



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

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

Eliane Natural Gas fuel switch project
Version 4 – 27/02/2007

A.2. Description of the project activity:

Eliane is a porcelain industry, which operates in a wet milling system, where the clay is mixed with water and triturated by ceramic spheres of high density, resulting in a liquid called slip. The slip is dried out (atomised) by spray dryers resulting in round particles of equal granulometry. These particles are used to produce the ceramics.

Eliane operates 6 units in Brazil: Camaçari (Bahia), Serra (Espírito Santo), Várzea de Palma (Minas Gerais), Londrina (Paraná), Criciúma (Santa Catarina) and Cocal do Sul (Santa Catarina). The project is restricted to Criciúma (Eliane Porcellanato unit, here after referred as Eliane IV) and Cocal do Sul units, (here after referred as Eliane I, II and V) the largest porcelain site in Brazil. Cocal do Sul and Criciúma started operation in 1960, and their core business is the production of ceramic. They have been using fuel oil and coking coal as the main energy sources in all the spray dryers up to the year 2001.

The natural gas pipeline arrived in Cocal do Sul in May of 2000, but only during 2001, considering the additional carbon credit revenues, Eliane started the fuel switch process from fuel oil and coal to natural gas. Given the high prices of natural gas, and the investment required for the conversion, the CERs brought the benefits necessary to implement the project (details in section B.3).

The project activity consists of the investments needed to adapt the existing equipment to the use of natural gas instead of fuel oil or coal, (equipment listed in section A.4.3). The extra income and other non-measurable benefits derived from the sale of carbon credits and participation in the Kyoto Protocol are enough to make the conversion viable.

The project activity considers the spray dryers converted to natural gas after 2001 and the refractory tunnel kiln. All the changes necessary were made only in the burners. There were no significant changes in the operation of the equipments.

The project is helping the Host Country fulfil its goals of promoting sustainable development. Specifically, the project:

- Diminishes the atmospheric emissions of pollutants and improves the air quality of the region;
- Brings social benefits related to improvement of labour conditions;
- Creates new employment for installation of equipment;
- Acts as a clean technology demonstration project which could be replicated across Brazil;
- Is an important capacity building activity, demonstrating the use of a new mechanism for funding environmentally friendly technologies, which reduces emissions of greenhouse gases.

**A.3. Project participants:****Table 1 - Project participants**

Name of Party involved	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host country)	Eliane (Maximiliano Gaidzinski S.A.)	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Ltd.	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.

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:****A.4.1.1. Host Party(ies):**

Brazil

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

South- region – Santa Catarina State

A.4.1.3. City/Town/Community etc:

Eliane I, II and V: Cocal do Sul city

Eliane IV: Criciúma city

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

Eliane I, II and V: Rua Maximiliano Gaidzinski, 245 ZIP: 88845-000

Eliane IV: Rod. Luis Rosso Km 4 Morro Estevão ZIP: 88803-470

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



Sectoral Scope Category 1 (Energy industries (renewable - / non-renewable sources)

Sectoral Scope Category 4 (Manufacturing industries)

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

The project activity is a fuel switch program that is based on the conversion of 9 spray dryers and one refractory tunnel kiln. The conversion is related to adaptations and modifications, allowing the consumption of natural gas instead of fuel oil or coal. This process will not increase the lifetime of equipment (estimated as more than 20 years), nor alter the production capacity significantly. The changes occurred in the burner, and these small items of equipment are easily changeable, and do not impact upon the lifetime of the larger pieces of equipment (the spray dryers themselves). As Eliane was already using state-of-the-art equipment, the conversion did not improve the quality of the porcelain produced. The equipment included in the project activity is listed in the following table:

Table 2 - Equipment details

Eliane Code	Location	Manufacturer	Model	Nominal capacity (litre of water vaporised/hour)	Nominal Production Capacity (Kg of powder atomised/hour)	Energy Source	Fuel Switch date
ATM-1	Eliane I	SACMI	ATM 15	1750	3800	Fuel oil/ Coal	Dec 2006
ATM-2	Eliane I	SACMI	ATM 25	2600	5500	Fuel oil/ Coal	Dec 2004
ATM-3	Eliane I	IMECAL	ATM 15	1750	3800	Fuel oil/ Coal	Dec 2006
ATM 1	Eliane II	SACMI	ATM 50	6500	14000	Fuel oil	Dec 2000 / Jan 2001
ATM 2	Eliane II	IMECAL	ATM 51	6500	14000	Fuel oil	Jan 2001
ATM 3	Eliane II	SACMI	ATM 65	7700	16500	Fuel oil	Jan 2001
ATM 1	Eliane IV	ICON	ATM 25	2600	5500	Fuel oil	Feb 2001
ATM 2	Eliane IV	IMECAL	ATM 25	2600	5500	Fuel oil	Feb 2001
FB9	Eliane I	IMECAL			300,000 m ² of porcelain/month	Fuel oil	May 2001
ATM 1	Eliane V	ICON	ATM 25	2600	5500	Fuel oil	Jan/ Feb 2001

The Spray Dryers dry out the ceramic in an aspersion system where the slip is launched against a current of hot air produced by the combustion of fuel (fuel oil and coal in the baseline scenario, and natural gas in the Project Activity) reducing the humidity of the ceramic from 35% to 6% (atomizing system). The



Spray Dryers give the atomized mass the right granulometry for the powder, leading to a perfect production of ceramic.

The main modification in the plant to perform the conversion from oil to gas is the connection of the plant to the gas supply grid, installation of natural gas monitoring equipments and adaptations in the Spray Dryers burners themselves to allow gas burning.

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

Years	Annual estimation of emissions reductions in tonnes of CO ₂
2001	20,807
2002	20,807
2003	20,807
2004	20,807
2005	20,807
2006	20,807
2007	20,807
Total estimated reductions (tonnes of CO ₂ e)	145,649
Total Number of crediting years	7
Annual Average over the crediting period of estimated emission reductions (tonnes of CO ₂ e)	20,807

A.4.5. Public funding of the project activity:

The project developer is not receiving any funding from Annex I parties.

**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:**

ACM0009 “Consolidated baseline methodology for fuel switching from coal or petroleum fuel to natural gas”

ACM0009 “Consolidated monitoring methodology for fuel switching from coal or petroleum fuel to natural gas”

Version 3, approved on 28 July 2006.

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

The project activity attends all the applicability requirements of ACM0009.

- Prior to the implementation of the project activity, only coal or oil (but not natural gas) have been used in the element processes;
- Federal and Regional regulations/programs do not constrain the facility from using the fuel oil being used prior to fuel switching. Most of the companies in the region use coal as fuel;
- Federal and Regional 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 nor is there any thermal capacity expansion planned for the project facility during the crediting period. Only the burners of the spray dryers were changed and it does not contribute to increase the equipment lifetime;
- The proposed project activity does not result in integrated process change. There are no significant modifications in equipments or internal processes;

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

Based on ACM0009, the project boundary covers CO₂ emissions associated with fuel combustion in each atomizer subject to the fuel switching from oil/coal to natural gas. The project boundary is applicable to both baseline emissions and project emissions.

Baseline			
Source	Gas	Included?	Justification/ Explanation
Oil / Coal Burning	CO ₂	Yes	Main emission source
	CH ₄	No	Minor Source
	N ₂ O	No	Minor Source

Project Activity			
Source	Gas	Included?	Justification/ Explanation
Natural Gas	CO ₂	Yes	Main emission source



Burning	CH ₄	No	Minor Source
	N ₂ O	No	Minor Source

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

Based on the methodology, the most plausible baseline scenario is determined through the application of the following steps.

Step 0 – Preliminary screening based on the starting date of the project activity

The project participants wish to have the crediting period starting prior to the registration of their project activity. For this reason, it is provided below:

(a) Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of the first CDM project activity, bearing in mind that only CDM project activities submitted for registration before 31 December 2005 may claim for a crediting period starting before the date of registration;

The decision of implementing the project happened in the first half of 2000, construction started in December of 2000. The receipts of the local natural gas company provide evidence for the start date of natural gas consumption.

(b) Provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available at, or prior to, the start of the project activity.

Eliane's management took the decision of implementing the project activity in spite of the project barriers, critically considering the incentive from the CDM. The following are the documents available that can be shown as evidence to support that CDM was seriously considered in the decision to proceed with the project activity:

Internal letters – 06 May 2000

Internal meeting reports – 12 May 2000

Public consultation meeting reports – 05 May 2000.

Step 1: Identify all realistic and credible alternatives for the fuel use in the element process

Scenario 1 - The proposed project activity not undertaken as a CDM project activity;

Scenario 2 - Continuation of the current practice of using oil as energy source;

Scenario 3 - Switching from oil to biomass;

Scenario 4 - Switching from oil to natural gas at a future point in time during the crediting period.

Step 2: Eliminate alternatives that are not complying with applicable laws and regulations

There are no mandatory policies, regulations or public policies requiring the fuel switching for the project developer or other companies in the sector or region. All scenarios meet this requirement.



Moreover, all the environmental licenses do not present any requirements related to the diminishing of air pollutants, or more specifically, requirements for fuel switching. Considering this, none of the alternatives were eliminated.

Step 3: Eliminate alternatives that face prohibitive barriers

According to step 3 of the latest version of the “Tool for demonstration assessment and of additionality” agreed by the CDM Executive Board, the following sub-steps should be used.

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity:

The latest version of the additionality tool prescribes 4 main types of barriers: investment barriers, technological barriers, barriers due to prevailing practice, and other barriers. In order to determine whether the proposed project activity faces barriers that would prevent the implementation of the proposed project activity, the following barriers were considered:

Barrier 1: (Investment barrier) The Scenario faces economic/financial barriers in terms of attractiveness, and financial and economic risks considering the overall economics of the project and/or economic conditions in the country.

Barrier 2: (Technological barriers) The Scenario requires additional management or operational effort and time, which was displaced from normal operations.

Barrier 3: (Barriers due to prevailing practice) Whether the Scenario represents prevailing business practice in the industry. In other words, it assesses whether in the absence of regulations it is a standard practice in the industry, if there is experience to apply the technology and if there tends to be high-level management priority for such activities.

Barrier 4: (Other barriers) Barrier related with securing the supply of the fuel. It is discussed below.

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The table below shows how barriers affect each one of the alternative scenarios identified in Step 1.

**Table: Matrix showing whether the barriers prevent the implementation each alternative scenario.**

Barrier Evaluated	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Barrier 1- Investment	YES	NO	YES	NO
Barrier 2 - Technological	YES	NO	YES	NO
Barrier 3- Prevailing Business Practice	YES	NO	YES	NO
Barrier 4 – Other	YES	NO	YES	YES
Final Situation	Project alternative is prevented by all identified barriers, as assessed in financial analysis and the fact that the project is the first of its kind.	The continuation of the current situation is not prevented by identified barriers	The use of biomass is prevented by all barriers as result of the lack of biomass in the region	This scenario faces barrier related with securing the supply of the fuel as a reasonable part of the natural gas supplied comes from other countries (see below).

The most plausible baseline scenario is Scenario 2 (continuation of current practices) as this scenario is not prevented by any of the identified barriers.

Regarding the barriers faced by the project activity, it is important to note that national and sectoral trends were analysed. The Project Activity takes place in the very competitive ceramic industry in Brazil. In order to analyse the sectoral trends, a comparison with the top five producers and the type of fuel used in the spray dryers in the region was undertaken, based on the time of decision-making.

Table: Fuel use of main competitor in the south region.

Competitors in ceramic business	Type of Fuel
Ceusa	Coal
Cecrisa	Coal
De Luca	Oil (and switched to coal)
Portobello	Coal (and switched to Natural Gas only in 2003)
Itagers	Coal

The use of natural gas or biomass is not a common trend in the sector. A natural gas pipeline was constructed to serve the region in 2000, and it is possible to connect all of the plants listed above to this gas supply. However, among the top five ceramic producers, none of them decided to use Natural Gas when it arrived in the region. Eliane was the first ceramic producer to use natural gas in the spray dryers, starting the fuel switch in 2001, six months after the arrival of the pipeline. The Eliane fuel switch was



pioneering in that it was carried out before any of the other leading plants in the region, at a time when all the other main players were using oil or coal. Subsequent to this, the Eliane project has influenced other producers to consider fuel switching options, and the Portobello plant switched to natural gas in 2003.

Additionally, the implementation of the project activity not as a CDM project (scenario 1) also faces significant barriers related to securing the supply of Natural Gas. For the implementation of this project activity some important parts of the equipment were changed over to only operate on natural gas, so if there is a sudden interruption in the supply of natural gas the production would be forced to stop. That scenario would never happen if the project activity continued to use fuel oil, since it can be stored far more easily and cheaply than large quantities of natural gas. It is important to consider that the natural gas supplied is not 100% extracted in Brazil, as a reasonable proportion of it is produced in Bolivia. As a consequence, any changes in the political situation in the Bolivian government could affect the distribution of gas (a similar scenario happened in registered CDM project Graneros when Argentina reduced the amount of gas to Chile and they switched back to coal).

Recent changes in the Bolivian administration, and the re-nationalisation of the gas extraction industries in the country have reinforced the importance of this risk, which acts as a significant disincentive to invest in gas based projects or fuel switching to gas in Brazil, as long as the gas supply in the country continues to be linked to Bolivia. Even if supply is not completely cut off, real or perceived problems in gas supply could lead to price spikes, posing an unacceptable burden on project developers who have switched to natural gas. Furthermore, political and economic upheaval outside the region continues to affect international gas markets and leads to supply uncertainties and price volatility. These are exactly the types of financial burdens that can be alleviated through additional secure revenue streams from the CDM.

Step 4: Compare economic attractiveness of remaining alternatives

As only one alternative remains as the most plausible baseline scenario, Step 4 is not required for this 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):
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According to ACM0009, in addition to the barrier analyses provided above, the following steps should be used in order to assess the additionality of the project activity.

Step 1: Investment & sensitivity analysis

The decision on fuel switching was made based on the average price of fuels in the years before the fuel switch (2000), in order to avoid an analysis based on instantaneous oscillations in fuel prices. The table below provides information about the price.

Table: Fuel prices

Parameter	unit	value
Fuel oil price	R\$/kJ	0,0082
Natural Gas price	R\$/kJ	0,0098



Coal price	R\$/kJ	0,0033
Increase in annual fuel costs	R\$	750,812

Moreover, the fuel switch requires investments for connecting the plant to the gas supply pipeline, internal pipeline installation (including regulators, pumps and safety equipments), and equipment conversions from oil to gas. All these investments were estimated to sum approximately R\$ 250,000.00

Considering the investments, operational cost differences, fuel prices and a discount rate of 18%, (SELIC rate is a national bank reference) the project activity presents the following financial analysis.

Table: Financial Analysis

Parameter	unit	value
Investments	R\$	- R\$ 263,504
Discount Rate	%	18%
NPV baseline	R\$	- R\$ 19,556,023
NPV project	R\$	- R\$ 22,987,456
Difference between NPVs	R\$	R\$ 3,431,433

To guarantee the consistency of the result, a sensitivity analysis was performed with variations as presented in table below, and even in these cases, the difference between baseline and project activity NPV was always negative.

Table: Sensitivity Analysis

Parameter	Variation	Result (Baseline NPV minus project activity NPV)
Investment change	decrease of 50%	- R\$ 3,037,503
Natural gas price modification	decrease of 10%	- R\$ 1,344,193

The project activity is not economically attractive even after a sensitivity analysis, demonstrating that it is additional to the baseline scenario.

Step 2: Common practice analysis

Detailed common practice analysis is provided in the procedure for identification of the baseline scenario provided above.

Step 3: Impacts of CDM registration

The CDM revenue expected for the Project has been crucial in encouraging the project developer to undertake the project activity. The impact of the approval and registration of the Project as a CDM activity will bring financial and non-financial benefits to the project developer, the ceramic industry and the Host Country.

As discussed in Step 1 above and the barrier analyses provided in the procedure for identification of the baseline scenario above, the project is not considered financially attractive, and also faces significant barriers to implementation. The impacts of registration of the project as a CDM project are as follows:

- CDM revenues make the project more attractive from an investment point of view by increasing the IRR/NPV.



- CDM project participation improves the image of the company as an environmentally and socially responsible company;
- The risk of non-supply is real and an additional revenue stream into the project, in the form of CDM revenue, provides greater certainty of cash flow into the project, and reduces this risk.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:
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The project activity attends all the applicability requirements of the methodology as discussed above:

- Prior to the implementation of the project activity, only oil 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; all environmental licenses do not present any requirements to make any changes related to the use of fuel oil.
- The project activity does not increase the capacity of thermal output or lifetime of the element processes during the crediting period, nor is there any thermal capacity expansion planned for the project facility during the crediting period; the project activity is related to conversion of equipment, allowing the consumption of natural gas instead of fuel oil.
- The proposed project activity does not result in integrated process change; the fuel switch is applied for spray dryers and one kiln, and each piece of equipment represents an element process. They are not fully integrated. An indication of this is the fact that the fuel switch process was done in many steps, one step for each element process. Each element process does not affect other processes.

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

Data / Parameter:	NCV_{NG}
Data unit:	TJ/ton
Description:	Net Calorific value for Natural Gas
Source of data used:	Natural Gas Supplier - SCGAS
Value applied:	0.05679
Justification of the choice of data or description of measurement methods and procedures actually applied :	This was the most credible source of information available. SCGAS is the direct supplier of Natural Gas.
Any comment:	This value was calculated using the NCV from SCGAS in kcal/kg - 13564 - multiplied by 4.1868E-6

Data / Parameter:	NCV_k
Data unit:	TJ/ton



Description:	Net Calorific value for Fuel Oil and Coal
Source of data used:	SCGAS
Value applied:	NCV _{oil} = 0.04015 NCV _{coal} = 0.01884
Justification of the choice of data or description of measurement methods and procedures actually applied :	This was the most credible source of information available.
Any comment:	This value was calculated using the NCV in kcal/kg – 9590 and 4500 - multiplied by 4.1868E-6

Data / Parameter:	EF_{FF}
Data unit:	tCO ₂ e/TJ
Description:	CO ₂ emission factor of the natural gas, coal or petroleum
Source of data used:	IPCC 1996
Value applied:	NG = 55.8 Coal = 93.7 Fuel Oil = 76.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC values are conservative
Any comment:	

Data / Parameter:	ε_{project} , ε_{baseline}
Data unit:	%
Description:	Fuel efficiency
Source of data used:	SCGAS
Value applied:	project (natural gas) = 95% baseline (coal) = 70% baseline (fuel oil) = 85%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The fuel efficiency was assessed by the fuel supplier
Any comment:	

Data / Parameter:	EF_{k,upstream}
Data unit:	tCO ₂ e/TJ
Description:	Carbon emission factor for leakage calculation



Source of data used:	IPCC 1996 referenced by the methodology ACM0009 version 3
Value applied:	Coal = 14.94 Fuel Oil = 0.086 Natural Gas = 3.360
Justification of the choice of data or description of measurement methods and procedures actually applied :	The relevant system element for natural gas (gas production and/or processing/ transmission/ distribution) is predominantly of recent vintage and built and operated to international standards.
Any comment:	

Data / Parameter:	Density_{NG}
Data unit:	ton/m ³
Description:	density of natural gas
Source of data used:	SCGAS
Value applied:	0.000634
Justification of the choice of data or description of measurement methods and procedures actually applied :	This was the most credible source of information available. SCGAS is the direct supplier of Natural Gas.
Any comment:	This parameter is used to convert from volume of natural gas to mass since the monitoring of Natural Gas is in volume unit (Nm ³)

B.6.3 Ex-ante calculation of emission reductions:

Project emissions

Project emissions (PE_y) include CO₂ 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 the respective net calorific values and CO₂ emission factors for natural gas (EF_{NG,CO_2}), as follows:

$$PE_y = FF_{project,y} \cdot NCV_{NG,y} \cdot EF_{NG,CO_2,y} \quad (1)$$

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

Where:

PE_y	Project emissions during year y in tCO ₂ e
$FF_{project,y}$	Quantity of natural gas combusted in all element processes during the year y in tonnes
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y in tonnes
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year y in TJ/tonne



EF_{NG, CO_2} CO₂ emission factor of the natural gas combusted in all element process in tCO₂/TJ

$$PE = 19,644,804 \text{ m}^3 * 0.000634 \text{ ton/m}^3 * 0.05679 \text{ TJ/ton} * 55.8 \text{ tCO}_2/\text{TJ} = 39,481 \text{ tCO}_2\text{e}$$

Baseline Emissions

Baseline emissions (BE_y) include CO₂ emissions from the combustion of the quantity of coal or fuel oil that would in the absence of the project activity be used in all element processes i , and respective net calorific values and CO₂ emission factors. The quantity of coal or fuel 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 coal or petroleum fuel).

$$BE_y = \sum_i FF_{baseline,i,y} \cdot NCV_{FF,i} \cdot EF_{FF,CO_2,i} \quad (3)$$

Considering that the net energy consumption is equivalent for both cases, we have:

$$FF_{baseline,i,y} = \sum_i FF_{project,i,y} \cdot \frac{NCV_{NG,y} \cdot \epsilon_{project,y}}{NCV_{FF,i} \cdot \epsilon_{baseline,i}} \quad (4)$$

Where:

BE_y	Baseline emissions during the year y in tCO ₂ e
$FF_{baseline,i,y}$	Quantity of fuel oil or coal that would be combusted in the elements process i during year y in tonnes
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year y in TJ/tonne
$EF_{FF, CO_2,i}$	CO ₂ emission factor of the fuel oil or coal combusted in the element process i in tCO ₂ /TJ
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y in tonnes
$NCV_{FF,i}$	Average net calorific value of fuel oil or coal that would be combusted in the absence of the project activity in the element process i during the year y in TJ/tonne
$\epsilon_{baseline,i}$	Energy efficiency of element process i if fired with fuel oil or coal
$\epsilon_{project,i,y}$	Energy efficiency of element process i if fired with natural gas

$$\begin{aligned} \text{fuel oil: } & 16,707 \text{ ton} * 0.04015 \text{ TJ/ton} * 76.6 \text{ tCO}_2\text{e/TJ} * 0.95 / 0.85 = 57,425 \text{ tCO}_2\text{e} \\ \text{coal: } & 1,936 \text{ ton} * 0.01884 \text{ TJ/ton} * 93.7 \text{ tCO}_2\text{e/TJ} * 0.95 / 0.70 = 4,637 \text{ tCO}_2\text{e} \\ & BE = 57,425 + 4,637 = 62,062 \text{ tCO}_2\text{e} \end{aligned}$$

**Leakage**

The emissions outside the project boundary were calculated for baseline and project scenarios. The net leakage emissions are calculated as the difference between the project leakage and the baseline leakage. As a conservative approach, if the baseline leakage emission is higher than project activity, the leakage is considered equal to zero, and the emission reductions from these sources are not requested.

$$LE_y = LE_{CH_4,y}$$

Where:

$LE_{CH_4,y}$ = Leakage emission due to fugitive upstream CH₄ emissions in the year y (tCO₂e)

$$LE_{CH_4,y} = [FF_{project,y} * NCV_{NG,y} * EF_{NG,upstream,CH_4} - FF_{baseline,k,y} * NCK_k * EF_{k,upstream,CH_4}] * GWP_{CH_4}$$

$$LE = 707.3 \text{ TJ} * 3.360 \text{ tCO}_2\text{e/TJ} - 670.8 \text{ TJ} * 0.086 \text{ tCO}_2\text{e/TJ} - 36.5 \text{ TJ} * 14.94 \text{ tCO}_2\text{e /TJ} = 1,774 \text{ tCO}_2\text{e}$$

Emission Reduction

$$ER_y = BE_y - PE_y - LE_y \quad (5)$$

Where:

ER_y = Emission reduction (tCO₂e)

BE_y = Baseline emissions (tCO₂e)

PE_y = Project activity emissions (tCO₂e)

LE_y = Leakage (tCO₂e)

Note: Total emission reductions described in this PDD are calculated using the consumption of natural gas in 2004, and applied to future years. The accurate emission reduction calculation for future years will be based on measured data from all equipments during the operation of the project activity.

$$ER = 62,062 \text{ tCO}_2\text{e} - 39,481 \text{ tCO}_2\text{e} - 1,774 \text{ tCO}_2\text{e} = 20,807 \text{ tCO}_2\text{e}$$

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

Year	Estimation of project activity emissions (tonnes of CO ₂)	Estimation of Baseline emissions (tonnes of CO ₂)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of emissions reductions (tonnes of CO ₂)
2001	39,481	62,062	1,774	20,807
2002	39,481	62,062	1,774	20,807
2003	39,481	62,062	1,774	20,807
2004	39,481	62,062	1,774	20,807
2005	39,481	62,062	1,774	20,807
2006	39,481	62,062	1,774	20,807
2007	39,481	62,062	1,774	20,807
TOTAL	276,367	434,434	12,418	145,649

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:	Nm ³
Description:	Natural Gas consumed in process element i in year y
Source of data to be used:	monitored by turbine flow meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	19,644,804
Description of measurement methods and procedures to be applied:	The operator should record collected data on log sheet paper every hour.
QA/QC procedures to be applied:	Uses flow meter totalizing natural gas consumption. So that, any mistake can be detected and corrected.
Any comment:	The readings of Natural Gas will be multiplied by a 2.9 factor as to correct the temperature and pressure at the time of the data collection in order to get Nm ³ .

B.7.2 Description of the monitoring plan:

The engineering department at the Eliane facility should collect information regarding fuel consumption and production of all the activities. All information will be collected and recorded on site. EcoSecurities is responsible for emission reduction calculations



The Natural Gas consumption will be monitored by flow meters hourly and consolidated monthly. The ceramic production is consolidated monthly. All data will be stored on the computer system and the log sheets

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the Eliane natural gas fuel switch project, in Brazil. The main components covered within the monitoring plan are:

1. Parameters 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.

The requirements of this MP are in line with the kind of information routinely collected by similar companies in the sector, thus, internalizing the procedures should be simple and straightforward. If necessary, the 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.

As the project activity is currently operating, monitoring has been undertaken since January 2001. All data have been archived electronically, and data will be kept for the full crediting period, plus two years.

The monitoring structure will be quite different, depending of the site location. Currently, the project activity involves two locations: Cocal do Sul and Criciúma. Each one has its own internal procedures for calculating and measuring the fuel consumption and production.

COCAL DO SUL (Eliane I, II and V)

In Cocal do Sul, two departments are involved with data collection related to project activity: the “Central de Massas”, and the Engineering department. The “Central de Massas” department is responsible for collecting the data, and inputting it into the electronic system. Natural gas measuring devices are installed only in the entrance of Cocal do Sul unit (SCGAS measuring device), and for the following equipments:

ELIANE II

ATM-1

ATM-2

ATM-3

The fuel consumption of other equipments is calculated based on energy efficiency consumption factors.

CRICIUMA (Eliane IV)

In Criciúma, the unique department involved with data collection and calculation is the Engineering department. Natural Gas measuring devices are installed only in the entrance of the Criciúma unit (SCGAS measuring device). The consumption of each piece of equipment is calculated based on energy efficiency consumption factors.



and the name of the responsible person(s)/entity(ies)

The application of the baseline study and monitoring methodology was completed on 27/02/2007

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**SECTION C. Duration of the project activity / crediting period****C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

01 December 2000 (construction start)

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

More than 20 years

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

01 January 2001

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

Not applicable

C.2.2.2. Length:

Not applicable

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

The environmental authority responsible for licensing Eliane activities did not request any environmental study for the fuel switch. Environmental impacts studies are requested only when the activity presents significant impacts, thus there are no significant negative impacts related to the project activity.

Table: Environmental licenses number for each unit.

Unit	Operational License number
Eliane I	LAO 1919/04
Eliane II	LAO 1921/04
Eliane IV	LAO 1459/04
Eliane V	LAO 1921/04

Notice that Eliane V has moved to Eliane II previously to gaining the license. Therefore, the equipments evaluated by Eliane II licensing process already contain Eliane V equipment. The nomenclature used here, designating Eliane V, was to comply with Eliane's internal nomenclature.

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:

No significant negative environmental impact is expected from the project activities.

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

According to the Resolution #1 dated on December 2nd, 2003, from the Brazilian Inter-Ministerial Commission of Climate Change (Comissão Interministerial de Mudança Global do Clima - CIMGC), decreed on July 7th, 1999¹, any CDM projects must send a letter with a description of the project and an invitation for comments by local stakeholders. In this case, letters were sent to the following local stakeholders:

- City Hall of Cocal do Sul and Criciuma;
- Chamber of Cocal do Sul and Criciuma
- Environment agencies from the state and Local Authority;
- Brazilian Forum of NGOs;
- District Attorney (known in Portuguese as Ministério Público, i.e. the permanent institution essential for legal functions responsible for defending the legal order, democracy and social/individual interests) and;
- Local communities associations.

Local stakeholders were invited to raise their concerns and provide comments on the project activity for a period of 30 days after receiving the letter of invitation. EcoSecurities and the project developer addressed questions raised by stakeholders during this period.

E.2. Summary of the comments received:

No comments received up to date.

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

No comments received up to date.

¹ Source: <http://www.mct.gov.br/clima/comunic/pdf/Resolucao01p.pdf>

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

Organization:	Eliane
Street/P.O.Box:	Rua Maximiliani Gaidzinski 245
Building:	
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FAX:	
E-Mail:	
URL:	www.eliane.com.br
Represented by:	
Title:	Engineering Manager
Salutation:	Mr.
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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable

**Annex 3****BASELINE INFORMATION****Calculation data****Fuel data**

Sources	density (Kg/m ³)	lower heating value (Kcal/kg)	Net calorific value (TJ/Ktonne)	Carbon oxidation (%)	Carbon content (tC/TJ)	Carbon Emission Factor (t CO ₂ /TJ)	Carbon Emission Factor (t CO ₂ /ton)	Fuel unit	Burning efficiency
coal	864	4.500	18,84	99,0%	25,80	93,65	1,76	kg	0,70
fuel oil	1000	9.590	40,15	99,0%	21,10	76,59	3,08	kg	0,85
natural gas	634	13.564	56,79	99,5%	15,30	55,82	3,17	kg	0,95

Source:

	Brasilian energy Balance, 2004 http://www.mme.gov.br/site/menu/select_main_menu_item.do?channelId=1432&pageld=4060
	IPCC 1996
	SCGas data
	Calculated

Leakage data

Project Emission Type Factor	tonne of CH ₄ /TJ	Source
Natural Gas Processing, Transport, and Distribution	3.36	IPCC 1996

Transportation	unit	value
Distance from purchase site	km	300
Truck capacity	ton	20
Truck consumption rate	l diesel / km	0.40
Truck consumption rate	kg diesel / km	0.336

Equipment data

(only equipments installed before 2006)

Code	Location	Annual energy consumption (in TJ)
ATM 1	Eliane II	99,4
ATM 2	Eliane II	69,3
ATM 3	Eliane II	139,3
ATM 1	Eliane IV	42,7
ATM 2	Eliane IV	42,7
ATM 1	Eliane V	52,7
FB9	Eliane I	224,7
ATM1	Eliane I	36,5

**Financial Analysis data**

	Parameter	value	Unit	Source
investments	Total Investments	263,504	R\$	Company data
energy prices	Fuel oil price	0.0082	R\$/kJ	Company data (obtained from suppliers). Average price of years 2000 and 2001
	Natural Gas price	0.0098	R\$/kJ	Company data (obtained from suppliers). Average price of years 2000 and 2001
others	Discount rate	18%		

**Annex 4****MONITORING INFORMATION****COCAL DO SUL (Eliane I, II and V)**

Table: Data to be collected or used to monitor emission reductions from the project activity.

ID number	Data variable	Data unit	(m), (c), (e)	Monitoring frequency	Monitoring method	Responsible parties/ individuals for monitoring	Monitoring equipments	Comments
1	Q_NG	Joule	m	Monthly	Flow meter	SC GAS	Entrance flow meter	Supported by SC GAS
2	Qn_NG	Joule	m	Monthly	Flow meter	Engineering department	Individual equipment flow meter	Supported by Eliane

Table: Equipment used to monitor emission reductions from the project activity.

Equipment	Variables monitored	Parties responsible for operating equipment	Procedure in case of failure	Default values to use in case of failure	Comments
Entrance flow meter	Q_NG	SC GAS	Failure reported to equipment supplier and repairs carried out. If repairs are not possible, equipment will be replaced by equivalent item.	Previous reading minus 5%	
Individual equipment flow meter	Qn_NG	Engineering department	Failure reported to equipment supplier and repairs carried out. If repairs are not possible, equipment will be replaced by equivalent item.	Previous reading minus 5%	

Table: Natural gas flow meters (Manufacturers and models)

Equipment	Manufacturer/ model	Specific information	Serial number
<u>Eliane IV</u> ATM 1	Elster DVGW	Nr.: DG4705 AQ 1264 QA 100 802 Pmax 4bar Qmin 10m³/h Qmax 160m³/h	69111800/2000
<u>Eliane IV</u> ATM 2	Elster DVGW	Nr.: DG4705 AQ 1264 QA 100 802 Pmax 4bar Qmin 10m³/h Qmax 160m³/h	69111801/2000
<u>Eliane I</u> ATM 1 – Klin Tunnel	Krom Schroder DG-4705	AQ 1264 DM 2502100 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69096189/98



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<u>Eliane II</u> ATM 1	Elster DVGW	Nr.: DG4705 AQ 1264 QA 250 1002 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69111805/2000
<u>Eliane II</u> ATM 2	Elster DVGW	Nr.: DG4705 AQ 1264 QA 250 1002 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69111806/2000
<u>Eliane II</u> ATM 3	Elster DVGW	Nr.: DG4705 AQ 1264 QA 250 1002 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69110159/2000

Table: Operational procedures and responsibilities for monitoring and quality assurance of emissions from project activity (E=responsible for executing, R=responsible for overseeing and assuring quality, I=to be informed)

Task	ELIANE		Equipment Supplier	SC GAS (Natural gas supplier)	EcoSecurities
	“Centro de Massas” department	Engineering department			
Collect data	E			E	
Enter data into spreadsheet	E	R			
Make monthly and annual reports		E			I
Achieve data & reports		E			I
Calibration / Maintenance, rectify faults		R	E	E	I

CRICIUMA (Eliane IV)

Data monitored is presented below.

Table: Data to be collected or used to monitor emission reductions from the project activity.

ID number	Data variable	Data unit	(m), (c), (e)	Monitoring frequency	Monitoring method	Responsible parties/ individuals for monitoring	Monitoring equipments	Comments
1	Q_NG	Joule	m	Monthly	Flow meter	SC GAS	Entrance flow meter	Supported by SC GAS



Table: Equipment used to monitor emission reduction from project activity.

Equipment	Variables monitored	Parties responsible for operating equipment	Procedure in case of failure	Default values to use in case of failure	Comments
Entrance flow meter			Failure reported to equipment supplier and repairs carried out. If repairs are not possible, equipment will be replaced by equivalent item.	Previous reading minus 5%	

Table: Operational procedures and responsibilities for monitoring and quality assurance of emissions from project activity (E=responsible for executing, R=responsible for overseeing and assuring quality, I=to be informed)

Task	ELIANE	Equipment Supplier	SC GAS (Natural gas supplier)	EcoSecurities
	Engineering department			
Collect data			E	
Enter data into spreadsheet	E			
Make monthly and annual reports	E			I
Achieve data & reports	E			I
Calibration / Maintenance, rectify faults	R	E	E	I