reductions.
QA/QC procedures to be applied:	The consistency of metered electricity generation will be cross-checked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years).
Any comment:	--

Data / Parameter:	**$EL_{PJ,imp,y}$**
Data unit:	(MWh)
Description:	**$EL_{PJ,imp,y}$** = Project electricity imports from the grid in year y (MWh).
Source of data to be used:	On-site measurements.
Value of data applied	3,000 (MWh).

for the purpose of calculating expected emission reductions in section B.5	This value is estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be applied:	This parameter will be measured using calibrated electricity meters. The level of accuracy of these meters is estimated as 0.3%. The Recovery Boiler department will be in charge of collecting and aggregating the data. The data will be monitored continuously and aggregated as appropriate, to calculate emission reductions.
QA/QC procedures to be applied:	The consistency of metered electricity generation will be cross-checked with receipts from electricity purchases.
Any comment:	--

Data / Parameter:	$\mathbf{EL_{PJ,aux,y}}$
Data unit:	(MWh)
Description:	$\mathbf{EL_{PJ,aux,y}}$ = Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	107,899 (MWh). This value is estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be applied:	This parameter will be measured using calibrated electricity meters. The level of accuracy of these meters is estimated as 0.5%. The Recovery Boiler department will be in charge of collecting and aggregating the data. The data will be monitored continuously and aggregated as appropriate, to calculate emission reductions.
QA/QC procedures to be applied:	The consistency of metered electricity generation will be cross-checked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years).
Any comment:	$EL_{PJ,aux,y}$ shall include all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of all power plants which are located at the project site and included in the project boundary (e.g. pumps, fans, instrumentation and control, etc.).

Data / Parameter:	$\mathbf{NCV_{BR,n,y}}$
Data unit:	(GJ/tonnes of dry matter)
Description:	$\mathbf{NCV_{BR,n,y}}$ = Net calorific value of biomass residue of category n in year y (GJ/tonne on dry basis).

Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below: **Biomass residue category k** / **Biomass residues type** / **Net calorific value (GJ/tonne of dry matter)** 1 / Black liquor / 13.2 2 / Methanol / 19.5 3 / CNCG / 6.47 4 / Fines from chip-screening / 18.6 5 / Combined bark and wood from wood yard / 15.6 6 / Primary sludge / 15.5 These values are estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be applied:	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Measure the NCV on dry-basis. This parameter will be carried out at least every six months, taking at least three samples for each measurement.
QA/QC procedures to be applied:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass.
Any comment:	Biogas should be included as appropriate if applicable (in which case convenient units such as GJ/m^3 should be used).

Data / Parameter:	$\mathbf{h_{LOW,y}}$ $\mathbf{h_{HIGH,y}}$
Data unit:	(GJ/tonnes)
Description:	$\mathbf{h_{LOW,y}}$ = Specific enthalpy of the heat carrier at the process heat demand side (GJ/tonnes). $\mathbf{h_{HIGH,y}}$ = Specific enthalpy of the heat carrier at the heat generator side (GJ/tonnes).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$\mathbf{h_{LOW,y}}$ = 2.7759 (GJ/tonnes). $\mathbf{h_{HIGH,y}}$ = 3.3607 (GJ/tonnes). This value is estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be applied:	The specific enthalpies should be determined based on the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure. For superheated steam, condensates and feedwater, the level of accuracy of the temperature measurement is estimated as 0.02 % of calibrated span, of pressure

	measurement is estimated as 0.075 % of calibrated span, and of flow meters measurement is estimated as 0.065% of calibrated span. The data will be monitored continuously and aggregated as appropriate, to calculate emission reductions.
QA/QC procedures to be applied:	--
Any comment:	The process heat demand side refers to where heat is finally used for heating purposes by end-users and the heat generator side refers to where heat is generated.

Data / Parameter:	**Moisture content of the biomass residues**
Data unit:	% water content in mass basis in wet biomass residues.
Description:	Moisture content of each biomass residue type k.
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below:
Description of measurement methods and procedures to be applied:	See table below:

Value of data applied for the purpose of calculating expected emission reductions in section B.5:

Biomass residue category k	Biomass residues type	Moisture content (% of water in wet biomass residues)
1	Black liquor	20%
2	Methanol	20%
3	CNCG	12.5% (saturated at 60° C)
4	Fines from chip-screening	45%
5	Combined bark and wood from wood yard	55%
6	Primary sludge	70%

Description of measurement methods and procedures to be applied:

Biomass residue category k	Biomass residues type	Procedure	Accuracy level of instruments involved	Department in charge
1	Black liquor	For determining the humidity of the black liquor (or equivalently, the solid content) there will be an on-line measurement of the solid content carried out by the refractometers installed in the pipes that carry the black liquor to the recovery boiler.	+/- 0.0002 in refraction index.	The Recovery Boiler department.
2	Methanol	The concentration will be measured by samples taken periodically from the methanol tank, measuring the sample weight and volume.	0.3% of measured value.	The Recovery Boiler department.
3	CNCG	Since CNCG are saturated, water content is determined by measuring the temperature at this point. The dry flow will be determined deducting the water content from the wet gas flow.	CNCG flow meter is +/- 0.5% of measured value + Zero Stability. Temperature instrument accuracy is 0.02% of calibrated span.	The Recovery Boiler department.
4	Fines from chip-screening	The fines moisture will be monitored and registered by taking periodic samples from the feed flow of the conveyor. Humidity content will be calculated by evaporating the water of the samples and measuring the weight before and after the water has been evaporated. This process will be carried out in dedicated scales.	0.3% of measured value.	The Recovery Boiler department.
5	Combined bark and wood from wood yard	The bark and wood moisture will be monitored and registered by taking periodic samples from the feed flow of the conveyor. Humidity content will be calculated by evaporating the water of the samples and measuring the weight before and after the water has been evaporated. This process will be carried out in dedicated scales.	0.3% of measured value.	The Recovery Boiler department.
6	Primary sludge	The primary sludge moisture will be monitored and registered by taking periodic samples from the containers feeding. Humidity content will be calculated by evaporating the water of the samples and measuring the weight before and after the water has been evaporated. This process will be carried out in dedicated scales.	0.3% of measured value.	The Recovery Boiler department.

	The moisture content should be monitored for each batch of biomass of homogeneous quality. The weighted average should be calculated for each monitoring period and used in the calculations.
QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	**LOC_y**
Data unit:	(Hour)
Description:	LOC_y = Length of the operational campaign in year y (hour).
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8,496 (hours). This value is estimated ex-ante from the corresponding energy / mass balance of the project plant.
Description of measurement methods and procedures to be applied:	The Technical Superintendence will be in charge of recording and adding the operation hours of the project activity during the year y.
QA/QC procedures to be applied:	--
Any comment:	--

<u>Monitored parameters from the "Tool to determine methane emissions avoided from disposal of waste at a solid disposal site (Version 05)":</u>

Data / Parameter:	**f**
Data unit:	--
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner.
Source of data to be used:	Written information from the operator of the solid waste disposal site and/or site visits at the solid waste disposal.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0. See comment below.
Description of measurement methods and procedures to be applied:	This parameter will be monitored annually.
QA/QC procedures to be applied:	--

Any comment:	No fraction of CH_4 will be captured and flared or used for another purpose in the landfield.

Data / Parameter:	**GWP_{CH4}**
Data unit:	(tCO_2e/tCH_4)
Description:	Global Warming Potential (GWP) of methane, valid for the relevant commitment period.
Source of data to be used:	Decisions under the UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period of the Kyoto Protocol).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	21
Description of measurement methods and procedures to be applied:	This parameter will be monitored annually.
QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	**W_x**
Data unit:	(tons)
Description:	Total amount of organic waste prevented from disposal in year x (tons).
Source of data to be used:	Measurements by project participants.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	According to the ACM0006 (Version 11.1), this parameter is the same as the $BR_{B2,n,y}$ described above.
Description of measurement methods and procedures to be applied:	According to the ACM0006 (Version 11.1), this parameter is the same as the $BR_{B2,n,y}$ described above. This parameter will be monitored continuously and aggregated annually.
QA/QC procedures to be applied:	--
Any comment:	According to the biomass monitoring procedures described above, the Project Proponent will directly monitor each biomass flow separately.

Data / Parameter:	**$p_{n,j,x}$**
Data unit:	--
Description:	Weight fraction of the waste type j in the sample n collected during the year x.
Source of data to be used:	Sample measurements by project participants.

Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below: Biomass residue category k / Biomass residues type / Biomass residues quantity (dry tonnes/yr) / Weight fraction (%): 4 / Fines from chip-screening / 25,185 / 49.4% 5 / Combined bark and wood from wood yard / 20,638 / 40.5% 6 / Primary sludge / 5,193 / 10.2% These values were obtained from the energy / mass balances of the project plant.
Description of measurement methods and procedures to be applied:	Sample the waste prevented from disposal, using the waste categories j, as provided in the table for DOC_j and k_j, and weigh each waste fraction. The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year.
QA/QC procedures to be applied:	--
Any comment:	This parameter only needs to be monitored if the waste prevented from disposal includes several waste categories j, as categorized in the tables for DOC_j and k_j. Such is the case with the proposed project activity. From the procedures outlined above, the Project Proponent will directly measure each biomass residue category separately and continuously. As a result, the sampling of the biomass waste j will not really be necessary in this case.

Biomass residue category k	Biomass residues type	Biomass residues quantity (dry tonnes/yr)	Weight fraction (%)
4	Fines from chip-screening	25,185	49.4%
5	Combined bark and wood from wood yard	20,638	40.5%
6	Primary sludge	5,193	10.2%

Data / Parameter:	**z**
Data unit:	--
Description:	Number of samples collected during the year x.
Source of data to be used:	Project participants.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable for ex-ante emission reduction calculation. Applicable for ex-post monitoring.
Description of measurement methods and procedures to be applied:	This parameter is monitored continuously and aggregated annually.
QA/QC procedures to be applied:	--
Any comment:	This parameter only needs to be monitored if the waste prevented from disposal includes several waste categories j, as categorized in the tables for DOC_j and k_j. Please see the comment for variable "**pn,j,x**" above.

<u>Monitored parameters from the "Tool to calculate project or leackage CO_2 emissions from fossil fuel combustion (Version 02)":</u>

Data / Parameter:	$FC_{i,j,y}$
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type i combusted in process j during year y.
Source of data to be used:	On-site measurements.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	In the case of the proposed project activity, the Project Proponent estimated a total consumption of: Diesel: 351 (ton/yr) Fuel oil: 1,039 (ton/yr)
Description of measurement methods and procedures to be applied:	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions. Measurement of this parameter will be performed according the procedures established hereby. <u>Fossil fuel consumption in the Recovery Boiler:</u> Fuel oil consumption will be determined as the sum of the measurements of flow meters measuring fuel oil entering to boiler burner ring, minus the sum of flow meters measuring fuel oil returning to tank. This measurement method is in accordance to the normal practice of the Pulp and Paper industry worldwide. The accuracy level of the instruments that will be used for the measurement of this parameter is +/- 0.5% of measured value. The department in charge of carrying out the measurement of this parameter is Recovery Boiler department. <u>Fossil fuel consumption in the Power Boiler:</u> Fossil fuel consumption will be calculated as the sum of the measurements of flow meters measuring fuel oil entering to boiler burner ring, minus the sum of flow meters measuring fuel oil returning to tank. This measurement method is in accordance to the normal practice of the Pulp and Paper industry worldwide. The accuracy level of the instruments that will be used for the measurement of

	this parameter is +/- 0.5% of measured value. <u>Fossil fuel consumption in the Auxiliary Boiler:</u> Fossil fuel consumption will be calculated as the sum of the measurements of flow meters measuring fuel oil entering to the boiler, minus the sum of flow meters measuring fuel oil returning to tank. This measurement method is in accordance to the normal practice of the Pulp and Paper industry worldwide. The accuracy level of the instruments that will be used for the measurement of this parameter is +/- 0.5% of measured value. <u>Other on-site fossil fuel consumption:</u> Other on-site fossil fuel consumption will be determined from truck consumption records or similar.
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Any comment:	--

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	(GJ/mass or volume unit).
Description:	Weighted average net calorific value fuel type i in year y.
Source of data to be used:	see table below

Data source	**Conditions for using the data source**
a) Values provided by the fuel supplier in invoices.	This is the preferred source if the carbon fraction if the fuel is not provided.
b) Measurements by the project participants.	If a) is not available.
c) Regional or national default values.	If a) is not available. These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).
d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines	If a) is not available.

	on National GHG Inventories. For the proposed project, the selected source is the one provided in option d) of the table above: the IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	43.3 (GJ/ton) for diesel. 41.7 (GJ/ton) for fuel oil.
Description of measurement methods and procedures to be applied:	Any future revision of the IPCC Guidelines should be taken into account. The appropriateness of the data will be reviewed annually.
QA/QC procedures to be applied:	Not applicable, since a default factor will be used in this case.
Any comment:	The monitoring of this variable applies, since according to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", this PDD is using option B to determine the CO_2 emission coefficient of fuel type i.

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	(tCO_2/GJ)
Description:	Weighted average CO_2 emission factor for fossil fuel type i in year y.
Source of data to be used:	(see table below)

Data source	Conditions for using the data source
a) Values provided by the fuel supplier in invoices.	This is the preferred source.
b) Measurements by the project participants.	If a) is not available.
c) Regional or national default values.	If a) is not available. These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).
d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.	If a) is not available.

For the proposed project, the selected source is the one provided in option d) of the table above: The IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2

	(Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0748 (tCO_2/GJ) for Diesel. 0.0788 (tCO_2/GJ) for Fuel Oil.
Description of measurement methods and procedures to be applied:	Any future revision of the IPCC Guidelines should be taken into account. The appropriateness of the data will be reviewed annually.
QA/QC procedures to be applied:	Not applicable, since a default factor will be used in this case.
Any comment:	The monitoring of this variable applies, since according to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", this PDD is using option B to determine the CO_2 emission coefficient of fuel type i.

Monitored parameters from the "Tool to calculate the emission factor for an electricity system (Version 02.2)":

Data / Parameter:	**$FC_{i,m,y}$ and $FC_{i,k,y}$**
Data unit:	Mass or volume unit.
Description:	Amount of fossil fuel type i consumed by power plant/unit m and k in year y.
Source of data to be used:	Utility or government records or official publications.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 3 of this PDD.
Description of measurement methods and procedures to be applied:	• Monitoring frequency simple adjusted OM: Once at the validation stage, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option). • Monitoring frequency BM: For the first crediting period, annually ex-post. For the second and third crediting period, only once ex-ante at the start of the second crediting period.
QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	(GJ / mass or volume unit)
Description:	Net calorific value (energy content) of fossil fuel type i in year y.
Source of data to be used:	The following data sources may be used in the relevant conditions apply:

	<table><tr><th>Data source</th><th>Conditions for using the data source</th></tr><tr><td>Values provided by the fuel supplier of the power plants invoices.</td><td>If data is collected from power plant operators (e.g. utilities).</td></tr><tr><td>Regional or national average default values.</td><td>If values are reliable and documented in regional or national energy statistics / energy balances.</td></tr><tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.</td><td>--</td></tr></table> National average default factors will be used in this case. The specific source is the MIEMDNE (National Energy Division of Uruguay) web site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Fuel oil: 40.9 (GJ/ton) Gas oil: 42.6 (GJ/ton) Natural Gas: 56.0 (GJ/ton)
Description of measurement methods and procedures to be applied:	• Monitoring frequency simple adjusted OM: Once at the validation stage, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option). • Monitoring frequency BM: For the first crediting period, annually ex-post. For the second and third crediting period, only once ex-ante at the start of the second crediting period.
QA/QC procedures to be applied:	--
Any comment:	The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. In such cases, also a gross calorific value basis will be used for CO_2 emission factor.

Data / Parameter:	**$EF_{CO2,i,y}$, $EF_{CO2,m,i,y}$**
Data unit:	(tCO_2/GJ)
Description:	CO_2 emission factor of fossil fuel type i used in power unit m in year y.
Source of data to be used:	The following data sources may be used if the relevant conditions apply: <table><tr><th>Data source</th><th>Conditions for using the data source</th></tr><tr><td>Values provided by the fuel supplier of the power plants invoices.</td><td>If data is collected from power plant operators (e.g. utilities).</td></tr><tr><td>Regional or national average default values.</td><td>If values are reliable and documented in regional or national energy statistics / energy balances.</td></tr></table>

	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. — -- Since no national or regional values are available, the Project Proponent used the IPCC default factors for the emission reduction calculation.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Fuel oil: 0.0755 (tCO_2/GJ) Gasoil: 0.0726 (tCO_2/GJ) Natural Gas: 0.0543 (tCO_2/GJ) For subsequent emission reduction calculations, an alternative source –in accordance with the monitoring methodology- may be used instead.
Description of measurement methods and procedures to be applied:	• Monitoring frequency simple adjusted OM: Once at the validation stage, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option). • Monitoring frequency BM: For the first crediting period, annually ex-post. For the second and third crediting period, only once ex-ante at the start of the second crediting period.
QA/QC procedures to be applied:	--
Any comment:	--

Data / Parameter:	**$EG_{m,y}$, $EG_{k,y}$**
Data unit:	(MWh)
Description:	Net electricity generated and delivered to the grid by power plant/unit m, k in year y.
Source of data to be used:	Utility or government records or official publications.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 3 of this PDD.
Description of measurement methods and procedures to be applied:	• Monitoring frequency simple adjusted OM: Once at the validation stage, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option). • Monitoring frequency BM: For the first crediting period, annually ex-post. For the second and third crediting period, only once ex-ante at the start of the second crediting period.

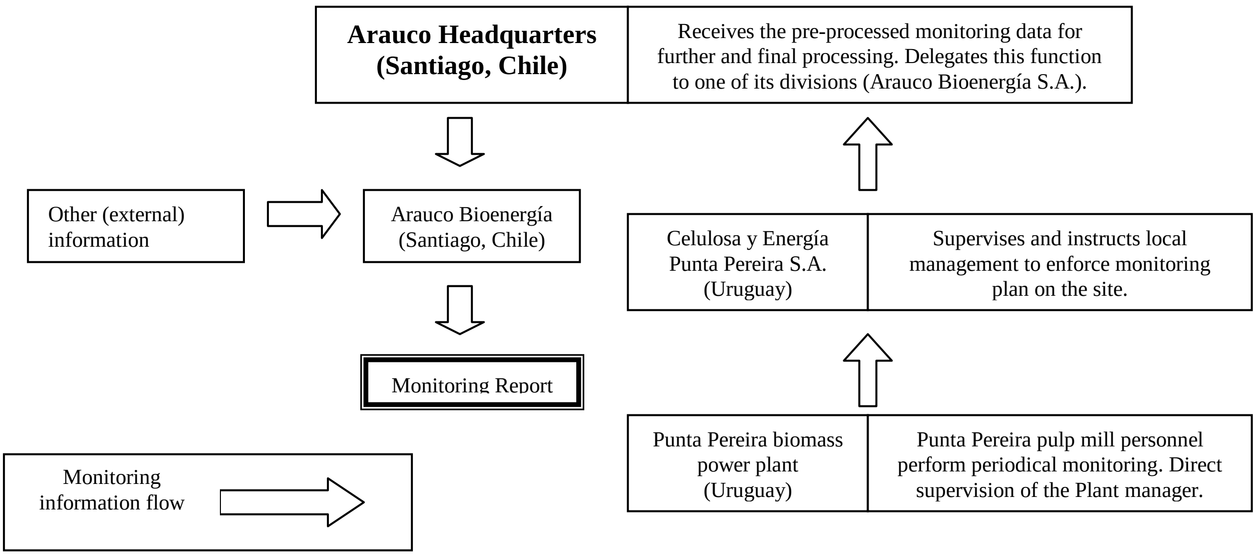
QA/QC procedures to be applied:	--
Any comment:	--

B.7.2. Description of the monitoring plan:

The Project Proponent will implement monitoring procedures according to the monitoring methodology applicable to the proposed project activity. This monitoring methodology will account for emission reductions and leakage effects (in case it corresponds) in an accurate and conservative manner. According to the monitoring methodology of the ACM0006 (Version 11.1), all data collected as part of monitoring will be archived electronically and kept at least for 2 years after the end of the last crediting period.

The monitoring methodology will be supported by a dedicated management information system designed exclusively to guarantee the quality of the information related to the Punta Pereira biomass power plant project activity. The system will use the same principles of the ISO 9001 version 2000 standard and will be incorporated to the plant's management information system. To ensure the quality and integrity of the management system, the Punta Pereira management will perform periodic internal audits.

<u>Monitoring information flow of the Punta Pereira biomass power plant project activity</u>



The Punta Pereira pulp mill management counts with on-site personnel (at the project activity site), who will be in charge of gathering and registering all the required information described in the monitoring plan. Such duties will be incorporated to the personnel's everyday activities to ensure continuity and high-quality standards. The information will be partially processed and stored there, and will be sent periodically (monthly) to Arauco Bioenergía in Santiago for further and final processing (table formats, reports, etc.). With the information at this level, Arauco will be in condition to certify the emission reduction of the Punta Pereira project activity periodically (i.e. once every year).

Finally, since the Punta Pereira pulp mill will be a modern facility, it will count with very high quality, security and environmental standards[40]. There will be plenty of safety measures and security procedures implemented in the facility in case of emergencies or accidental events that might result in unintended emissions. Particularly, for events related to accidental fires, the mill will count with on-line fire sensors that continuously monitor the entire production cycle and will have a fire brigade especially trained to fight any fire contingency in the facility.

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

01/04/2011.

Arauco Bioenergía S.A. is the company responsible for the technical services related to GHG emission reductions, and is therefore, the entity that determined the baseline and developed the PDD of the proposed project activity. Consultoría en Energía & Ingeniería Eléctrica and Carbosur also contributed to the development of this CDM project activity.

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:

17/01/2011.

This was the date in which the Punta Pereira Board of Directors decided to proceed with the Punta Pereira pulp mill, including the additional investment in surplus electric power generation. This was explicitly stated in the corresponding Board of Director meeting report.

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

Minimum of 30 years, considered from the date in which the project starts operating[41].

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

The proposed project activity will use a renewable crediting period; therefore section C.2.1 will be completed below.

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[40] The Punta Pereira management will most likely pursue ISO, Custody Chain and OSHAS standard certification, once in operation.

[41] Please see the Environmental Impact Assessment of the Punta Pereira Project, page 2.2 (53), available at: http://www.montesdelplata.com.uy/descargables.html and in the IDB financial institution web page at: http://search.iadb.org/search/cgi-bin/query-meta.exe?v%3afile=viv_QXOEY3&v:state=root%7Croot-10-10%7C0&. In addition to these references, the Project Proponent provided information indicating that approximately 35% of the pulp mills in the relevant geographical region had been operating for more than 30 years. The rest of the pulp mills are more recent facilities. Considering this evidence, the expected operational lifetime of 30 years appears to be reasonable and conservative for the proposed project activity.

C.2.1. Renewable crediting period:

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

01/04/2013.

C.2.1.2. Length of the first crediting period:

Seven (7) years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not chosen.

C.2.2.2. Length:

Not chosen.

SECTION D. Environmental impacts

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

The proposed project activity mostly presents positive environmental impacts and very minor (if any) negative impacts:

- **Quality of the water:** There will be no significant impacts in the quality of the water because:
  - Condensates from the evaporation plant will be recycled and purified.
  - Containment, spill collection system and reuse of the liquids.
- **Solid Wastes:** There will be a positive impact in the disposal of solid wasted from the wood-handling and effluent treatment plant. These residues will be used as fuel in the power boiler, instead of being disposed in a landfield, near the project plant.
- **Atmospheric emissions:** There will be minor impacts due to air emissions.

- The Project Proponent will install high-efficiency electrostatic precipitators, which will eliminate most of the particulate material present in the flue gases of the power boiler.

- The sulphur dioxide emission from the power boiler will be controlled by using a fuel with low content of sulphur when starting the plant.

- The nitrogen oxides emission from the power boiler will be controlled by the optimization of the combustion process.

All the impacts addressed above, were mentioned and resolved during the corresponding Environmental impact Assessment procedure.

No transboundary impacts were identified for this project.

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:

In accordance to the Uruguayan environmental regulations (Decree 349/005), a complete Environmental Impact Study for the new pulp mill (including the proposed CDM project activity) was made by the Project Proponent during the year 2010. This report was submitted to the DINAMA, the Uruguayan Environmental Authority, in May 2010.

After a full review of the documents, the DINAMA asked for additional information, which was provided during the year 2010. Finally in December 2010, the Ministry of Housing land and environment, through a Ministerial Resolution gave the (AAP), which means “Prior Environmental Authorization” to the Project Proponent.

According to this resolution, the Punta Pereira pulp mill (including the proposed CDM project activity) fully complies with all the outstanding environmental requirements, regulations and permits that are applicable in this case.

SECTION E. Stakeholders’ comments

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

In order to obtain national approval, public hearings are required by the Designated National Authority of Uruguay (*Dirección Nacional de Medio Ambiente – DINAMA*). Public Hearings are the opportunity for the stakeholders to learn the features of the project and to express their ideas about the project.

The Project Proponent held two public hearings in the cities of Montevideo (April 11th, 2011) and Colonia (April 12th, 2011). Both hearings consisted of brief presentations about climate change and the CDM, followed by a description of the project, its environmental impact assessment and its contribution

to sustainable development of Uruguay. Both public hearings were open to the public and the following stakeholders attended to the hearings:

Public hearing in Montevideo

- Government: Asociación de despachantes de Aduana (Customs Dispatch Association).
- Government: ADME: Administración del Mercado Eléctrico (Administration of the electric market).
- Government: MIEM: Ministerio de Industria, Energía y Minería (Ministry of Energy and Mining).
- Government: Unidad de Cambio Climático de la DINAMA (Uruguay DNA).
- Government: Dirección General Forestal (Forestry administration body).
- Private company: Estudio Posadas y Vecino (Law company).
- Private company: LKSur, Praxis Lab, Concrexur, Frimaral.
- Comisión del Río de la Plata (Rio de la Plata commission).
- Financial institution: Banco Comercial, BROU, Banco de la República Oriental de Uruguay.

Public hearing in Colonia

- Government: Ediles Departamental (local governmental authorities).
- Government: IMC: Intendencia Municipal de Colonia.
- Government: Intendente del Departamento de Colonia.
- Government: Sociedad Fomento de Conchillas.
- Government: Representantes del MIDES (Ministerio de Desarrollo Social).
- Government: INIA: instituto Nacional de Investigación Agropecuaria.
- Government: Inspección Departamental de Educación Primaria.
- Civil institution: Comisión de amigos de Conchillas.
- Civil institution: Club CUOPYC.
- Civil institution: Radio de Colonia (radio of Colonia).
- Civil institution: Miembros de la junta Departamental.
- Private company: UPM S.A. (Pulp and Paper industry).
- Private company: Three Squares International.
- Private company: Montes del Plata employees.
- Press: Diario La Colonia.
- Press: “Estampas” magazine.
- Local citizens.

Both public hearings were advertised in two written press media; both in 08/04/2011:

- El País
- Noticias

The Project Proponent sent direct invitations to the attendants mentioned above. In addition, since the two public hearings were open to the public, they were also advertised in the “El Espectador” radio:

- In the radio program: “En perspectiva”.
- Twice in other programs of the same radio.

In both public hearings, the participants were invited to express their concerns and suggestions about the proposed CDM project. All comments were recorded, and their summary is shown in the table presented in section E.2.

E.2. Summary of the comments received:

Questions received during public consultation and their corresponding responses are shown in the table below.

Questions and answers from the Public Hearings in Montevideo

	Date	Name / Institution	Comments/Questions	Answers
1	11 April 2011	Juan Gabito Commission for the administration of the Rio de la Plata	-What volume and flow of water will the plant consume in its operation? -Where will the points of intake and discharge be located? -Explain in higher detail the systems that monitor the returned water quality, the prevention systems and the water treatment systems.	The co-generation plant that is the subject of this CDM hearing doesn’t have a significant additional use of water with regards to the pulp mill, so the co-generation project itself doesn’t add an increase in water usage. The same situation goes for the treatment of effluents since most of the intermediate effluents that circulate in the power generation circuit are re-used, re-circulated and the condensate returned to the steam generation system, thus the project itself doesn’t add neither in water usage nor on effluent dumping. Either way, though it is not the subject of the hearing, it’s worth commenting that the project as a whole has been evaluated in its effect with regards to the effluents discharged into the Rio de la Plata as well as water usage (the water intake will be from the Rio de la Plata), the spillway will also be to the Rio de la Plata. The environmental impact study was presented to the relevant authority which is the DINAMA on May 2010. That environmental authorization was granted on December 30th 2010, evaluating all these impacts and the mitigating measures that the company presented. There is going to be a strict monitoring plan with regards to quality of discharge (of the complex as a whole), as well as the quality of the Rio de la Plata water. With pleasure, we can give detailed information to

				anyone who wants to approach us by phone or mail. Either way it is contained in the environmental report that is both on DINAMA's website as well as the Montes del Plata website: www.montesdelplata.com.uy.
2	11 April 2011	Luis Ordeig Unit for Climate Change Ministry of Housing, Territorial Planning and Environment.	There is mention that there is no affect in the physicochemical and microbiological parameters for the Rio de la Plata. This is to be expected due to the large flow and the effect of dilution, but there is no mention of local effects being considered for the dump zone or how these would be minimized or compensated or if there will be regular monitoring.	This was answered together with question 1
3	11 April 2011	Federico Ferrés COFUSA	- How many megawatts are generated based on black liquor and how many are generated by the biomass boiler? - Are residues from the plant the only ones to be used by the boiler or will you bring in biomass from the forest? -Is the energy from the sludge and biomass boiler used elsewhere? Can you briefly describe it?	- I am going to show the relation of steam that each boiler generates because as it's seen in the diagram that was presented with the project description, the steam from both boilers is mixed in a common collector and is then distributed to both turbines. The biomass boiler generates an amount of steam that is equivalent to 5MW and the recovery boiler around 160MW. It's a small amount in comparison to the recovery boiler (which generates based on black liquor). - Only residues from the plant are used, which are the residual bark that comes with the logs, residues from the chipping process (they go through a sieve and some residues remain that can't be used for the process and are burned in the boiler), and the sludge from the primary treatment of effluents also have an energetic value that is taken advantage of. - Yes. The boiler uses fluidized bed technology.

				The biomass bed boilers have a bed of sand that, as the name implies, is fluidized by a distributed air flow with many mouths which makes the bed optimally mix the biomass with the air generating a complete and adequate combustion. Also, this bed provides a thermal inertia that allows it to absorb moisture variations in the fuel, which makes it easier to burn several types of fuel. It is used in several places abroad. I have no knowledge of whether or not another such boiler exists in Uruguay.
4	11 April 2011	Ing. Alberto Hernández	-What is the estimated evolution of the prices of the CERs (certificates generated by these projects) for the next few years, especially taking into account the situation of Japan? -What is the additionality of the power generation component from the steam from the recovery boiler?	- As you know, if nuclear power, before what happened with the tsunami, if Japan had critics, it has many more now because of what happened with the TEPCO plants. This caused that in Europe, specifically in Germany (they are the main generators of greenhouse gases, almost 450 million tons per year), that they started to review their plans to prolong the life of the nuclear reactors the Germans have there. CO_2 emissions associated to nuclear energy are zero. And the fact that calling for the retirement or not prolonging the nuclear plans throughout Europe and in this case Germany evidently makes abatement plans and emission reduction in Europe to be more complicated. Therefore this favours the prices of these emission certificates that somehow allow compensating local emissions, in this case the EU emissions (specifically in Germany). So there is a higher demand for these certificates and the price will have to increase. Now, we have somehow seen this confirmed by existing reports (all investment banks do this type of studies) and they show around €14 to €15 for this year and over €20 for 2020. Now, the CDM topic is a complex subject, highly dynamic. No one knows exactly what is going to happen, everyone bets on and the international community in general bets on that the mechanism will go on, but no one rules out that, especially at an EU level, there will be other mechanisms that allow for a better way to fulfill with a larger amount of credits the greater demand for credits that will happen if one thinks on what’s needed to achieve the needed emission reduction. Therefore the possibility is being considered to generate other

				mechanisms parallel to the CDM post 2012. In short: Rising. -These biomass projects are complex, a pulp mill is a relatively complex project. It cannot be considered that the investment involves only the power boiler and that is the whole CDM project, that is not so. The CDM project in the end consists in making the pulp mill more efficient with regards to its use of electric and thermal energy. Therefore the pulp mill is thought and designed in a way to be a more efficient plant, to have better energy efficiency. Thus the recovery boiler is designed to be able to handle black liquor concentrations of 80% instead of the 73% that is normally seen according to standard practices in the pulp business. But this is just an example. In general the whole plant has certain modifications that allow the plant to generate this surplus. As you just heard, the presence of the power boiler doesn't allow it to achieve a surplus of 50MW or 70MW. The power boiler contributes but it is a part of a whole, a project that is thought of in an integral manner. It is a more efficient pulp mill that allows it to generate this type of surplus.

Questions and answers from the Public Hearings in Colonia

	Date	Name / Institution	Comments/Questions	Answers
1	12 April 2011	Liliana Chevalier Junta Departamental de Colonia	Is there any effluent that is not re-used? What is its destination? What guarantee is there that the ashes used as industrial landfill are not contaminant? How much drinking water is used daily by the company and what is its final destination? As for the social aspects, on what measure are you working so that this not	In answering these topics that refer to the subject of effluents and the generation of solid residues, it corresponds to comment that the CDM project itself, that is, the generation of surplus electric energy, doesn't add any additional usage of water nor in the generation of effluents, to what would normally be generated by the pulp mill. So the subject of effluents is not proportionally significant because all intermediate effluents are collected and re-used, and the condensates re-enter the cycle, so there are no significant effluents generated at water level and what little is dumped, also goes to the effluent treatment plant that attends to the whole industrial complex and is monitored and controlled permanently as well as the quality of the surface water with a well detailed monitoring plan. On

			transform into a negative impact?	DINAMA's website as well as our own, you will find a detailed monitoring plan of all the emissions and environmental quality that will be developed and will be supervised obviously by the DINAMA. The ash generated, that is a non-dangerous industrial residue, goes to a final deposit site that is an industrial landfill, whose executive project was approved by the DINAMA and has an adequate volume to contain the generated residue and avoid any type of leachate. Montes del Plata, obtained the prior environmental authorization for the whole project that includes: the pulp mill, the power generation and the harbour. That authorization is from December 30th of the previous year and was a result of an environmental impact study that was presented in May and that, after successive complementary information solicited by the DINAMA, concluded in an environmental authorization for the whole project. The last question is answered together with the following questions.
2	12 April 2011	Javier García Sevicol Ltda.	How long do you estimate it will take to get the project started? What are the more notorious difficulties that you have faced? On the first starting stage, How many jobs do you estimate: direct, dependent, Uruguayan and foreign, how many outsourced and how many jobs in the whole development of the project?	These are answered together with the questions of the following citizen.
3	12 April 2011	Ana Maria Maciera Mydes Colonia	I would like you to further develop the fundaments of the decentralization of development item. Since the local social impact that will be produced is well known. Considering that development is not just considered as economic gain	There are several aspects that form the topics of social impact, job generation, and percentage of local and foreign labour in the various phases of the project. I believe that many of you were present at the environmental public hearing done in Radial Conchillas. All of these topics were developed there because these topics were precisely the subject of that hearing but it's not the case of this

			and mitigation of environmental impact. But also the wellbeing of the population, not just the workers directly employed by the company, but of society in general.	hearing. We will still do a summary of what we have already presented in that occasion. We also inform you that you may find it at the DINAMA website and the Montes del Plata website (www.montesdelplata.com.uy), in what is the environmental report summary and social studies. To summarize, there is a clear commitment from the company that is to prioritize local labour. We are working both with the city hall and the CEPE of Colonia to generate a database of all people interested in participating and working with the contractors that will develop the enterprise. You know that this enterprise will be done by Montes del Plata but through contracting of companies specialized in the different areas. The topics of training are also being worked on. We are, through Inefob and the Focap, promoting in some manner training instances at a national level and together with Focap we will launch several training courses in the construction area, especially in Colonia. The intent is so that the social impact spills as much as possible over to the local community and the department of Colonia. Also at a national level, because as you know, the company develops forest activities in several departments of the country where there is also a propagation of everything related to the social and economic impact as well as environmental care. The energy co-generation project itself doesn't generate any additional impact because the amount of labour that integrates the project, though significant since it's a highly trained and qualified workforce doesn't cause an impact as for the amount of people. We are talking between 15 and 20 new jobs, that are high quality jobs but that don't generate an impact in what can be demand or overpopulation. We understand that the CDM project doesn't generate any negative impact. The global project doesn't generate negative impact either, because we understand that for those activities that increase during the construction phase like for example, the amount of people that will come to the area, we are implementing a number of investigative measures and programs so that the end result is a positive impact for the local community. We will be always available for any consults you want, be it to the phones on our office in Colonia, personally on the office or through our website, you can send us any question you might have.

				Obviously as was commented these questions are not specific to what this hearing has to do with energy co-generation but we understand that the idea was to give a general picture of where you can find the information and the several instances you might have, to ask any questions on all the general topics that might be of interest to you.

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

All comments and questions received were answered during the public hearings. There were no questions left out and all participants showed themselves satisfied with the answers provided. It must be noted thought, that most of the questions were about plant operation details instead of the proposed CDM project activity. Regardless of this, they were all properly clarified.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The financial plans for the Project do not involve public funding.

Annex 3

BASELINE INFORMATION

URUGUAY POWER GENERATION AND IMPORTS, 2008, 2009 AND 2010

(ELECTRICITY IN MWh)

POWER PLANTS	START OPERATION	DATE OF RETIREMENT	POWER OUTPUT (MW)	Nº OF UNITS	PLANT TYPE	FUEL TYPE	LOW COST / MUST RUN	CDM PROJECT	TOTAL NET 2008	TOTAL NET 2009	TOTAL NET 2010	TOTAL NET 3YR-AVG
Central Batlle unidad 3 (Sala B)	1955	N.A.	50	1	Open cycle	Fuel oil	No	No	199,975	178,967	-4	**125,961**
Central Batlle unidad 4 (Sala B)	1957	N.A.	50	1	Open cycle	Fuel oil	No	No	-282	-8	2,477	**729**
Central Batlle unidad 5	1970	N.A.	88	1	Steam cycle	Fuel oil	No	No	512,922	309,569	132,074	**317,677**
Central Batlle unidad 6	1975	N.A.	125	1	Steam cycle	Fuel oil	No	No	437,630	293,092	180,106	**303,609**
Central Batlle unidad 7	2009	N.A.	80	1	Engines	Fuel oil	No	No	0	18	276,831	**92,283**
CTR (La Tablada) unidad 1	1992	N.A.	113	1	Engines	Gas oil	No	No	505,563	405,399	-9,619	**299,659**
CTR (La Tablada) unidad 2	1992	N.A.	113	1	Engines	Gas oil	No	No	160,873	397,154	117,605	**225,211**
Punta del Tigre unidad 1	2006	N.A.	50	1	Open cycle	Gas oil	No	No	258,507	215,252	94,818	**189,288**
Punta del Tigre unidad 2	2006	N.A.	50	1	Open cycle	Gas oil	No	No	295,836	150,207	82,285	**175,751**
Punta del Tigre unidad 3	2006	N.A.	50	1	Open cycle	Gas oil	No	No	254,314	69,064	25,798	**116,392**
Punta del Tigre unidad 4	2006	N.A.	50	1	Open cycle	Gas oil	No	No	253,750	184,981	85,166	**174,316**
Punta del Tigre unidad 5	2008	N.A.	50	1	Open cycle	Gas oil	No	No	169,952	172,719	82,150	**141,255**
Punta del Tigre unidad 6	2008	N.A.	50	1	Open cycle	Gas oil	No	No	222,641	182,504	59,587	**154,554**
CH Constitución Máquina 1	1982	N.A.	110	1	Reservoir	Hydro	Yes	No	218,466	330,992	620,085	**389,848**
CH Constitución Máquina 2	1982	N.A.	110	1	Reservoir	Hydro	Yes	No	113,947	320,580	635,135	**356,554**
CH Constitución Máquina 3	1982	N.A.	110	1	Reservoir	Hydro	Yes	No	239,876	341,251	671,482	**417,536**
CH Gabriel Terra máquina 1	1947	N.A.	39	1	Reservoir	Hydro	Yes	No	102,969	87,514	237,307	**142,583**
CH Gabriel Terra máquina 2	1945	N.A.	39	1	Reservoir	Hydro	Yes	No	109,613	95,174	241,972	**148,887**
CH Gabriel Terra máquina 3	1948	N.A.	39	1	Reservoir	Hydro	Yes	No	89,667	86,941	231,745	**136,101**
CH Gabriel Terra máquina 4	1948	N.A.	39	1	Reservoir	Hydro	Yes	No	97,467	86,829	232,140	**138,783**
CH Baygorria máquina 1	1960	N.A.	36	1	Run of the river	Hydro	Yes	No	78,360	81,280	196,627	**118,727**
CH Baygorria máquina 2	1960	N.A.	36	1	Run of the river	Hydro	Yes	No	103,677	91,806	202,910	**132,789**
CH Baygorria máquina 3	1960	N.A.	36	1	Run of the river	Hydro	Yes	No	102,436	62,993	193,084	**119,507**
Salto Grande (Uruguay)	1979	N.A.	N.A.	N.A.	Reservoir	Hydro	Yes	No	3,251,188	4,294,886	4,788,209	**4,110,811**
TGAA Maldonado unidad 1	1982	N.A.	25	1	Open cycle	Gas oil	No	No	27,464	22,621	220	**16,749**
GD Los Caracoles	2008	N.A.	10	1	Wind	Wind	Yes	No	2,875	31,916	34,346	**23,010**
GD Los Caracoles 2	2010	N.A.	10	1	Wind	Wind	Yes	No	0	0	23,331	**7,777**
GD Nuevo Manantiales	2008	N.A.	13	1	Wind	Wind	Yes	Yes	0	693	11,994	**4,229**
GD Fenirol	2010	N.A.	10	1	Biomass	Biomass	Yes	No	0	-92	16,845	**5,584**
GD Bioener	2010	N.A.	12	1	Biomass	Biomass	Yes	No	0	-883	14,051	**4,389**
GD Galofer	2010	N.A.	14	1	Biomass	Biomass	Yes	Yes	0	0	10,947	**3,649**
UPM	2007	N.A.	36	1	Biomass	Biomass	Yes	Yes	115,974	159,781	201,103	**158,808**
San Borja (diesel interconectada)	2005	N.A.	2	1	Engines	Gas oil	No	No	0	4,434	22	**1,485**
Rivera (diesel interconectada)	2005	N.A.	4	1	Engines	Gas oil	No	No	3,759	2,908	20	**2,229**
Zenda Leather S.A.	2008	N.A.	3	1	Cogeneration	Natural Gas	Yes	No	3,478	9,538	4,570	**5,850**
Weherhaueser S.A.	2010	N.A.	5	1	Biomass	Biomass	Yes	No	0	0	8,508	**2,836**
Liderdat	2010	N.A.	5	1	Biomass	Biomass	Yes	No	0	0	1,098	**1,098**
Agroland	2008	N.A.	0.3	1	Wind	Wind	Yes	No	-549	-621	-1,069	**-745**
Alur	2010	N.A.	10	1	Biomass	Biomass	Yes	No	0	0	-216	**-216**
Las Rosas	2004	N.A.	1	1	Biomass	Biomass	Yes	No	421	375	1,033	**610**
Electricity imports	**0**	**0**	**0**	**0**	**N.A.**	**N.A.**	**Yes**	**No**	**962,559**	**1,467,984**	**386,843**	**935,542**
Total electricity									**8,895,328**	**10,137,819**	**10,093,616**	**9,701,693**

Source: ADME

FOSSIL FUEL DATA AND POWER PLANT EMISSION FACTORS, 2008, 2009 AND 2010

POWER PLANTS	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	LOW COST / MUST RUN	CO_2 EF 2008 (tCO_2/MWh)	CO_2 EF 2009 (tCO_2/MWh)	CO_2 EF 2010 (tCO_2/MWh)
Central Batlle unidad 3 (Sala B)	50	Open cycle	Fuel oil	No	0.978	1.021	0.882
Central Batlle unidad 4 (Sala B)	50	Open cycle	Fuel oil	No	0.978	1.021	0.882
Central Batlle unidad 5	88	Steam cycle	Fuel oil	No	0.802	0.848	0.827
Central Batlle unidad 6	125	Steam cycle	Fuel oil	No	0.799	0.821	0.848
Central Batlle unidad 7	80	Engines	Fuel oil	No	0.642	0.642	0.642
CTR (La Tablada) unidad 1	113	Engines	Gas oil	No	0.867	0.876	0.953
CTR (La Tablada) unidad 2	113	Engines	Gas oil	No	0.857	0.891	0.873
Punta del Tigre unidad 1	50	Open cycle	Gas oil	No	0.703	0.690	0.690
Punta del Tigre unidad 2	50	Open cycle	Gas oil	No	0.681	0.730	0.662
Punta del Tigre unidad 3	50	Open cycle	Gas oil	No	0.678	0.653	0.709
Punta del Tigre unidad 4	50	Open cycle	Gas oil	No	0.693	0.724	0.653
Punta del Tigre unidad 5	50	Open cycle	Gas oil	No	0.712	0.681	0.703
Punta del Tigre unidad 6	50	Open cycle	Gas oil	No	0.681	0.681	0.669
CH Constitución Máquina 1	110	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Constitución Máquina 2	110	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Constitución Máquina 3	110	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Gabriel Terra máquina 1	39	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Gabriel Terra máquina 2	39	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Gabriel Terra máquina 3	39	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Gabriel Terra máquina 4	39	Reservoir	Hydro	Yes	0.000	0.000	0.000
CH Baygorria máquina 1	36	Run of the river	Hydro	Yes	0.000	0.000	0.000
CH Baygorria máquina 2	36	Run of the river	Hydro	Yes	0.000	0.000	0.000
CH Baygorria máquina 3	36	Run of the river	Hydro	Yes	0.000	0.000	0.000
Salto Grande (Uruguay)	N.A.	Reservoir	Hydro	Yes	0.000	0.000	0.000
TGAA Maldonado unidad 1	25	Open cycle	Gas oil	No	1.260	1.349	1.257
GD Los Caracoles	10	Wind	Wind	Yes	0.000	0.000	0.000
GD Los Caracoles 2	10	Wind	Wind	Yes	0.000	0.000	0.000
GD Nuevo Manantiales	13	Wind	Wind	Yes	0.000	0.000	0.000
GD Fenirol	10	Biomass	Biomass	Yes	0.000	0.000	0.000
GD Bioener	12	Biomass	Biomass	Yes	0.000	0.000	0.000
GD Galofer	14	Biomass	Biomass	Yes	0.000	0.000	0.000
UPM	36	Biomass	Biomass	Yes	0.000	0.000	0.000
San Borja (diesel interconectada)	2	Engines	Gas oil	No	0.619	0.619	0.619
Rivera (diesel interconectada)	4	Engines	Gas oil	No	1.096	1.096	1.096
Zenda Leather S.A.	3	Cogeneration	Natural Gas	Yes	0.487	0.487	0.487
Weherhaueser S.A.	5	Biomass	Biomass	Yes	0.000	0.000	0.000
Liderdat	5	Biomass	Biomass	Yes	0.000	0.000	0.000
Agroland	0	Wind	Wind	Yes	0.000	0.000	0.000
Alur	10	Biomass	Biomass	Yes	0.000	0.000	0.000
Las Rosas	1	Biomass	Biomass	Yes	0.000	0.000	0.000
Electricity imports	N.A.	N.A.	N.A.	N.A.	0.000	0.000	0.000

Sources: ADME, UTE and other official sources.

OPERATING MARGIN CALCULATION

(ACCORDING TO THE METHODOLOGICAL TOOL (VERSION 02.2)

Selected option: Ex-ante option: considers the last 3-year data available.

		2008	2009	2010
Total emissions from non-low cost / must run power plants	(tCO_2/yr)	2,575,315	2,110,665	836,155
Total emissions from low-cost / must-run power plants	(tCO_2/yr)	1,693	4,641	2,224
Total net energy generated in the grid (incl. imports)	(GWh/yr)	8,895	10,138	10,094
Total net energy by non-Low cost / must run power plants	(GWh/yr)	3,303	2,589	1,130
Total net energy by low cost / must run power plants (incl. imports)	(GWh/yr)	5,592	7,549	8,964
Factor λ	(number)	0.0002	0.1054	0.3098
Operating Margin	**(tCO_2/GWh)**	**779.53**	**729.44**	**510.99**

Generation weighted-average Operating Margin	**(tCO_2/GWh)**	**669.04**

BUILD MARGIN CALCULATION

(ACCORDING TO THE METHODOLOGICAL TOOL (VERSION 02.2)

Selected option: Option 2: Calculated expost, using the most recent information available up to the registration date of the project activity.

POWER PLANTS	POWER OUTPUT (MW)	PLANT TYPE	FUEL TYPE	START OPERATION	CDM PROJECT	TOTAL GEN 2010 (GWh)	(tCO_2/GWh)
GD Los Caracoles 2	10	Wind	Wind	2010	No	23,331	0.000
GD Fenirol	10	Biomass	Biomass	2010	No	16,845	0.000
GD Bioener	12	Biomass	Biomass	2010	No	14,051	0.000
GD Galofer	14	Biomass	Biomass	2010	Yes	10,947	0.000
Weherhaueser S.A.	5	Biomass	Biomass	2010	No	8,508	0.000
Liderdat	5	Biomass	Biomass	2010	No	1,098	0.000
Alur	10	Biomass	Biomass	2010	No	-216	0.000
Central Batlle unidad 7	80	Engines	Fuel oil	2009	No	276,831	0.642
Punta del Tigre unidad 5	50	Open cycle	Gas oil	2008	No	82,150	0.717
Punta del Tigre unidad 6	50	Open cycle	Gas oil	2008	No	59,587	0.682
GD Los Caracoles	10	Wind	Wind	2008	No	34,346	0.000
GD Nuevo Manantiales	13	Wind	Wind	2008	Yes	11,994	0.000
Zenda Leather S.A.	3	Cogeneration	Natural Gas	2008	No	4,570	0.487
Agroland	0.3	Wind	Wind	2008	No	-1,069	0.000
UPM	36	Biomass	Biomass	2007	Yes	201,103	0.000
Punta del Tigre unidad 1	50	Open cycle	Gas oil	2006	No	94,818	0.704
Punta del Tigre unidad 2	50	Open cycle	Gas oil	2006	No	82,285	0.676
Punta del Tigre unidad 3	50	Open cycle	Gas oil	2006	No	25,798	0.723
Punta del Tigre unidad 4	50	Open cycle	Gas oil	2006	No	85,166	0.667
San Borja (diesel interconectada)	2.12	Engines	Gas oil	2005	No	22	0.632
Rivera (diesel interconectada)	4.3	Engines	Gas oil	2005	No	20	1.118
Las Rosas	1	Biomass	Biomass	2004	No	1,033	0.000
CTR (La Tablada) unidad 1	113	Engines	Gas oil	1992	No	-9,619	0.973
CTR (La Tablada) unidad 2	113	Engines	Gas oil	1992	No	117,605	0.891
CH Constitución Máquina 1	110	Reservoir	Hydro	1982	No	620,085	0.000
CH Constitución Máquina 2	110	Reservoir	Hydro	1982	No	635,135	0.000
CH Constitución Máquina 3	110	Reservoir	Hydro	1982	No	671,482	0.000
TGAA Maldonado unidad 1	25	Open cycle	Gas oil	1982	No	220	1.283
Salto Grande (Uruguay)	N.A.	Reservoir	Hydro	1979	No	4,788,209	0.000
Central Batlle unidad 6	125	Steam cycle	Fuel oil	1975	No	180,106	0.848
Central Batlle unidad 5	88	Steam cycle	Fuel oil	1970	No	132,074	0.827
CH Baygorria máquina 1	36	Run of the river	Hydro	1960	No	196,627	0.000
CH Baygorria máquina 2	36	Run of the river	Hydro	1960	No	202,910	0.000
CH Baygorria máquina 3	36	Run of the river	Hydro	1960	No	193,084	0.000
Central Batlle unidad 4 (Sala B)	50	Open cycle	Fuel oil	1957	No	2,477	0.882
Central Batlle unidad 3 (Sala B)	50	Open cycle	Fuel oil	1955	No	-4	0.882
CH Gabriel Terra máquina 3	38.8	Reservoir	Hydro	1948	No	231,745	0.000
CH Gabriel Terra máquina 4	38.8	Reservoir	Hydro	1948	No	232,140	0.000
CH Gabriel Terra máquina 1	38.8	Reservoir	Hydro	1947	No	237,307	0.000
CH Gabriel Terra máquina 2	38.8	Reservoir	Hydro	1945	No	241,972	0.000
Total						9,706,772	

GENERATION IN 2010 (EXCLUDES IMPORTS)	(GWh / yr)		9,706,772
20% OF GEN. IN 2010	(GWh / yr)		1,941,354
5 MOST RECENT PLANT GEN (EXCL. CDM)	(GWh / yr)		63,833

BUILD MARGIN	(tCO_2/GWh)		238.99

Note:

According to the "Tool to calculate the emission factor for an electricity system (Version 02.2)", in this case the sample group of power units m includes CDM project activities.

COMBINED MARGIN CALCULATION

(ACCORDING TO THE METHODOLOGICAL TOOL (VERSION 02.2)

OM: Ex-ante option: considers the last 3-year data available.
BM: Option 2: Calculated expost, using the most recent information available up to the registration date of the project activity.

Operating Margin	(tCO_2/GWh)	669.04
Build Margin	(tCO_2/GWh)	238.99
Combined Margin	**(tCO_2/GWh)**	**454.01**

<u>Annex 4</u>

MONITORING INFORMATION

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