CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004

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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 n°03, 28 July 2006

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 in 6 units in Brazil: Camaçari (Bahia), Serra (Espirito Santo), Várzea de Palma (Minas Gerais), Londrina (Paraná), Criciuma (Santa Catarina) and Cocal do Sul (Santa Catarina). The project is restricted to Criciuma (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 Criciuma started operation in 1960, and its core business is the production of ceramic. It has been using fuel oil, and cooking coal as the main energy sources in all the spray dryers and one refractory tunnel kiln 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 credits revenues, Eliane started the fuel switch process from fuel oil 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 to adapt the existing equipment to the use of natural gas instead of fuel oil, (equipment listed in section A.4.3). The extra income and other non-measurable benefits derived from the sale of carbon credits and participation of Kyoto Protocol are enough to make the conversion viable.

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;
- Act 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:

Name of party involved (indicates a host country)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicates if the party involved wish to be considered a 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.		

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: 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. This process will not increase the lifetime of equipment, nor alter the production capacity significantly. 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:

Eliane Code	Location	Name	Manufacturer	Model	Nominal capacity (litre of water vaporised/hour)	Nominal Production Capacity (Kg of powder atomised/hour)	Energy Source	Fuel Switch date	Remaining Lifetime
ATM-1	Eliane I	Spray Dryer	SACMI	ATM 15	1750	3800	Fuel oil/ Coal	Dec 2006	More than 20 years
ATM-2	Eliane I	Spray Dryer	SACMI	ATM 25	2600	5500	Fuel oil/ Coal	Dec 2004	More than 20 years
ATM-3	Eliane I	Spray Dryer	IMECAL	ATM 15	1750	3800	Fuel oil/ Coal	Dec 2006	More than 20 years
FB9	Eliane I	refractory tunnel kiln	IMECAL		300,000 m^2 of porcelain/month		Fuel oil	May 2001	More than 20 years
ATM 1	Eliane II	Spray Dryer	SACMI	ATM 50	6500	14000	Fuel oil	Dec 2000 / Jan 2001	More than 20 years
ATM 2	Eliane II	Spray Dryer	IMECAL	ATM 51	6500	14000	Fuel oil	Jan 2001	More than 20 years
ATM 3	Eliane II	Spray Dryer	SACMI	ATM 65	7700	16500	Fuel oil	Jan 2001	More than 20 years
ATM 1	Eliane IV	Spray Dryer	ICON	ATM 25	2600	5500	Fuel oil	Feb 2001	More than 20 years
ATM 2	Eliane IV	Spray Dryer	IMECAL	ATM 25	2600	5500	Fuel oil	Feb 2001	More than 20 years

Eliane Code	Location	Name	Manufacturer	Model	Nominal capacity (litre of water vaporised/hour)	Nominal Production Capacity (Kg of powder atomised/hour)	Energy Source	Fuel Switch date	Remaining Lifetime
ATM 1	Eliane V	Spray Dryer	ICON	ATM 25	2600	5500	Fuel oil	Jan/ Feb 2001	More than 20 years

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 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 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 gas monitoring equipments and adaptations in the Spray Dryers burners themselves to allow gas burning.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The baseline is defined as the consumption of fuel oil, in the equipment listed above, to produce ceramic. All the equipments are located in Eliane I, II, IV and V units (as described above), and are part of the ceramic production processes. Given that during the previous years the natural gas prices were higher than fuel oil, the fuel switch was not the most attractive course of action, and thus not the baseline.

The project activity will reduce CO_2 emissions by replacing the fuel oil, a carbon intensive source, with natural gas (less carbon intense fuel), in the ceramic production line.

The project activity, due to the replacement of fuel oil, will reduce the CO_2 emissions related to fuel transportation. However, the increased natural gas use will increase the fugitive methane emissions in the natural gas pipeline used to supply the project activity. Only CO_2 and CH_4 are accounted in the leakage calculation.

The GHG emissions reductions are detailed in section A.4.4.1 and calculations presented in section E.

Additionality is demonstrated by analysing the national and sector trends and elaborating a financial analysis. All the gains and costs related to the implementation of the project activity must be included, explicitly the following parameters:

- Investment requirements for using natural gas;
- Discount rate appropriate to country and sector;
- Efficiencies of fuels;
- Current price and projected prices of each fuel;
- Operation costs of each fuel;
- Residual value of equipment at the end of lifetime of the project activity.

If the NPV of project activity is negative, the project is additional. The financial analysis parameters, emission reduction data and data sources are detailed in Annex 3.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reduction in tonnes of CO_2e
2001	18,828
2002	18,828
2003	18,828
2004	18,828
2005	18,828
2006	18,828

2007	18,828
Total estimated reductions (tonnes of CO_2e)	131,796
Total Number of crediting years	7
Annual Average over the crediting period of estimated emission reductions (tonnes of CO_2e)	18,828

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 methodology

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

ACM0009 **"Consolidated methodology for industrial fuel switching from coal or petroleum fuel to natural gas"**
Version 3, approved on 28 July 2006.

B.1.1. 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.2. Description of how the methodology is applied in the context of the project activity:

According to the methodology, the Baseline Scenario is defined as the current use of fossil fuels (petroleum and/or coke) in the existing facility up to the end of the crediting period, without any retrofit which extends its capacity or lifetime or improves its fuel efficiency. According to the baseline methodology, for this project activity the baseline is defined as the continued consumption of fuel oil for the production of ceramic, excluding any additional equipment or expansion.

The emission reduction calculations include only CO_2 from combustion and CO_2 and CH_4 from fugitive emissions associated with fuel transportation and distribution. Carbon dioxide emission factors are determined using country-specific lower heating values (specific for Brazil) and standard IPCC values for carbon content and oxidation fraction. The leakage emissions related to transportation and distribution of baseline fuels and natural gas are estimated using region-specific emission factors given by IPCC. The CH_4 emissions are converted to equivalent CO_2 emissions using the GWP as agreed in the Kyoto Protocol.

Spray Dryers and the kiln that were using fuel oil before the fuel switch were considered for the emissions reduction calculations. Costs related to the conversion were taken into account in the financial analysis.

Following the Meth-Panel recommendation, the data used to demonstrate additionality was based on the period prior to decision-making. The decision was made in December 2000, and the project activity started during the first half of 2001. For baseline calculations the data used is the most recent possible, meaning updated future plans, and any other recent applicable publications.

B.3. 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:

Identification of the baseline scenario

The baseline scenario of the project activity 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 1);

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

Scenario 3 - Switching from oil to biomass (scenario 3);

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

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:

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: 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: The Scenario requires additional management or operational effort and time, which was displaced from normal operations.

Barrier 3: 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: 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- Economic/ financial	**YES**	NO	**YES**	NO
Barrier 2 - Technical and operational	**YES**	NO	**YES**	NO
Barrier 3- Prevailing Business Practice	**YES**	NO	**YES**	NO
Barrier 4 – Other Barriers	NO	NO	**YES**	**YES**
Final Situation	Project alternative is prevented by all identified barriers, as assessed in financial analysis and the fact that they are first of a 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)
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 evaluated to this project activity.

Additionality

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 key 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.
- 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.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary covers CO_2 emissions associated with fuel combustion in each element process subject to the fuel switching. The project boundary will consider only facilities that were using fuel oil in 2000. The equipments to be considered are listed in section A.4.3.

Table: Emission sources included and excluded in the project boundary

	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

CO_2 and CH_4 leakage emissions were included in the project and baseline boundaries.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

Date of conclusion: 28 July 2006

Person/entity determining the baseline:

Luis Filipe Kopp
EcoSecurities do Brasil Ltda.
Rua Lauro Muller n°116, sala 4303, Botafogo
Rio de Janeiro – RJ, Brasil
CEP: 22290 160
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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

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. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

ACM0009 **"Consolidated methodology for industrial fuel switching from coal or petroleum fuel to natural gas"**
Version 3, approved on 28 July 2006.

D.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 as shown in Section B.1.1.

- 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.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data Type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1. $FF_{project\ i,y}$	Mass	Natural Gas consumed in process element i in year y	m³	m	*Continuously*	*100%*	*Electronic***	Project lifetime	Monitored by operation pattern (e.g., normal, start-up, holiday, etc.) at the process i (e.g., boiler). To be monitored for each element process. Confirmed by natural gas purchase record.
2. $E_{project\ i}$	Energy efficiency	Fuel efficiency of natural gas used at the process *i*	%	m	*monthly*	*100%*	*Electronic***	Project lifetime	To be determined for each process i
3. $E_{project\ i,y}$		Average fuel	%	c	*Annually*	*Calculated from*	*Electronic***		

	Energy efficiency	efficiency of natural gas used at the process *i* in year *y*				*12 monthly*$E_{project\ i}$		Project lifetime	

***The data will be kept archived during the project lifetime more 2 years*

Default values will be used for calorific value and CO_2 emission factor.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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

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 m^3 [3]
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y in m^3 [3]
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year y in MWh/m^3 [3]
$EF_{NG,CO2,y}$	CO_2 emission factor of the natural gas combusted in all element processes in the year y in t CO_2/MWh

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
4 $FF_{baseline\ i,y}$	Quantity of oil that would be consumed in process element i in year y	*Project developer*	tonnes	c	*monthly*	*calculated*	*electronic***	
5 $E_{baseline\ i}$	Fuel efficiency of oil consumed at the process *i* in baseline	*Project developer*	%	m	*Once, before conversion to natural gas*	*100%*	*Electronic***	

***The data will be kept archived during the project lifetime more 2 years*

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

$$BE_y = \sum_i FF_{baseline,i,y} \cdot NCV_{FF,i} \cdot EF_{FF,CO2,i} \quad (3)$$

with

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

where:

BE_y	Baseline emissions during the year y in t CO_2e
$FF_{baseline,i,y}$	Quantity of coal or 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
$FF_{project,i,y}$	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 coal or 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 coal or 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 coal or oil respectively

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Not applicable

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	*For how long is archived data kept?*	Comment

Default values will be used for emission factors for upstream methane emission and net calorific values.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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.
The leakage formula is:

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

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
$LE_{LNG,CO2,y}$	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

$$LE_{CH4,y} = \left[FF_{project,y} \cdot NCV_{NG,y} \cdot EF_{NG,upstream,CH4} - \sum_k FF_{baseline,k,y} \cdot NCV_k \cdot EF_{k,upstream,CH4} \right] \cdot GWP_{CH4} \qquad \textbf{(5)}$$

with

$$FF_{project,y} = \sum_i FF_{project,i,y} \quad \text{and} \qquad \textbf{(6)}$$

$$FF_{baseline,k,y} = \sum_i FF_{baseline,i,k,y} \qquad \textbf{(7)}$$

where:

$L_{CH4,y}$ Leakage emissions due to upstream fugitive CH_4 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 m^3 [3]
$FF_{project,i,y}$ Quantity of natural gas combusted in the element process i during the year y in m^3 [3]
$NCV_{NG,y}$ Average net calorific value of the natural gas combusted during the year y in MWh/m^3 [3]
$EF_{NG,upstream,CH4}$ 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 (a coal or oil type) 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 (a coal or oil type) 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 (a coal or oil type) 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 (a coal or oil type) in t CH_4 per MWh fuel produced
GWP_{CH4} Global warming potential of methane valid for the relevant commitment period

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The formula used to estimate the emission reduction is:

$$ER_y = BE_y - PE_y - LE_y \qquad \textbf{(8)}$$

Where,

ER_y Emissions reductions of the project activity during the year y in t CO_2e
BE_y Baseline emissions during the year y in t CO_2e
PE_y Project emissions during the year y in t CO_2e
LE_y Leakage emissions in the year y in t CO_2e

Total emission reductions are calculated *ex ante,* using an estimated value for efficiency of equipment. The accurate emission reduction calculation will be based on measured data during project activity.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)* From table D.2.1.1 & D.2.1.3	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	*Low*	*Confirmed by natural gas distributor measurements.*
2	*Low*	*When possible, there will be recorded for each equipment.*
3	*Low*	*Not a single value, but an average at each process i.*
4	*Low*	*This value is calculated based on natural gas measured data, thus no QA/QC is applicable.*
5	*Low*	*This value is calculated based fuel oil consumption before the implementation of the project.*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

Eliane has an internal commission related to energy conservation inside the Engineering department. All information and data relating to fuel consumption and energy efficiency have been collected for a long time. Moreover, information about fuel consumption is also requested to render account. The fuel switch process will not request modifications or improvements on the existing internal process. The detailed monitoring plan is presented in annex 4.

D.5 Name of person/entity determining the monitoring methodology:

Date of conclusion: 28 July 2006
Person/entity determining the monitoring:

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SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The formula used for calculating the project emissions is presented in section D.2.1.2.

Natural Gas consumption (m^3)	Emission by NG combustion (tonnes of CO_2e)
17,417,000	35,004

The quantity of Natural gas consumed in converted equipments and the equipment efficiency after conversion are estimated at this time.

E.2. Estimated leakage:

Leakage emissions are associated with fugitive CH_4 emission and CO_2 fuel transportation emissions. The formula is presented in section D.2.3.2. Values used for calculating leakage are in Annex 3.

Leakage was calculated for the baseline and project activity. 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.

Project leakage emissions (in tonnes of CO_2e per year).	Baseline emissions (in tonnes of CO_2e per year).	Net emissions (in tonnes of CO_2e per year).
1,487	522	965

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Emission by NG combustion	35,004
Net Leakage Emissions	965
Total Project Emissions	35,969*

* in tonnes of CO_2e per year

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Fuel oil consumption (tonnes of fuel)	Coal consumption (tonnes of fuel)	Baseline Emission (tonnes of CO_2e)
16,707,276	1,936,490	54,797

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

Emission Reduction	18,828*

* in tonnes of CO_2e per year

E.6. Table providing values obtained when applying formulae above:

E.6 Table providing values obtained when applying formulae above				
The ex post calculation of baseline emissions rates may only be used if proper justification is provided. Not withstanding, the baseline emissions rates shall be calculated ex ante reported in the CDM-PDD. The result of the application of the formulae above shall be indicated using the following tabular format				
Year	Estimation of project activity emissions (tonnes of CO2)	Estimation of Baseline emissions (tonnes of CO2)	Estimation of leakage (tonnes of CO2 e)	Estimation of emissions reductions (tonnes of CO2)
2001	35,004	54,797	965	18,828
2002	35,004	54,797	965	18,828
2003	35,004	54,797	965	18,828
2004	35,004	54,797	965	18,828
2005	35,004	54,797	965	18,828
2006	35,004	54,797	965	18,828
2007	35,004	54,797	965	18,828
Total (tones of CO2 e)_	245,028	383,580	6,756	131,796

SECTION F. Environmental impacts

F.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 represents a significant impacts, thus there are no significant negative impacts related to 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 the license emission. 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 nomenclature.

F.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:

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

SECTION G. Stakeholders' comments

G.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, 1999[1], 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.

G.2. Summary of the comments received:

No comments received up to date.

G.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/Resolução01p.pdf

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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URL:	www.eliane.com.br
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 CO2/TJ)	Carbon Emission Factor (t CO2/ton)	Fuel unit	Burning efficiency
coal	864	4.500	18,84	99,0%	25,80	93,65	1,76	kg	0,7
fuel oil	1000	9.590	40,15	99,0%	21,10	76,59	3,08	kg	0,7
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&pageId=4060
IPCC 1996
SCGas data
Calculated

Leakage data

Project Emission Type Factor	tonne of CH4/TJ	Source
Natural Gas Processing, Transport, and Distribution	0.118	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

Code	Location	Annual energy consumption (in TJ)
ATM 1	Eliane II	69.56
ATM 2	Eliane II	48.50
ATM 3	Eliane II	97.54
ATM 1	Eliane IV	29.90
ATM 2	Eliane IV	29.90
ATM 1	Eliane V	36.92
FB9	Eliane I	157.26
ATM1	Eliane I	25.54

Financial Analysis data

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

Annex 4

MONITORING PLAN

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 Criciuma. Each one has it 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.

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
Eliane IV ATM 1	Elster DVGW	Nr.: DG4705 AQ 1264 QA 100 802 Pmax 4bar Qmin 10m³/h Qmax 160m³/h	69111800/2000
Eliane IV ATM 2	Elster DVGW	Nr.: DG4705 AQ 1264 QA 100 802 Pmax 4bar Qmin 10m³/h Qmax 160m³/h	69111801/2000
Eliane I ATM 1 – Klin Tunnel	Krom Schroder DG-4705	AQ 1264 DM 2502100 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69096189/98
Eliane II ATM 1	Elster DVGW	Nr.: DG4705 AQ 1264 QA 250 1002 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69111805/2000
Eliane II ATM 2	Elster DVGW	Nr.: DG4705 AQ 1264 QA 250 1002 Pmax 4bar Qmin 20m³/h Qmax 400m³/h	69111806/2000
Eliane II 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)

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. 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