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:

Fuel Switch Project in Caieiras, SP, Brazil
Version number of the document: 3
Date: 27/02/2007

A.2. Description of the project activity:

One of the first paper manufacturers of Brazil, inaugurated at a time when the country was supplied by imports, MD Papéis underwent deep changes, without turning away from key goal: producing high quality papers and being always tuned in, in order to predict market demands and trends.

MD Papéis are committed to providing products and services that satisfy its customers and to sustaining the continuous improvement of its Quality Management System. The main certificates that verify MD's commitment to Total Quality, especially concerning the products developed for food packaging and pharmaceutical use: CETEA (Mercosur), FDA (USA), ISEGA (Germany). MD Papéis also has a quality management system certified according to NBR ISO 9001:2000.

MD Papéis, a company that belongs to Formitex group, is known worldwide for its ability of mastering different technologies for manufacturing special papers, developed for the industry, where business-to-business transactions are most frequent.

Purpose of the project activity

Located in an industrial area of the municipality of Caieiras, State of São Paulo, the company has developed a series of mechanisms and programs that put concern with the environment and the well being in the first place. As part of these programs, in the beginning of the year 2005, MD Papéis started to plan a conversion on its fuel oil-fired steam boilers into gas-fired boilers, through the contractual negotiation with Comgás - the gas natural supplier - and the development of the project's engineer. As it will be further detailed, in the baseline scenario the company would continue using fuel oil in its boilers during the crediting period.

MD Papéis' processes are heavily based on steam that is produced by its boilers (there's no import of steam in Caieiras Plant). The company uses two Aalborg fuel oil-fired boilers.

How the proposed project activity reduces greenhouse gas emissions

Due to a variety of barriers (described in details on Section B.3), the use of natural gas in industries is not a business as usual situation in Brazil. The most likely scenario for MD Papéis' project in the Municipality of Caieiras is to keep using fuel oil in its boilers.

The lack of national and/or sectoral policies and circumstances that influence the decisions or impose obligations to the proposed project activity also contributes to this situation. The use of fuel oil and natural gas are not restricted nor demanded by any Brazilian and local law or regulation. No sectoral policies incentive the use of natural gas (as well as no policies disincentive the use of fuel oil). Therefore, no sectoral policies and circumstances would make the project activity preferred, rather than the baseline scenario.

For MD Papéis' project the main cause of emission reduction is related to the fact that natural gas is less carbon intensive than fuel oil.

It is important to note that the above mentioned GHGs emission reductions are additional to the current site conditions and the current practices, and would not occur in the absence of the project thus, the project complies with the concept of additionality defined under Kyoto's Clean Development Mechanism.

Contribution of the project activity to sustainability

The project contributes to sustainable development since it:
- Contributes to mitigate greenhouse gas emissions as natural gas is less carbon intensive than other fossil fuels, such as fuel oil.
- Is safer to deal with natural gas than fuel oil, in terms of transportation and storage (natural gas uses pipelines instead of trucks and there's no need to store natural gas in tanks, so it also minimize the risks of accidents and soil/water contamination).
- Creates direct and indirect new jobs during conversion and operation of the equipments.
- Also makes natural gas available in the region where the plant is located.

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)
Brazil	• Private entity : MD Papéis	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		

- Brazil has ratified the Kyoto Protocol on 23/08/02

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

The Federative Republic of Brazil

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

State of São Paulo

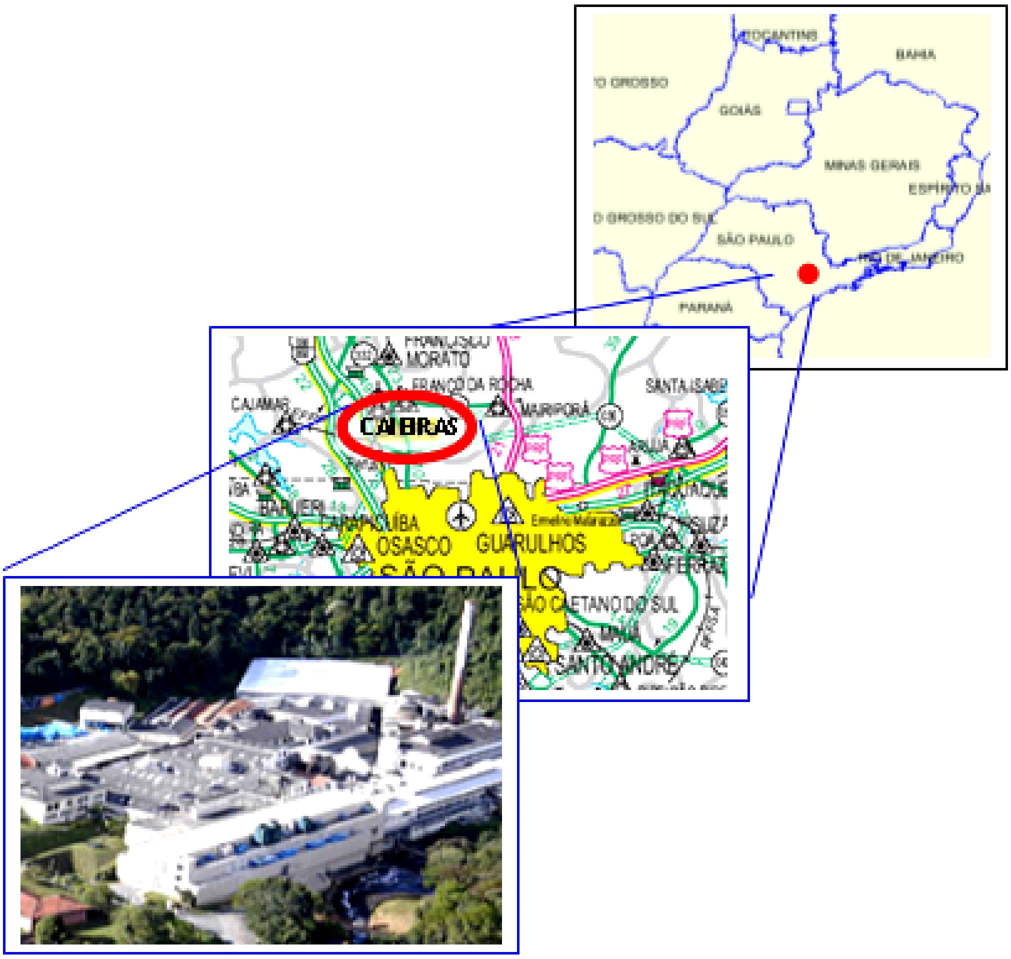
A.4.1.3. City/Town/Community etc:

Caieiras

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

The municipality of Caieiras is located in the Metropolitan Region of the city of the most important Brazilian city: São Paulo (about 32 km from São Paulo). The area surrounding the town of Caieiras is largely industrialized comprising important plastic and pulp and paper companies (**Figure 1**).

Figure 1 - Location map of MD Papéis.



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

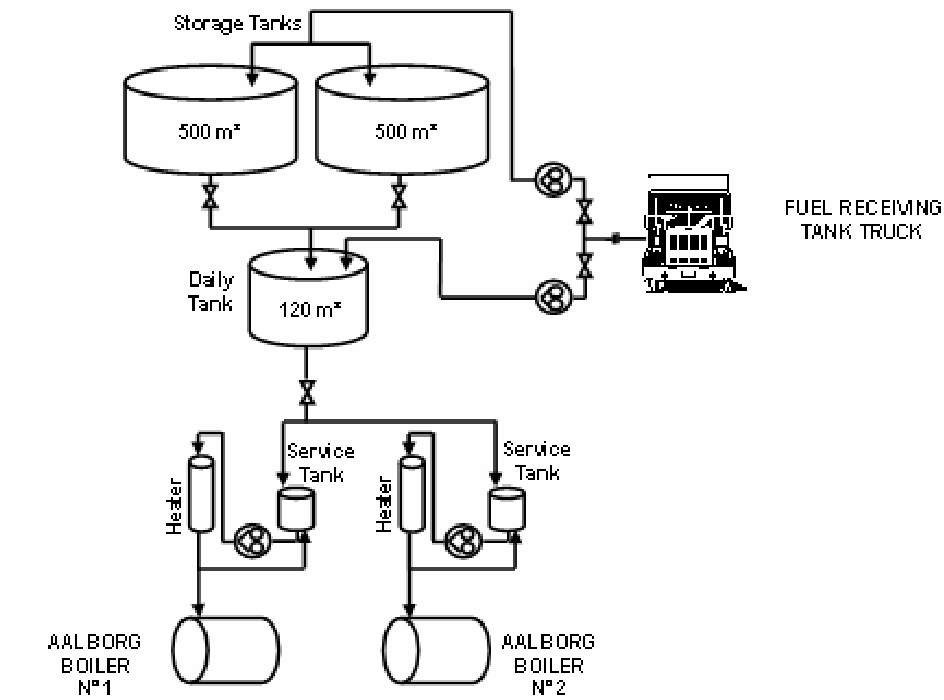
This project belongs to Category 4: Manufacturing Industries listed in the *Sectoral Scopes* for accreditation of the operational entities.

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

The project activity consists of the conversion of fuel oil-fired boilers into natural gas-fired boilers. The utilization of a less intensive carbon content fuel will reduce significantly GHG emissions due to MD Papéis' operations.

Also, the project activity will bring some environmental benefits and will minimize some risks of the daily fuel operation (such as accidents and water/soil contamination). Currently, the fuel oil is transported by tank trucks to plant and it is stored in storage tanks (**Figure 2**). After the project implementation, the fuel (natural gas) will be transported to the plant through gas pipelines and no natural gas will be stored in the plant.

Figure 2 - MD Papéis' Fuel Process



Regarding the technology to be employed by the project activity, it is pretty conventional and basically it consists of the replacement of fuel burners (from oil fuel burners to natural gas injection system), the construction of the internal natural gas pipeline and revamping of field instrumentation (some existing accessories used to maintain oil temperature for instance, will be eliminated). Also, oil storage tanks will be sanitized and the pollutant effect in their surroundings will be mitigated. **Table 1** presents the characteristics of the boilers that are going to be converted according to the project activity.

Table 1 – Aalborg Boilers characteristics.

Manufacturer	Aalborg Industries Ltda
Model	AR-4N
Type	Fire tube
Assembly	Horizontal
Number of Gas Passes	03
Steam production (w/ water at 20°C)	20.000 Kg/h
Steam Quality	Saturate
Fuel	Oil 1A / 3A / NG
Fuel NCV	9.650 Kcal/Kg
Burner	KBO 750
Operation Pressure	10,5 Kgf/cm²
Design Pressure	12,0 Kgf/cm²
Hydrostatic Testing Pressure	18,0 Kgf/cm²
Thermal efficiency at 80% load	90 %
CO_2 in the combustion gases	13 %
Oil consumption (w/ water at 20° C)	1.483 Kg/h
Year of installation	Manufactured in 1998 and Installed in 1999 (both boilers)
Expected lifetime	18 years (both boilers)

As mentioned, all boilers have a remaining lifetime of 18 years and there will be no increase of efficiency because of the conversion.

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

The project activity is estimated to reduce GHG emissions annually by 10,298.76 tCO_2e.

Table 2 - Emission reductions over the crediting period

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Beginning in 01/03/07	8,582.30
Year 2008	10,298.76
Year 2009	10,298.76
Year 2010	10,298.76
Year 2011	10,298.76
Year 2012	10,298.76
Year 2013	10,298.76
Year 2014	10,298.76
Year 2015	10,298.76
Year 2016	10,298.76
Ending in 28/02/2017	1,716.46
Total estimated reductions (tons of CO_2e)	102,987.55
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tons of CO_2e)	**10,298.76**

A.4.5. Public funding of the project activity:

No public funds are used.

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:

Version 3 of ACM0009 – *Consolidated baseline methodology for industrial fuel switching from coal or petroleum fuel to natural gas*.

Available on the UNFCCC website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

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

The currently operated paper plant of MD Papéis has not started using natural gas. The project activity consists of the conversion of existing boilers from oil to natural gas.

This project meets the applicability criteria of ACM0009 as:

- Prior to the implementation of the project activity, only oil (but not natural gas) has been used in the element processes;
- Regulations/programs do not constrain the facility from using the fossil fuels being used prior to fuel switching;
- Regulations do not require the use of natural gas or any other fuel in the element processes;
- The project activity does not increase the capacity of thermal output or lifetime of the element processes during the crediting period (i.e. emission reductions are only accounted up to the end of the lifetime of the relevant element process), nor is there any thermal capacity expansion planned for the project facility during the crediting period;
- The proposed project activity does not result in integrated process change

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

The project boundary covers CO_2 emissions associated with fuel combustion in each element process subject to the fuel switching. The project boundary is applicable to both baseline emissions and project emissions.

For the purpose of determining project activity emissions, the carbon dioxide emissions from the combustion of natural gas in each element process were included.

For the purpose of determining baseline emissions, carbon dioxide emissions from the combustion of the quantity of coal or oil that would be used in each element process in the absence of the project activity were included.

The **spatial extent** of the project boundary encompasses the physical, geographical site of the industrial facility.

	Source	Gas	Included?	Justification/ Explanation
Baseline	Baseline fuel burning	CO_2	Yes	Main emission source
		CH_4	No	Minor source
		N_2O	No	Minor source
Project Activity	Natural gas burning	CO_2	Yes	Main emission source
		CH_4	No	Minor source
		N_2O	No	Minor source

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

In this section it is determined the most plausible baseline scenario following all the steps pointed on the Approved Consolidated Methodology ACM0009.

Step 1. Identification of all realistic and credible alternatives for the fuel use in the element process
There are four realistic and credible alternatives available to the project the projects participants
(1) Continuation of the current practice of using oil as the fuel;
(2) Switching from petroleum fuel to biomass;
(3) Switching from petroleum fuel to natural gas at a future point in time during the crediting period;
(4) The project activity not undertaken under the CDM (switching from fuel oil to natural gas)

Step 2. Elimination of alternatives that are not complying with applicable laws and regulations
Currently, the four alternatives are consistent with Brazilian laws and regulations and no legislation made anyone of the options mandatory/preferred. Thus, the decision of MD Papéis in choosing the natural gas is not forced nor restricted by any legal requirement and the proposed project activity is not the only alternative, as the company would continue to use the oil fuel. No alternative is eliminated in Step 2.

Step 3. Elimination of alternatives that face prohibitive barriers
The alternatives 1 and 4 don't face any prohibitive barrier. However, the alternative 2 faces technical barriers as biomass is not available and also the burning of it in the boiler is not operational efficient or even possible. According to the equipment's manual (supplied by Aalborg Industries), the flame tube boiler only works with fuel oil or natural gas. The utilization of biomass in flame tube boilers would generate residues inside the equipment. Generally, the biomass boiler is a water tube type.

The alternative 3 also faces prohibitive barriers as the determination of the future prices of natural gas and fuel oil is not accurate.

The Brazilian fuel oil price is freely determined by the suppliers companies, such Petrobras, Esso, Shell, Ipiranga, and is affected mainly by the oil international price. The crude oil prices are determined largely in an international marketplace by the balance between production in OPEC and non-OPEC nations and demand. The oil prices have been highly volatile over the past 25 years, and periods of price volatility can be expected in the future principally because of unforeseen political and economic circumstances (EIA/DOE, 2006[1]). Therefore, it is not possible to predict the fuel oil prices, since they vary with the oil

[1]Energy Information Administration (EIA).*International Energy Outlook 2006*. Chapter 3. 2006
Available in: http://www.eia.doe.gov/oiaf/ieo/pdf/oil.pdf

international markets, which are affected by a lot uncertain variables (such as climate, fuel availability and geopolitics).

According to ANP (2002)[2], the natural gas price that is sold to the distributors, such as Comgás, is composed fundamentally by two parcels: (i) wellhead price, which is destined to remunerate the producer, and (ii) transport price, destined to the gas transport from the producing area to the consumption area.

Nowadays, there are three distinct forms to determine the natural gas in Brazil[3]. One of them is related to the natural gas produced in the country. The national natural gas is regulated by the Energy Ministry, who establish the maximum national natural gas price to be sold to the concessionary companies of canalized gas. This price is composed by the sum of the wellhead price in the transport pipeline entrance and the reference parcel of transport between the reception and delivery places. As ANP notes, the natural gas price produced in Brazil is determined according to the bundle of fuels oil, which is rated in the international markets.

The second form consists in the determination of the imported natural gas price. The import natural gas price, which is destined to local distribution, has already been liberalized. In this case, the parts negotiate freely the present and future contracts.

The natural gas of State of São Paulo is imported from Bolívia. Then, the price is liberalized and the accurate forecast is not possible mainly due to a lot of uncertainties involving the domestic and international markets that affect direct or indirectly the fuels price.

As Almeida (2006)[4] notes, the distributors companies and the consumers don’t know how Petrobras and the government will guarantee the supply in the next years. Besides, these agents don’t know the future price of the natural gas.

Therefore, the alternative 3 faces prohibitive barriers and is eliminated in this step.

Step 4. Comparison of economic attractiveness of remaining alternatives
As required by the baseline methodology ACM0009, compare the economic attractiveness without CER sales revenues for Alternative 1 and Alternative 4 by applying Step 2 (investment comparison analysis) of the latest version of the *Tool for demonstration assessment and of additionality* agreed by the CDM Executive Board.

The *Tools for the demonstration and assessment of additionality* suggests three analysis methods: simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Therefore, the investment comparison analysis (Option II) is adopted and the most plausible baseline scenario is selected through cost comparison of using natural gas and fuel oil based on providing same amount of heat.

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[2] Agência Nacional do Petróleo. *Indústria Brasileira de Gás Natural: Histórico Recente da Política de Preços.* Séries ANP Número IV. Rio de Janeiro, 2002. Available in: http://www.anp.gov.br/doc/gas/LivroHistoricoTarifa.PDF

[3] The third form will be not mentioned here, as it is related to the natural gas destined to the thermoelectric plants.

[4] Almeida E. Crise do Gás Boliviano e o Futuro da Industria de Gás Natural no Brasil. Boletim Infopetro Petróleo e Gás Brasil. Março/Abril de 2006 – ano 7 – n.2.
Available in: www.ie.ufrj.br/infopetro.

The likelihood of development of this project, as opposed to the continuation of its baseline will be determined by analyzing its net present value (NPV). The investment comparison analysis was conducted, considering some basic data:

(i) Costs of both fuels (price and consumption)

- *Fuel oil*
  Price: 0.6180 R$/Kg
  64.03648 R$/Gcal;
  Consumption: 16,840,000 Kg/per year
- *Natural Gas*
  Price: 0.60768 R$/$m^3$
  67.03533 R$/Gcal
  Consumption: 17,926,751.24 m^3/ per year (or 1,493,896 m^3/ per month)

  Source: MD Papéis, based on the volume of natural gas necessary to meet the historic energy need of the plant (from 2005) – that used to be met by the fuel oil consumption in the baseline scenario.

Natural gas prices per unit of energy were higher than fuel oil prices at the time when the decision of implementing the project was undertaken, i.e., in the beginning of 2005. Therefore, the natural gas higher costs comparatively to the fuel oil costs and the investment required to the conversion, through the project lifetime (18 years), make the project NPV without CDM negative (please see the costs comparison analysis through the NPV).

The source of natural gas prices is CSPE, which is the regulatory commission of energy of the State of São Paulo and responsible for the establishment of the prices of natural gas in the State. The information regarding the fuel oil price during the period is based on the MD Papéis purchasing receipts with Petrobras, Shell and Grigollettos, which are the fuel oil's suppliers. The natural gas price is based on the monthly price established for CSPE related to the same period, which is available on CSPE n. 297, from 28-5-2004.; industrial segment, class 10.
Regarding the fuels forecast, the determination of the future price of both fuels is not accurate, mainly due to a lot of uncertainties involving the domestic and international markets that affect direct or indirectly the fuels price.

(ii) Total investment necessary to the conversion of the boilers: R$ 863,135

(iii) Combustion efficiency of different fuels in the element process

- *Fuel oil:* 90.0%
- *Natural gas:* 90.0%
  Source: Equipment Supplier - Aalborg-industries

(iv) Lifetime of the project, which is equal to the remaining lifetime of the existing heat generation facility: 18 years

Besides, for calculation of the NPV indicator, the following assumptions have to be made:

- Average nominal Brazil's basic interest rate in 2005: 18.0% per year (source: www.bacen.gov.br)
- Inflation: Based on the Extended National Consumer Price Index (IPCA) in 2005: 5.7% per year (source: www.ibge.gov.br)

Alternative 1 – Fuel Oil boilers

NPV: R$ (70,114,844)
Period: 2006 (2º semester) – 2024 (1º semester)
Real Interest rate: 12.3%

Alternative 4 – Natural Gas boilers

NPV: R$ (74,082,429)
Period: 2006 (2º semester) – 2024 (1º semester)
Real Interest rate: 12.3%

A sensitivity analysis of the costs NPV was conducted when the Brazilian real interest rate and natural gas price are altered. These parameters were selected due to the strong influence on the project attractiveness.

As can be seen in Table 3 and Table 4, the alternative 1 (fuel oil boilers) remains the most cost effective even in the case where these parameters change in favor of the alternative 4 (natural gas boilers).

Table 3 – NPV Sensibility Analysis

Interest Rate	Costs NPV	Costs NPV
	Fuel Oil	Natural Gas
14% (2% Up)	(62,114,644)	(65,697,270)
13% (1% Up)	(65,920,740)	(69,686,827)
12%	(70,114,844)	(74,082,429)
11% (1% Down)	(74,748,783)	(78,938,295)
10% (2% Down)	(79,882,620)	(84,317,258)

Table 4 – NPV Sensibility Analysis

Natural Gas Price Reduction	Costs NPV	Costs NPV
	Fuel Oil	Natural Gas
0.50%	(70,114,844)	(73,717,547)
1.00%	(70,114,844)	(73,356,277)
1.50%	(70,114,844)	(72,998,567)
2.00%	(70,114,844)	(72,644,364)
2.50%	(70,114,844)	(72,293,616)
3.00%	(70,114,844)	(71,946,274)

Therefore, comparing the costs NPV of the two alternatives above, the most cost effective scenario is the alternative 1- fuel oil boilers -, which presents the highest NPV. Then, the alternative 1 remains the baseline scenario as this would be the scenario in the absence of the project activity.

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):

In this section it is provide the demonstration of the additionality of the Project based on the consolidated baseline methodology ACM0009.

Step 1. Investment and Sensitivity Analysis

- **Alternative 1 – Fuel oil boilers**

This is the original situation at the site, used as the reference scenario in the cash flow analysis of the costs of the fuel.

- **Alternative 4 – Natural gas Boilers**

Table 4- Economical Analysis without CDM Revenues

Period (2006-2024)	Investment	NPV
Years	R$	R$
18	863,135	(3,965,474)

Table 5 - Economical Analysis with CDM Revenues

Period (2006-2024)	Investment	CDM Revenues	NPV
Years	R$	R$	R$
18	863,135	5,005,194.99	(1,479,036)

A sensitivity analysis of the NPV was conducted when the Brazilian basic interest rate is altered. This parameter was selected because it the most likely to fluctuate over time and the most influent in project attractiveness. As it can be seen, the project NPV remains lower (negative) than its alternative even in the case where this parameter changes in favor of the project.

Table 6 - Sensibility Analysis

Interest Rate	NPV With CDM	NPV Without CDM
14.3%	(1,324,983)	(3,582,626)
13.3%	(1,397,432)	(3,766,087)
12.3%	(1,479,036)	(3,965,474)
11.3%	(1,574,095)	(4,189,512)
10.3%	(1,681,931)	(4,434,638)

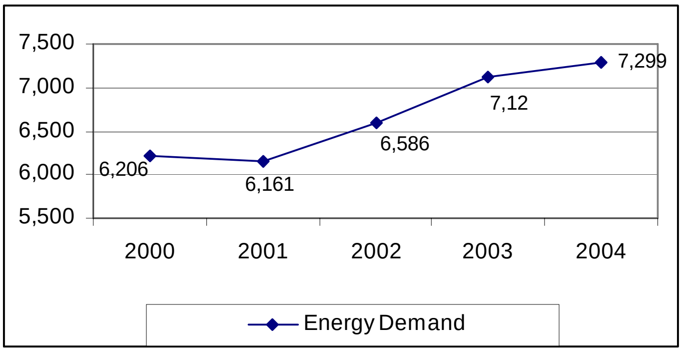
From the both analysis of the results one concludes that:
Alternative 4 has a negative NPV with and without the CERs. It shows that the impact of the CDM revenues is important for the project to be chosen, as it reduces the financial loss. Therefore, as the NPV of the Alternative 4 without the CERs is negative, the project is additional.

Step 2. Common Practice Analysis
Traditionally, natural gas has played a minor role in Brazilian energy system. Until 1995, gas production, imports and transportation was a Petrobras monopoly and domestic reserves were relatively small. In 1997, the liberalization of the Brazilian energy market started the opening of the natural gas market to the private capital.

The natural gas demand has been presented an increasing trend in Brazil. The demand passed from 4.2 billion m^3 in 1990 to 7.7 billion m^3 in 1999, involving a cumulated annual rising of 7%. Since the interconnection with Bolivia, the annual consume enlarged 25.1% until arrive at 15.1 billion m^3 in 2002.

Graph 1 presents the evolution of the total final consumption of energy (electricity and fuels) in the pulp and paper sector for the past five years.

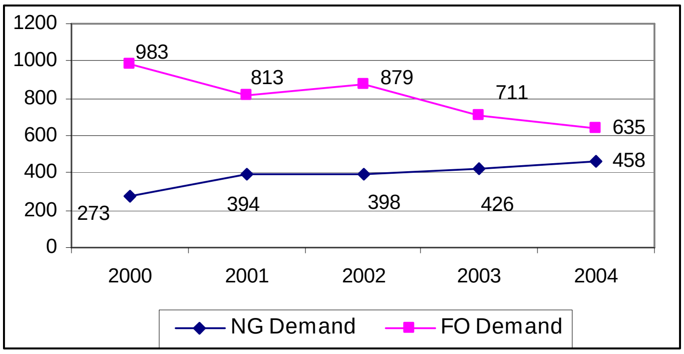
Graph 1 - Total energy demand evolution in the pulp and paper sector (in 1000 toe)



Source: BEN – Balanço Energético Nacional (2005)

Graph 2 shows the evolution of the demand of natural gas and fuel oil considering the same period.

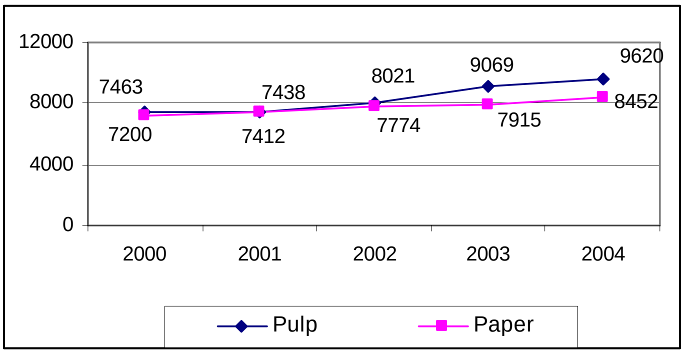
Graph 2 - Natural gas and fuel oil demand in the pulp and paper industry (in 1000 toe)



Source: BEN – Balanço Energético Nacional (2005)

Graph 3 shows the evolution of the production of pulp and paper for the same period (2000 – 2004).

Graph 3 - Pulp and Paper Production (in 1,000 tones)

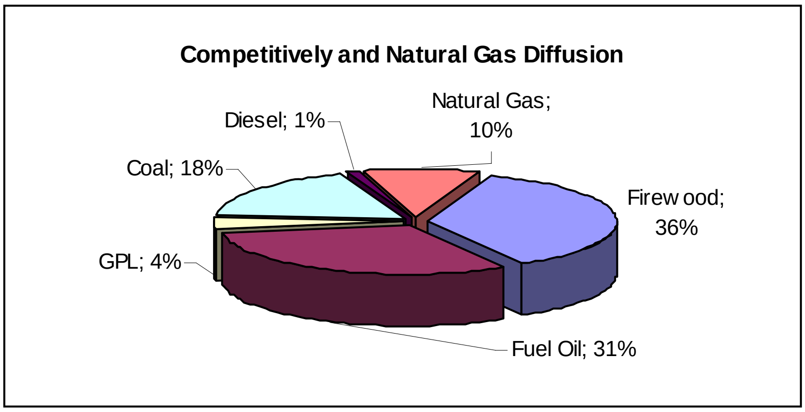


Source: BEN – Balanço Energético Nacional (2005)

As the previous graphs indicate there was an increase in the absolute demand of natural gas in the sector and a corresponding decrease in fuel oil demand between the years 2000 and 2004. The increase of demand of natural gas can be associated to the reform of the oil and gas sectors.

However, the use of natural gas on industry represents only 10% of the total market (**Graph 4**). The most common practice has already been the use of fuel oil. In relation to the gas selling, the paper industry represents only 11.3% of the total selling, according to the most recent data available at Comgás' website (**Graph 5**). So, currently, the use of the natural gas in the industry segment is not the common practice in Brazil.

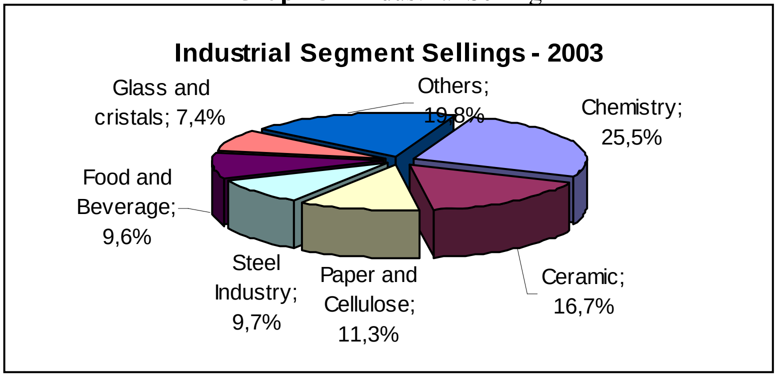
Graph 4 – Natural Gas Diffusion



Source: CSPE - 2005[5]

[5] http://www.cspe.sp.gov.br/downloads/secoes/gas_audiencia/01-2005/Etapa-I/DocumentacaoGeral/ResumoExecutivoPlanoNegocios.pdf

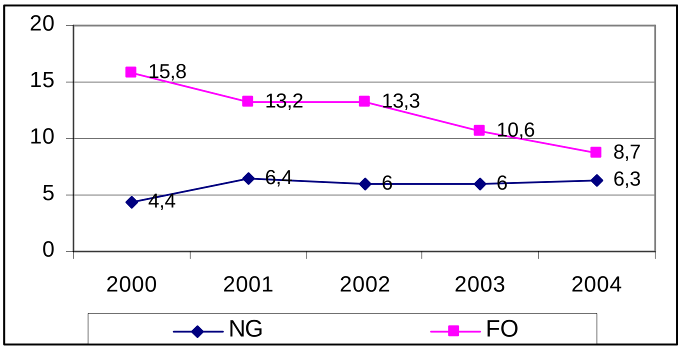
Graph 5 – Industrial Selling



Source: Comgás - 2003[6]

Furthermore, the trend in natural gas demand has been maintained flat since 2001, which can be associated to the high uncertainty regarding natural gas market development in the country, mainly derived from the existing barriers to its diffusion. **Graph 6** presents the relative demand of natural gas and fuel oil related with pulp and paper sector.

Graph 6 - Relative Demand of Fuel Oil and Natural Gas in Pulp and Paper Industry (in % toe)



Source: BEN – Balanço Energético Nacional (2005)

According to a reported published by ANP[7] (National Petroleum Agency), a Brazilian regulatory entity for petroleum and natural gas, the most important barriers for the diffusion of natural gas on Brazilian markets are associated with its interface with the oil fuels and power industries. The report listed four types of barriers:

1. **Transport and Distribution Segments**: Significant dependence of the Petrobras' strategies
The expansion of the use of the natural gas in Brazil basically depends on the infrastructure of transport and distribution. However, this infrastructure is underdeveloped and also lack of perspectives of future investments. Petrobras, the state owned federal company, had historically monopoly rights for oil and gas production, imports and transportation in Brazil. Even after the process of reform, the company has still been the greatest operator of the sector. In its strategic decisions the company seeks to preserve its

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[6] http://www.comgas.com.br/templates/gempresas_industria_cenergetico.aspx?page=594&idiom=1
[7] Agência Nacional do Petróleo – ANP. Estudo para Elaboração de Modelo de desenvolvimento da indústria de Gás Natural Brasileira (ANP, 2005). Available on www.anp.gov.br.

markets, jeopardizing the development of other players and companies and the establishment of a real free market.

The company has a dominant position on the segment of gas transport, but also on the activities of distribution for the gas produced domestically and the imported gas. In relation to the transport segment, Petrobras is responsible for the main projects of expansion of the pipelines. The expansion of the transport network by Petrobras wouldn't be enough for natural gas diffusion in Brazil. Furthermore, the existence of conflict with access to the Gasbol (Bolivian-Brazilian natural gas pipeline) evidences its inefficient use, which operates with idler capacity.

In relation to the distribution segment, currently the network is insufficient, with exception of CEG (Gas company of the State of Rio de Janeiro), that has covered all the metropolitan region of Rio de Janeiro. The other companies do not attend the half of the number of municipalities within in its areas of concession.

2. Low competitively of the natural gas prices comparatively to other energetic fuels prices:
According to the ANP's report, the price of the gas is the most important variable for introduce it in the industrial segment. Considering this segment, the reduced price of fuel oil, in especial of the heaviest oils, may represent a barrier to the introduction of natural gas. Besides, the existence of taxes applied successively to the several stages of the natural gas chain in addition to the different taxes applied in the different States where the natural gas pipeline goes through, represents another problem to the market

In the specifically case of MD Papéis, the industry is located on the State of São Paulo, which is mainly supplied by imported gas from Bolivia. It must be considered the actual problems in Bolivia that may result in increasing of the uncertainty in relation to the maintenance of the gas supply, generating future higher prices of natural gas on this City gate. It would reduce even more the competitively of the natural gas.

3. Regulatory and Institutional Uncertainties
The gas regulation is divided between federal and state level authorities. Oil and both production and transportation of gas to the city gates are regulated by a federal regulatory agency (ANP) created in 1997 while gas distribution is regulated at state level by regulatory agencies that most often take on board the regulation of other public services (water and sewage, and public transportation). There are limits and gaps in the regulatory framework established by Law 9,478/97 and other related legislation that uncertainties in the responsibilities and possibilities of the regulatory agency (ANP) to regulate the market. Examples given by ANP were the lack of definition about free access to the grid to other companies. Furthermore, there is a lack of clearly division of competencies between the Federal regulatory agency (ANP) and the State regulatory agencies. This increase the so-called regulatory risks of the natural gas market in Brazil, in which create an uncertainly environment to the agents' behavior and its investment decision.

Step 3. Impact of CDM Registration
All of these aspects above identified created a scenario in 2006 in which the development of a solid and secure natural gas market have been perceived with caution by MD Papéis. The choice for natural gas implied important changes and additional costs for the company, besides facing an uncertain scenario regarding natural gas markets and prices definition. These changes represented barriers for the project to happen in the absence of the incentives of the CDM. It was demonstrated in step 1 – Investment Analysis that the use of natural gas represents a negative NPV with and without the CERs., but the CERs reduce the financial loss. It was demonstrated in step 2, that the use of natural gas in industrial segment, particularly in paper and cellulose industry, is not a common practice. Then, the proposed project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The calculation of both baseline emission and leakage is done for each element process of the project according to the approved consolidate methodology ACM0009:

Project emissions

Project emissions (PE_y) include CO_2 emissions from the combustion of natural gas in all element processes *i*. Project emissions are calculated based on the quantity of natural gas combusted in all element processes *i* and respective net calorific values and CO_2 emission factors for natural gas ($EF_{NG,CO2}$), as follows:

$$PE_y = FF_{project,y} \cdot NCV_{NG,y} \cdot EF_{NG,CO2,y} \quad (1)$$

with

$$FF_{project,y} = \sum_i FF_{project,i,y} \quad (2)$$

where:

PE_y	Project emissions during the year y in t CO_2e
$FF_{project,y}$	Quantity of natural gas combusted in all element processes during the year *y* in m³
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process *i* during the year *y* in m³
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year *y* in MWh/m³
$EF_{NG,CO2,y}$	CO_2 emission factor of the natural gas combusted in all element processes in the year y in t CO_2/MWh

For the determination of emission factors and net calorific values, guidance by the 2000 IPCC Good Practice Guidance should be followed where appropriate.

Baseline emissions

Baseline emissions (BE_y) include CO_2 emissions from the combustion of the quantity of oil that would in the absence of the project activity be used in all element processes i. Baseline emissions are calculated based on the quantity of oil that would be combusted in each element processes i in the absence of the project activity and respective net calorific values and CO_2 emission factors. The quantity of oil that would be used in the absence of the project activity in an element process i ($FF_{baseline,i,y}$) is calculated based on the actual monitored quantity of natural gas combusted in this element process ($FF_{project,i,y}$) and the relation of the energy efficiencies and the net calorific values between the project scenario (use of natural gas) and the baseline scenario (use of oil).

$$BE_{y,ff} = \sum_i FF_{baseline,i,y} * NCV_{FF,i} * EF_{FF,CO2,i} \quad (3)$$

with

$$FF_{baseline,i,y} = FF_{project,i,y} * \frac{NCV_{NG,y} * \varepsilon_{project,i}}{NCV_{FF,i} * \varepsilon_{baseline,i,y}} \quad (4)$$

Where:

$BE_{y,ff}$	Baseline emissions during the year y in t CO_2e
$FF_{baseline,i,y}$	Quantity of fossil fuels that would be combusted in the absence of the project activity in the element process[8] i during the year y in a volume or mass unit
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y in m³
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year y in MWh/m³
$NCV_{FF,i}$	Average net calorific value of the oil that would be combusted in the absence of the project activity in the element process i during the year y in MWh per volume or mass unit
$EF_{FF,CO2,i}$	CO_2 emission factor of the oil type that would be combusted in the absence of the project activity in the element process i in t CO_2/MWh
$\varepsilon_{project,i,y}$	Energy efficiency of the element process i if fired with natural gas
$\varepsilon_{baseline,i}$	Energy efficiency of the element process i if fired with other fossil fuels respectively

For the determination of emission factors and net calorific values, guidance by the 2000 IPCC Good Practice Guidance was followed. IPCC default emission factors (country-specific, if available) were used if they manner (i.e. lower values should be chosen within a plausible range).

For MD Papéis's project activity, the efficiency of the element process does not change due to the fuel switch, so it is assumed $\varepsilon_{project,i} = \varepsilon_{baseline,i}$ as a simplification.

Leakage
Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered:

• Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.

Thus, leakage emissions are calculated as follows:

$$LE_y = LE_{CH4,y} + LE_{LNG,CO2,y} \qquad (5)$$

Where

LE_y	Leakage emissions during the year y in t CO_2e
$LE_{CH4,y}$	Leakage emissions due to fugitive upstream CH_4 emissions in the year y in t CO_2e

[8] An "*element process*" is defined as fuel combustion in a single equipment at one point of an industrial facility or of a district heating system, for the purpose of providing thermal energy (the fuel is not combusted for the purpose of electricity generation or used as oxidant in chemical reactions or otherwise used as feedstock). For each element process, energy efficiency is defined as the ratio between the useful energy (the enthalpy of the steam/water/gas multiplied with the steam/water/gas quantity) and the supplied energy to the element process (the net calorific values of the fuel multiplied with the fuel quantity).

$LE_{LNG,CO2,y}$	Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in t CO_2e

LNG is not used in the project plant, so $LE_{LNG,CO2,y}$ is not considered.

Fugitive methane emissions

For the purpose of determining fugitive methane emissions associated with the production – and in case of natural gas, the transportation and distribution of the fuels – project participants should multiply the quantity of natural gas consumed in all element processes *i* with a methane emission factor for these upstream emissions ($EF_{NG,upstream,CH4}$), and subtract for all fuel types *k* which would be used in the absence of the project activity the fuel quantities multiplied with respective methane emission factors ($EF_{k,upstream,CH4}$), as follows:

$$LE_{CH4,y} = \left[FF_{project,y} . NCV_{NG,y} . EF_{NG,upstream,CH4} - \sum_k FF_{baseline,k,y} . NCV_k . EF_{k,upstream,CH4} \right] . GWP_{CH4} \quad (6)$$

with

$$FF_{project,y} = \sum_i FF_{project,i,y} \text{ and} \quad (7)$$

$$FF_{baseline,k,y} = \sum_i FF_{baseline,i,k,y} \quad (8)$$

where

$L_{CH4,y}$	Leakage emissions due to upstream fugitive CH4 emissions in the year y in t CO_2e
$FF_{project,y}$	Quantity of natural gas combusted in all element processes during the year *y* in m³
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process *i* during the year *y* in m³
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year *y* in MWh/m³
$EF_{NG,upstream,CH4}$	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of natural gas in t CH_4 per MWh fuel supplied to final consumers
$FF_{baseline,k,y}$	Quantity of fuel type *k* (oil) that would be combusted in the absence of the project activity in all element processes during the year *y* in a volume or mass unit
$FF_{baseline,i,k,y}$	Quantity of fuel type *k* (oil) that would be combusted in the absence of the project activity in the element process *i* during the year *y* in a volume or mass unit
NCV_k	Average net calorific value of the fuel type *k* (oil) that would be combusted in the absence of the project activity during the year *y* in MWh per volume or mass unit
$EF_{k,upstream,CH4}$	Emission factor for upstream fugitive methane emissions from production of the fuel type k (oil) in t CH_4 per MWh fuel produced
GWP_{CH4}	Global warming potential of methane valid for the relevant commitment period

Where reliable and accurate national data on fugitive CH_4 emissions associated with the production, and in case of natural gas, the transportation and distribution of the fuels is available, project participants should use this data to determine average emission factors by dividing the total quantity of CH_4 emissions by the quantity of fuel produced or supplied respectively[9]. Where such data is not available, project

[9] GHG inventory data reported to the UNFCCC as part of national communications can be used where country-specific approaches (and not IPCC Tier 1 default values) have been used to estimate emissions.

participants may use the default values provided in **Table 7**. In this case, the natural gas emission factor for the location of the project should be used, except in cases where it can be shown that the relevant system element (gas production and/or processing/transmission/distribution) is predominantly of recent vintage and built and operated to international standards, in which case the US/Canada values may be used.

Note that the emission factor for fugitive upstream emissions for natural gas ($EF_{NG,upstream,CH4}$) should include fugitive emissions from production, processing, transport and distribution of natural gas, as indicated in the **Table 7**.

Table 7 - Default emission factors for fugitive CH_4 upstream emissions

Activity	**Unit**	**Default emission factor**	Reference for the underlying emission factor range in Volume 3 of the *1996 Revised IPCC Guidelines*
Oil			
Production	t CH_4 / PJ	2.5	Tables 1-60 to 1-64, p. 1.129 - 1.131
Transport, refining and storage	t CH_4 / PJ	1.6	Tables 1-60 to 1-64, p. 1.129 - 1.131
Total	t CH_4 / PJ	4.1	
Natural gas			
Other oil exporting countries / Rest of world			
Production	t CH_4 / PJ	68	Table 1-63 and 1-64, p. 1.130 and 1.131
Processing, transport and distribution	t CH_4 / PJ	228	Table 1-63 and 1-64, p. 1.130 and 1.131
Total	t CH_4 / PJ	296	
Note: The emission factors in this table have been derived from IPCC default Tier 1 emission factors provided in Volume 3 of the 1996 Revised IPCC Guidelines, by calculating the average of the provided default emission factor range.			

Table 8 presents the data that should be monitored for baseline emissions calculation:

Table 8 - Parameters to be monitored for calculation of baseline emissions

ID	Data variable	Source of data	Data unit	Recording frequency
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y	Excel workbook for calculation of total natural gas consumed.	m³	Continuously
$\varepsilon_{project,i,y}$	Average fuel efficiency of natural gas used at the process *i in year y*		%	Annually
$NCV_{NG,y}$	Average net calorific value of natural gas in year y	Default values according to IPCC Good Practice Guidance	MWh/m^3	Annually
$EF_{NG,CO2,y}$	Average CO_2 emission factor of the natural gas combusted in year y	Default values according to IPCC Good Practice Guidance	tCO_2/MWh	Annually

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

According to ACM0009, monitoring of parameters for calculating leakage is not needed. The tables below include all the data and parameters that are not monitored throughout the crediting period but are determined only once and thus remain fixed throughout the crediting and that are available when validation is undertaken.

The emission factor for fugitive upstream emissions for natural gas ($EF_{NG,upstream,CH4}$) should include fugitive emissions from production, processing, transport and distribution of natural gas. Tables below present the default emission factors for fugitive CH_4 upstream emissions

Data / Parameter:	Oil Production
Data unit:	t CH_4 / PJ
Description:	Emission factor range
Source of data used:	Volume 3 of the *1996 Revised IPCC Guidelines* Tables 1-60 to 1-64, p. 1.129 - 1.131
Value applied:	2.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Oil Transport, refining and storage
Data unit:	t CH_4 / PJ
Description:	Emission factor range
Source of data used:	Volume 3 of the *1996 Revised IPCC Guidelines* Tables 1-60 to 1-64, p. 1.129 - 1.131
Value applied:	1.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Natural gas Production
Data unit:	t CH_4 / PJ
Description:	Emission factor range
Source of data used:	Volume 3 of the *1996 Revised IPCC Guidelines* Tables 1-60 to 1-64, 1.130 and 1.131
Value applied:	68
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Natural Gas Processing, transport and distribution
Data unit:	t CH_4 / PJ

Description:	Emission factor range
Source of data used:	Volume 3 of the *1996 Revised IPCC Guidelines* Tables 1-60 to 1-64, 1.130 and 1.131
Value applied:	228
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Note: The emission factors in these tables below have been derived from IPCC default Tier 1 emission factors provided in Volume 3 of the 1996 Revised IPCC Guidelines, by calculating the average of the provided default emission factor range.

B.6.3 Ex-ante calculation of emission reductions:

Project emissions (PE_y) include CO_2 emissions from the combustion of natural gas in all element processes *i*. Project emissions are calculated based on the quantity of natural gas combusted in all element processes *i* and respective net calorific values and CO_2 emission factors for natural gas ($EF_{NG,CO2}$). Annual project emissions *PE* during each year of the selected crediting period is calculated as:

$$PE_y = FF_{project,y} \,.\, NCV_{NG,y} \,.\, EF_{NG,CO2,y}$$

Where

According to the *2000 IPCC Good Practice Guidance*, emission factor can be either provided by the fuel supplier or it can be a default value. Since the natural gas emission factor value was not provided by the supplier, default emission factor of the natural gas was taken from Volume 3 of the *1996 Revised IPCC Guidelines*:

$EF_{NG,,CO2,y}$ = 15.3 tC / TJ = 56.1 tCO_2 / TJ

Net Calorific Value of the natural gas was provided by MD Papéis and the future natural gas supplier (Comgás):

NCV_{NG} = 9,065 kcal / m^3

Quantity of natural gas to be combusted in the element process during a typical year was informed by MD Papéis:

$FF_{project,y}$ = 17,926,751 m^3/year

Year	Estimation of project (tonnes of CO2 e)
Beginning in 01/03/07	31,807.77
2008	38,169
2009	38,169
2010	38,169
2011	38,169
2012	38,169
2013	38,169
2014	38,169
2015	38,169
2016	38,169
Ending in 28/02/2017	6,361.55
Total (tonnes of CO_2e)	381,693

Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. The following leakage emission sources shall be considered:

• Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.

Thus, leakage emissions are calculated as follows:

$$LE_{CH4,y} = \left[FF_{project,y}.NCV_{NG,y}.EF_{NG,upstream,CH4} - \sum_{k} FF_{baseline,k,y}.NCV_{k}.EF_{k,upstream,CH4} \right].GWP_{CH4}$$

where

Default emission factors of the fuels utilized in the baseline and project scenarios were taken from Volume 3 of the *1996 Revised IPCC Guidelines*:
$EF_{NG,upstream,CH4}$ = 296 tCH_4 / PJ
$EF_{oil,upstream,CH4}$ = 4.1 tCH_4 / PJ

Net Calorific Value of the fuels utilized in the baseline and project scenarios were provided by MD Papéis and the future natural gas supplier (Comgás):
NCV_{NG} = 9,065 kcal / m^3
NCV_{oil} = 9,650 kcal / kg

Year	Estimation of leakage (tonnes of CO2 e)
Beginning in 01/03/07	3,475.55
2008	4,171
2009	4,171
2010	4,171
2011	4,171
2012	4,171
2013	4,171
2014	4,171
2015	4,171
2016	4,171
Ending in 28/02/2017	695.11
Total (tonnes of CO_2e)	41,707

Baseline emissions (BE_y) include CO_2 emissions from the combustion of the quantity of oil that would in the absence of the project activity be used in all element processes i. Baseline emissions are calculated based on the quantity of oil that would be combusted in each element processes i in the absence of the project activity and respective net calorific values and CO_2 emission factors. The quantity of oil that would be used in the absence of the project activity in an element process i ($FF_{baseline,i,y}$) is calculated based on the actual monitored quantity of natural gas combusted in this element process ($FF_{project,i,y}$) and the relation of the energy efficiencies and the net calorific values between the project scenario (use of natural gas) and the baseline scenario (use of oil).

$$BE_{y,ff} = \sum_i FF_{baseline,i,y} * NCV_{FF,i} * EF_{FF,CO2,i}$$

with

$$FF_{baseline,i,y} = FF_{project,i,y} * \frac{NCV_{NG,y} * \varepsilon_{project,i}}{NCV_{oil,i} * \varepsilon_{baseline,i,y}}$$

Where:

Net Calorific Value of the fuels utilized in the baseline and project scenarios were provided by MD Papéis and the future natural gas supplier (Comgás):
NCV_{NG} = 9,065 kcal / Nm^3
NCV_{oil} = 9,650 kcal / kg

Default emission factor of the fuel oil was taken from Volume 3 of the *1996 Revised IPCC Guidelines*:
$EF_{FF,CO2,i}$ = 21.1 tC / TJ = 77.37 tCO_2 / TJ

Efficiency values of the fuels utilized in the baseline and project scenarios were provided by the Equiment Supplier of MD Papéis:

$\varepsilon_{project,i,y}$ = 90.0%
$\varepsilon_{baseline,i}$ = 90.0%

Estimated annual emission reductions ER_y are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$
$$= 52{,}639 - 38{,}169 - 4{,}171$$
$$= \mathbf{10{,}299\ tCO_2e}$$

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

Year	Estimation of project activity emissions (tonnes of CO2 e)	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of emission reductions (tonnes of CO2 e)
Beginning in 01/03/07	43,865.62	31,807.77	3,475.55	8,582.30
2008	38,169	52,639	4,171	10,298.76
2009	38,169	52,639	4,171	10,298.76
2010	38,169	52,639	4,171	10,298.76
2011	38,169	52,639	4,171	10,298.76
2012	38,169	52,639	4,171	10,298.76
2013	38,169	52,639	4,171	10,298.76
2014	38,169	52,639	4,171	10,298.76
2015	38,169	52,639	4,171	10,298.76
2016	38,169	52,639	4,171	10,298.76
Ending in 28/02/2017	8,773.12	6,361.55	695.11	1,716.46
Total (tonnes of CO_2e)	381,693	526,387	41,707	102,987.55

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$FF_{project,i,y}$
Data unit:	m^3
Description:	Natural gas consumed in process element i in year y
Source of data to be used:	Field instrument
Value of data applied for the purpose of calculating expected emission reductions in section B.5	17,926,751 m^3/year
Description of measurement methods and procedures to be	The data will be 100% monthly monitored and archived on electronic paper

applied:	
QA/QC procedures to be applied:	
Any comment:	Purchasing receipts from the supplier could be used to evidence FF

Data / Parameter:	$\varepsilon_{project,i,}$
Data unit:	%
Description:	Fuel efficiency of natural gas used at the process i
Source of data to be used:	Field instrument
Value of data applied for the purpose of calculating expected emission reductions in section B.5	90%
Description of measurement methods and procedures to be applied:	The data will be measured monthly and archived on electronic paper
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\varepsilon_{project,i,y}$
Data unit:	%
Description:	Average Fuel efficiency of natural gas used at the process i in year y
Source of data to be used:	Field instrument
Value of data applied for the purpose of calculating expected emission reductions in section B.5	90%
Description of measurement methods and procedures to be applied:	The data will be calculated annually from 12 months and archived on electronic paper
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$NCV_{NG,y}$
Data unit:	MWh/m^3
Description:	Net calorific value of natural gas in year y
Source of data to be used:	Provided by local natural gas supplier - Comgás
Value of data applied for the purpose of	0.01054 $MWh/\ m^3$ (9,065 kcal / m^3)

calculating expected emission reductions in section B.5	Conversion factor 1Kcal = $1.163*10^{-6}$ MWh
Description of measurement methods and procedures to be applied:	The data will be supplied monthly by Comgás, 100% monitored and archived on electronic paper
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$EF_{NG,CO2}$
Data unit:	tCO_2/MWh
Description:	Average CO_2 emission factor of the natural gas combusted in the year y
Source of data to be used:	IPCC Good Practice Guidance
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.278tCO_2/MWh (77.37 tCO_2 / TJ) Conversion Factor – 1 GJ = 0.2777778MWh
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	Default values according to IPCC Good Practice Guidance

Data / Parameter:	$NCV_{NG,y}$
Data unit:	MWh/m^3
Description:	Average net calorific value of natural gas in year y
Source of data to be used:	Calculated from data provided monthly by local natural gas supplier - Comgás
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.01054 MWh/ m^3 (9,065 kcal / m^3)
Description of measurement methods and procedures to be applied:	The data will be calculated annually by MD Papéis, 100% monitored and archived on electronic paper
QA/QC procedures to be applied:	
Any comment:	

All the monitoring data will be archived during and at least two years after the crediting period. All data will be managed according with MD Papéis's ISO9001:2000 procedures.

B.7.2 Description of the monitoring plan:

The global monitoring process will be put under the responsibility of the Utilities Manager. The details of the operational and management structure for monitoring purposes can be found in the Monitoring Plan in Annex 4.

1/ Data collection
The Utilities Technician is in charge of all data collection activities

2/ Data processing, validation, adjustment, and recording
The Utilities Engineer is in charge of programming all formulae in the spreadsheets which are used. The Utilities Technician processes the data, checks the data for consistency, validates them, and records them every day as an electronic file. In case of failure of an instrument, or non-consistency of the data, he adjusts the data according to a procedure that will be written during the project implementation. In case the failure is not covered by the procedure, the Utilities Manager makes the decision to correct the figures or to abandon the data.

3/ Data archiving
The Utilities Engineer is responsible for archiving the data. Once validated, the data are input in an electronic folder and protected against any modification. A backup of all the data is made every day on the plant server. Both original document and the backup file are kept for two years after the end of the crediting period.

4/ Calculation of Emission Reductions
The calculation of the Emission Reductions is done monthly by the Utilities Engineer, based on the monthly data, and validated by the Utilities Manager.
A quarterly and yearly summary are also calculated based on the monthly results.
The Utilities Manager is responsible for the declaration of the Emission Reductions, at a frequency to be fixed later in the project implementation.

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)

Date of completing the final draft of this baseline section (*DD/MM/YYYY*):
06/11/2006

Alberto O. Lupetti / MD Papéis.
Tel.: +55 11 44417821
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and

with the expertise of Augusto Mello, Christianne Maroun and Leticia Roxo from ICF International (not a project participant).

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/08/2006

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

18 years

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

C.2.1. Renewable crediting period

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

Not selected.

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/03/07 (right after Registration)

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

MD Papéis plant is in operation since 1890 and it is located in an industrial area of Caieiras. The company already has an Operational License (L.O. 29002527) valid until 26/12/2007.

There's no significant negative impact due to the implementation of the project. In fact, there are many positive impacts, such as, its contribution to greenhouse gas emissions mitigation as natural gas is less carbon intensive than other fossil fuels, such as fuel oil; the fact that it is safer to deal with natural gas than fuel oil, in terms of transportation and storage (natural gas uses pipelines instead of trucks and there's no need to store natural gas in tanks, so it also minimize the risks of accidents and soil/water contamination); and the creation of direct and indirect new jobs during conversion and operation of the equipments.

According to a preliminary consultation to the Environmental Agency of São Paulo State (CETESB), CETESB won't oppose to the proposed fuel switching project. A formal licensing process according to Brazilian regulations will be carried out in due time.

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

The environmental licensing process, in which the Environmental Agency of São Paulo State (CETESB) requests the necessary environmental studies, is still being conducted, according to the project timeframe and the Brazilian regulation.

Considering the very low potential of the project environmental impacts and also its highly positive potential environmental impacts, it is unlikely that the Environmental Agency of São Paulo State (CETESB) will require an environmental impact assessment (EIA) for this project.

SECTION E. Stakeholders' comments

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

MD Papéis has decided to visit local stakeholders in order to present and to explain the Fuel Switch project of Caieiras plant. During the visits, MD Papéis technicians and the stakeholders were able to discuss the advantages, perceptions and the environmental and social benefits of the implementation of the new project.

This way, first step of the invitation process was to develop a list of stakeholders. The starting point for this task was the Resolution #1, issued by the Brazilian Designated National Authority – ***Comissão Interministerial de Mudança Global do Clima (CIMGC)***, which establishes a minimum list of stakeholders to be invited. The following stakeholders were included on the mentioned list:

- Caieiras City Hall;
- Caieiras Chamber of Council;

- Environmental Agency of the State of São Paulo (CETESB);
- Environmental Agency of the Municipality of Caieiras;
- Brazilian Forum of NGOs (FBOMS);
- Community Associations:
- Public Attorney for São Paulo State Diffuse Matters (Ministério Público);

Due to the diversity of the stakeholders and different levels of knowledge of each stakeholder, MD Papéis' strategy was to develop a basic model of the invitation and a brief presentation about Climate Change, Clean Development Mechanism and the Fuel Switch project of Caieiras.

Consequently, with this material, MD Papéis technicians visited stakeholders and were able to adjust the approach and language for each stakeholder based on their knowledge. This strategy aims to guarantee that all of the stakeholders have enough information to provide comments.

Some of the mentioned stakeholders were contacted through official channels either using registered mail or certified, due to some official regulations and internal procedures of some agencies and institutions. In these cases, the information related to the project was sent attached to the invitation model.

E.2. Summary of the comments received:

The following table (**Table 9**) summarizes all the stakeholders consultation processes including comments received until the present date.

Table 9- Stakeholders consultation processes

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Stakeholder	Sector/category	Strategy	Contact inf.	Observations	Position
Caieiras City Hall	Governmental/ City	Meeting with Mayor or an official representative. Project presentation, signature collection, invitation letter for comments delivery	Name : Névio Dártora Date of the contact: 19/07/06 Phone: 44427700	Registered	FAVORABLE TO THE PROJECT
Caieiras Chamber of Council	Governmental/ City	Meeting with an official representative of the Chamber. Project presentation, signature collection, invitation letter for comments delivery	Name:Milton Valbuza Date of the contact: 18/07/06	It was sent to the Chamber of Council (registered). MD will monitor the internal process of the Chamber.	NOT RECEIVED YET
State environmental agency (CETESB)	Governmental/ State	Delivering of the invitation letter for comments in annex to the request for environmental license information (first step of license process)		MD will monitor the discussion with Cetesb's São Paulo branch.	FAVORABLE TO THE PROJECT
Municipal environmental agency	Governmental/ City	Meeting with an official representative of the agency. Project presentation, signature collection, invitation letter for comments delivery	Name: Marcio M. Souza Date of the contact: 21/07/06 Phone: 44427018	Registered	FAVORABLE TO THE PROJECT
Brazilian Forum of NGOs - FBOMS	NOGs	Sending of the invitation letter for comments and draft PDD by registered mail	Name: Esther Neuhaus Address: SCS, Quadra 08, Bloco B-50 Venâncio 2000, Salas 133/135, CP-70333-900 Brasília - DF, BRASIL Phone: (61) 3033-5535 ou 3033-5545	Waiting for the PDD in order to send the comments	NOT RECEIVED YET
Community Associations	Local community	Meeting with Community Association representative. Project presentation, signature collection, invitation letter for comments delivery	Name: Paulo Rogério Rodrigues de Araujo Date of the contact: 20/07/06 Phone: 4605-5974	Meeting with the Community Association representative, Paulo Araújo	FAVORABLE TO THE PROJECT
Public Prosecution Service	Governmental/ State	Meeting with an official representative of the House. Project presentation, signature collection, invitation letter for comments delivery		The questionnarie has already sent	NOT RECEIVED YET

As no negative or technical comments have been received yet, no modifications on the project were done. Modifications on the project can be done, to satisfy at the same time the relevant observations from stakeholders and the validator as soon as these comments are received.

Model of the invitation of comments given to the stakeholders listed in the item E1.

SUA OPINIÃO É MUITO IMPORTANTE PARA NÓS. SEUS COMENTÁRIOS SERÃO ENCAMINHADOS PARA A ENTIDADE RESPONSÁVEL PELO PROJETO.

MD PAPÉIS

MAIS QUE PAPÉIS, SOLUÇÕES

A MD Papéis, preocupada com uma das principais questões ambientais da atualidade, relacionada ao tema Mudanças Climáticas, está avaliando a possibilidade de converter suas caldeiras, de óleo para gás natural. Entre outros benefícios, a conversão reduzirá os chamados gases de efeito estufa, responsáveis pelo aumento de temperatura no Mundo; gerará postos de trabalho, durante as fases de projeto e implantação; e reduzirá riscos de acidentes e contaminação, durante o transporte e o manuseio de óleo.

POR FAVOR, RESPONDA ÀS PERGUNTAS ABAIXO E FAÇA SEUS COMENTÁRIOS

1. Você acredita que o Projeto da MD Papéis, de Substituição de Combustível, com objetivo de Reduzir as Emissões de Gases de Efeito Estufa, contribui para o desenvolvimento sustentável do Brasil?

____

____

__Na sua opinião, o projeto contribui para a transferência de tecnologia para o Brasil?

____

____

__Haverá melhoria na situação sócio-ambiental da região, com a implantação do projeto?

____

____

__Que outros comentários e/ou críticas você tem a fazer?

____

____

__

Por favor, envie este folheto para o endereço abaixo. Obrigado.

NOME: ______________________________

ENTIDADE: ______________________________

TEL.: ______________________________

MD PAPÉIS

MAIS QUE PAPÉIS, SOLUÇÕES

Rodovia Presidente Tancredo de Almeida Neves, km34 – SP-332

Cep 07700-000 Caieiras – SP

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**MD Papéis**
Street/P.O.Box:	Rodovia Presidente Tancredo de Almeida Neves, km 34 – SP-332
Building:	
City:	Caieiras
State/Region:	São Paulo
Postfix/ZIP:	07700-000
Country:	Brazil
Telephone:	+55 11 4441 7800
FAX:	+55 11 4605 2195
E-Mail:	
URL:	
Represented by:	
Title:	Utilities Manager
Salutation:	Mr.
Last Name:	Lupetti
Middle Name:	Orignella
First Name:	Alberto
Department:	Utilities
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Direct FAX:	+33 1 53 56 61 10
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Personal E-Mail:	alberto@mdpapeis.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is used

Annex 3

BASELINE INFORMATION

The following table summarizes the parameters to be monitored for calculation of baseline emissions.

ID	Data variable	Source of data	Data unit	Recording frequency
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y	Excel workbook for calculation of total natural gas consumed.	m^3	Continuously
$\varepsilon_{project,i,y}$	Average fuel efficiency of natural gas used at the process i in year y	Excel workbook for calculation of fuel efficiency	%	Annually
$NCV_{NG,y}$	Average net calorific value of natural gas in year y	Default values according to IPCC Good Practice Guidance	MWh/m^3	Annually
$EF_{NG,CO2,\ y}$	Average CO_2 emission factor of the natural gas combusted in year y	Default values according to IPCC Good Practice Guidance	tCO_2 / MWh	Annually

Default emission factor of the natural gas was taken from Volume 3 of the *1996 Revised IPCC Guidelines*:

$EF_{NG,,CO2,y}$ = 15.3 tC / TJ = 56.1 tCO_2 / TJ

Net Calorific Value of the natural gas was provided by MD Papéis and the future natural gas supplier (Comgás):

NCV_{NG} = 0.01054 MWh/ m^3 (9,065 kcal / Nm^3)
Conversion factor 1untKcal = $1.163*10^{-6}$ MWh

Efficiency values of the fuels utilized in the baseline and project scenarios were provided by MD Papéis:

$\varepsilon_{project,i,y}$ = 90.0%
$\varepsilon_{baseline,i}$ = 90.0%

The volume of natural gas considered in the calculations is the volume necessary to meet the historic energy need of the plant (from 2005) – that used to be met by the diesel oil consumption in the baseline scenario – instead of the minimum volume of natural gas indicated in the contract

The detailed emission calculation, financial data and assumptions are presented in the following tables 1, 2 and 3:

1. Emission Calculations

Fuel	NCV				Carbon Emission Factor (CEF)		Total Fugitive CH4 Upstream
	kcal / kg	kJ / kg	kJ / m^3	kcal / Nm^3	t C / TJ	t CO_2 / TJ	t CH_4 / PJ
Fuel Oil (MD)	9,650	40,403			21.1	77.37	296.00
Natural Gas (MD)			37,953	9,065	15.3	56.10	4.10

kJ	kcal
1	0.2388
4.1868	1

	Volume	Mass	Energy	
Baseline	litres	kg	kcal	TJ
Fuel Oil		16,840,000	162,506,000,000	**680.38**
Project	m^3		kcal	TJ
Natural Gas	17,926,751		162,506,000,000	**680.38**
Efficiency				
Baseline	0.9			
Project	0.9			

	Baseline	*Project*	*Leakage*	*ER*
$FF_{project}$ (m^3)		17,926,751.24		
Emissions (tCO_2e)	**52,638.74**	**38,169.32**	**4,170.66**	**10,298.76**

	Baseline (tCO_2e)	*Project (tCO_2e)*	*Leakage (tCO_2e)*	*Emission Reduction (tCO_2e)*	
Beginning in 01/03/07	43,865.62	31,807.77	3,475.55	**8,582.30**	*Beginning in 01/03/07*
2008	52,638.74	38,169.32	4,170.66	**10,298.76**	*2008*
2009	52,638.74	38,169.32	4,170.66	**10,298.76**	*2009*
2010	52,638.74	38,169.32	4,170.66	**10,298.76**	*2010*
2011	52,638.74	38,169.32	4,170.66	**10,298.76**	*2011*
2012	52,638.74	38,169.32	4,170.66	**10,298.76**	*2012*
2013	52,638.74	38,169.32	4,170.66	**10,298.76**	*2013*
2014	52,638.74	38,169.32	4,170.66	**10,298.76**	*2014*
2015	52,638.74	38,169.32	4,170.66	**10,298.76**	*2015*
2016	52,638.74	38,169.32	4,170.66	**10,298.76**	*2016*
Ending in 28/02/2017	8,773.12	6,361.55	695.11	**1,716.46**	*2016*
				102,987.55	***10y***

2. Cash Flow without CERs

NGXFO	2006 (2 Sem)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 (1 sem)
Delta Investment																			
Investment Conversion	(581,107)	(282,029)																	
Additional Expense/savings																			
Savings with NG	(243,666)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(243,666)
Savings with O&M - NG	4,045	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	4,045
DELTA Depreciation Boiler (5.56% a.a)	(16,142)	(31,387)	(29,643)	(27,996)	(26,441)	(24,972)	(23,585)	(22,274)	(21,037)	(19,868)	(18,764)	(17,722)	(16,737)	(15,808)	(14,929)	(14,100)	(13,317)	(12,577)	(5,939)
DELTA Depreciation Boiler Stand By (5.88% a.a)	0	(16,590)	(15,614)	(14,696)	(13,831)	(13,018)	(12,252)	(11,531)	(10,853)	(10,214)	(9,614)	(9,048)	(8,516)	(8,015)	(7,543)	(7,100)	(6,682)	(6,289)	(2,960)
Profit	(255,763)	(527,219)	(524,500)	(521,934)	(519,515)	(517,232)	(515,079)	(513,048)	(511,132)	(509,325)	(507,620)	(506,012)	(504,496)	(503,065)	(501,715)	(500,442)	(499,241)	(498,108)	(248,520)
Cash Flow	(820,728)	(761,271)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(239,621)

3. Cash Flow with CERs

NGxFO	2006 (2 Sem)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024 (1 sem)
Investment Conversion	(581,107)	(282,029)																	
Savings with NG	(243,666)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(487,332)	(243,666)
Savings with O&M - NG	4,045	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	8,090	4,045
(5.56% a.a)	(16,142)	(31,387)	(29,643)	(27,996)	(26,441)	(24,972)	(23,585)	(22,274)	(21,037)	(19,868)	(18,764)	(17,722)	(16,737)	(15,808)	(14,929)	(14,100)	(13,317)	(12,577)	(5,939)
Stand By (5.88% a.a)	0	(16,590)	(15,614)	(14,696)	(13,831)	(13,018)	(12,252)	(11,531)	(10,853)	(10,214)	(9,614)	(9,048)	(8,516)	(8,015)	(7,543)	(7,100)	(6,682)	(6,289)	(2,960)
Profit	(255,763)	(527,219)	(524,500)	(521,934)	(519,515)	(517,232)	(515,079)	(513,048)	(511,132)	(509,325)	(507,620)	(506,012)	(504,496)	(503,065)	(501,715)	(500,442)	(499,241)	(498,108)	(248,520)
CDM Revenues	0	500,519	500,519	500,519	500,519	500,519	500,519	500,519	500,519	500,519	500,519	0	0	0	0	0	0	0	0
Cash Flow	(820,728)	(260,752)	21,277	21,277	21,277	21,277	21,277	21,277	21,277	21,277	21,277	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(479,242)	(239,621)

Annex 4

MONITORING INFORMATION

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from MD Papéis’ fuel switching project in Caieiras. The main components within the monitoring plan are:

1. Parameter to be monitored, and how the data will be collected;
2. The equipment to be used in order to carry out monitoring;
3. Operational procedures and quality assurance responsibilities.

If necessary, this MP can be updated and adjusted to meet operational requirements, provided that such modifications are approved by a Designated Operational Entity during the process of verification.

The Utilities Manager will be responsible for the activities related to implementation of the procedures.

1. Parameter to be monitored, and how the data will be collected
Parameters to be monitored, and how data will be collected are described in Section D above.

Continuously readings of all field meters will be registered in either electronic form or on paper worksheets. Data collected will be entered in electronic worksheets and stored.

CER quantity calculations will be carried out by the Utilities Engineer using a Microsoft Excel worksheet, and a hard copy backup of the data may be printed. Backup of the data electronically may be conducted on a weekly basis, and hard copy data may be printed weekly or monthly.

All data will be kept for the full crediting period, plus two years.

2. The equipment to be used in order to carry out monitoring
Production data will be used to monitor the fuel efficiency (natural gas consumption and steam production).

The most important equipment necessary to carry out monitoring is:

Flow meter – Metering the natural gas consumption at the plant

The amount of natural gas consumed will also be monitored from paid fuel-invoices.

All meters and sensors will be subject to regular maintenance and testing regime according to the technical specifications from the manufacturers to ensure accuracy and good performance.

Periodic controls of the field monitoring records will be carried out to check any deviation.

3. Operational procedures and quality assurance responsibilities.
As said before, the Utilities Manager will be responsible for the activities related to implementation of all procedures required to allow an accurate assessment of the reductions resulting from the project.

MD Papéis will as well conduct regular training and quality control programs to ensure that good management practices are ensured and implemented by all project operating personnel in terms of record-keeping, equipment calibration, overall maintenance, and procedures for corrective action. An operations manual will be developed for operating personnel. The procedures for filling data and calculations to be performed by the operator will be included in a daily log to be placed in the main control room.

Internal audits will be carried out and recommendations on system and procedures improvements will be presented. Periodic reports to evaluate performance and assist with performance management will be elaborated.

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