CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Fuel switching to natural gas in Ladrillera Santafé
Version 4.11.
11th October, 2007

A.2. Description of the small-scale project activity:

The small-scale project activity project aims to reduce GHG emissions through a fuel switch program from solid and liquid fossil fuels to natural gas. The fuel switch replaces the original fuel with a less carbon intensive fuel, thereby lowering the GHG emissions per unit of production.

The fuel switching will take place in three factories belonging to the company Ladrillera Santafé, S.A., a Colombian company specialized on production of materials for the construction sector (bricks, floors, tiles, etc.). Next table summarizes the characteristics of these factories.

Factory	Plant	Furnaces	Approximate maximum capacity (t/day)	Products	Initially involved in the Project activity?
Arcillas de Soacha	AS1	1 furnace (tunnel)	400	Blocks and blocks stones	Yes
	AS2	1 furnace (tunnel)	300	Pavers stones	Yes
Soacha	S1	1 furnace (tunnel)	500	Structural blocks and bricks	Yes
	S2	2 furnace (tunnel)	500 - 400	Structural blocks and bricks	No, but involved in the mid term.
	S3	1 furnace (tunnel)	500	Structural blocks, bricks and pavers	Yes
Usme	U1	1 furnace (Hoffman)	250 - 200	Pavers stones and bricks of facade.	No
	U2	2 furnace (tunnel)	500 - 400	Pavers stones and bricks of facade	Yes
	U3	4 furnace (tunnel)	1.000 - 750	Structural bricks, pavers stones and bricks of façade	Yes
	U4	Dryer and furnace of rollers, Additionally count on a complete line of enamel	30.000 roofing tiles/day	Roofing tiles and accessories	No

Until the year 2005, these industrial facilities consumed only crude, diesel and coal in their processes. As a result of the project activity, natural gas is replacing these fuels, and GHG emissions will be mitigated in 440.548 tons of CO_2e during the ten years that are considered as crediting period.

Initially, the fuel switching is only planned in six of the nine existing plants. Operating equipments have shown to be adequate in terms of energy efficiency and quality of the final product so, in the future, more plants could joint to the project activity depending on the economic evolution of the program.

The project also brings additional social, environmental, and economic benefits, contributing to the sustainable development objectives of the Colombian Government, in accordance with the Law 99/1993 and other national policies tending to a better life quality (e.g. Rational Use of Energy and Cleaner Production)[1]. The main contributions of the project to sustainable development are:

- Reduces the emission of local pollutants such particulate matter, NO_X and SO_2.
- Improves the labour conditions and creates new employment related to the installation and operation of new equipment.
- Contributes to technology and capacity development[2].
- Acts as a clean technology demonstration project which could be replicated in other industrial plants across Colombia.

Among these benefices, it is worth highlighting the contribution of the project to air quality improvement. The switching to natural gas will reduce emissions in the surroundings of Bogotá[3], where several pollutants show higher concentrations than the reference values. This kind of initiatives that promote the use of cleaner fuels in the Bogotá area are an objective considered in the air pollution mitigation policies implemented by the local and national administration[4].

A.3. 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)
Colombia (Host Country)	Ladrillera Santafé, S.A.	No
Spain	Gas Natural SDG	No

[1] An explanation of these policies can be found in the web site of the Ministry of Environment, Housing, and Spatial Planning of Colombia www.minambiente.gov.co.

[2] All technology, labour, and technical maintenance will be provided within Colombia.

[3] Environmental benefits associated to the project are detailed in the Paragraph D.1.

[4] See document Conpes 3344 for details.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Colombia

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

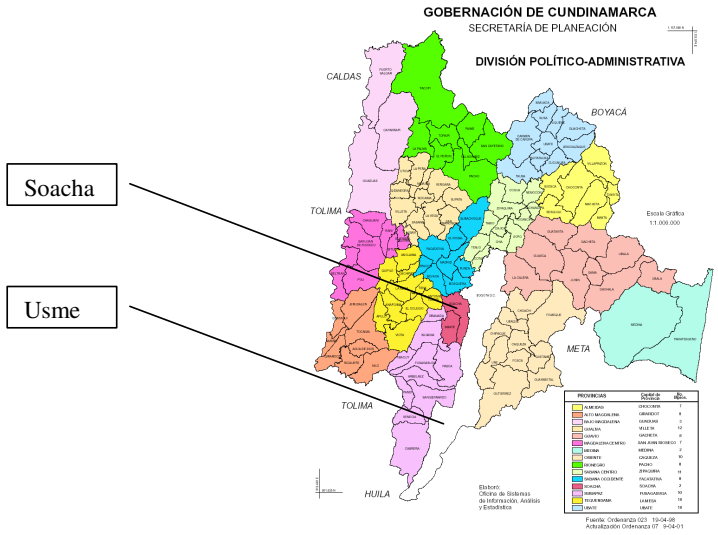
The factories involved in the project activity are located in the Cundinamarca District and in Capital District of Bogotá. (The Capital District of Bogotá is nearly completely surrounded by Cundinamarca territory)

A.4.1.3. City/Town/Community etc:

The project is developed in the next municipalities:

- Soacha: This Municipality is the capital of the Soacha Province, located in the Cundinamarca District.
- Usme: It is the municipality number 5 of the Bogotá C.D.

Municipalities where the project is developed



Source: Planning Secretary of Cundinamarca

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The addresses of the factories are:

- Soacha Factory: Vereda Panamá. Vía Fusunga. Soacha.
- Usme Factory: Vía Usme. km 7. No. 63 – 10. Usme.
- Arcillas de Soacha Factory: Vereda Pantoja. Vía Fusunga, km 5. Soacha.

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project activity involves fuel switching from solid and liquid fossil fuels to natural gas at industrial facilities, including the next actuations:

- Development of the external pipelines supplying the industrial sites
- Industrial link-ups
- Construction of measurement and regulation stations
- Installation of cut valves
- Construction of the internal pipelines
- Installation of regulation trains
- Adaptation of the existing equipments and installation of new equipments running on natural gas
- Other actuations: formation, calibration, adjustments, etc.

These actuations have been developed by both project participants. Gas Natural S.A. E.S.P. has built the derivation from the distribution network up to the place of gas delivery in the factories, point where the regulation stations will be located. The equipments, valves and accessories that allow limiting the natural gas pressure from the conditions of supply of the distribution network to the pressure of work that needs every plant, will constitute this stations.

Ladrillera Santafé S.A. has built a hut in every factory to locate the measurement and regulation station and the internal pipeline network from this station to the natural gas consumption points. This industrial company have also purchased and installed the new equipments. Ladrillera Santafé has initially considerer to replace or modify the equipments listed in the next tables to use natural gas, but more equipment could be replaced in the mid and long term. These equipments represent the most innovative technology in the Colombian brick sector, combining boilers and various types of high efficiency burners.

Images from the boiler, the furnace and the shaping process actually operating in Soacha Factory



ARCILLAS DE SOACHA 1				
SUBSTITUTED EQUIPMENT				
Process	SHAPING	DRYING	FIRING	
Equipment			Burner	
Characteristics			Beralmar Promatic	
			Closed distribution circuit	
Quantity			99 injectors	
Fuel			Carbon	
Calorific Power			50.000 Kcal/h	
Fuel consumption			73 - 82 g / min	
NEW EQUIPMENT INVENTORY				
Process	SHAPING	DRYING	FIRING	
Equipment		Burner	Burner	Burner
Characteristics		Wayler	Bernini	Bernini
		Air Vein (MJ3H)	Impulse	High-speed
Quantity		1	3	16
Fuel		Natural Gas	Natural Gas	Natural Gas
Calorific value		3'500.000 kcal/h	960.000 kcal/h	160.000 kcal/h
Estimated natural gas consumption		104.000 m^3/month	70.000 m^3/month	4.500-12.000 m^3/month
Operational starting		Nov 06	May 07	Jun 07

ARCILLAS DE SOACHA 2				
SUBSTITUTED EQUIPMENT				
Process	SHAPING	DRYING	FIRING	
Equipment			Burner	
Characteristics			Beralmar Promatic	
			Closed distribution circuit	
Quantity			99 injectors	
Fuel			Carbon	
Calorific Power			50.000 Kcal/h	
Fuel consumption			73 - 82 g / min	
NEW EQUIPMENT INVENTORY				
Process	SHAPING	DRYING	FIRING	
Equipment		Burner	Burner	Burner
Characteristics		Wayler	Bernini	Bernini
		Air Vein (MJ3H)	Impulse	High-speed
Quantity		1	3	16
Fuel		Natural Gas	Natural Gas	Natural Gas
Calorific value		1'200.000 kcal/h	960.000 kcal/h	160.000 kcal/h
Estimated natural gas consumption		52.000 m^3/month	70.000 m^3/month	4.500-12.000 m^3/month
Operational starting		Apr-07	May-07	Jun-07

SOACHA 1					
SUBSTITUTED EQUIPMENT					
Process	SHAPING	DRYING		FIRING	
Equipment	Boiler	Boiler	Heat Generator	Pulsar (Nafta)	
Characteristics	Dynaterm	Dynaterm	Eclipse	CEG "Morando"	
	acuatubular	acuatubular	-	BR C024	
Quantity	1	1	2	2	
Fuel	Coal	Coal	Crude Oil	Crude Oil	
Calorific Power	80 BHP	100 BHP	1'000.000 kcal/h	1'380.000 kcal/h	
Fuel consumption	54,02 ton/month	59,76 ton/month	6.989 gal/month	5.647 gal/month	
NEW EQUIPMENT INVENTORY					
Process	SHAPING	DRYING	FIRING		
Equipment	Boiler	Burner	Burner	Burner	Burner
Characteristics		Baltur	Morando	Morando	Morando
	Pirotubular	"Tubo de fuego"	Impulses	Impulses	High speed
Quantity	1	1	2	2	8
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Calorific value	100 BHP	5'076.000 kcal/h	960.000 kcal/h	960.000 kcal/h	160.000 kcal/h
Estimated natural gas consumption	40.560 m^3/month	83.000 m^3/month	27.000 m^3/month	27.000 m^3/month	4.500 - 12.000 m^3/month
Operational starting	Mar-07	Sep-05	Jan-06	Jan-07	Apr-06

SOACHA 3						
SUBSTITUTED EQUIPMENT						
Process	SHAPING	DRYING		FIRING		
Equipment		Caldera		Pulsar (Nafta)	Air-fuel	
Characteristics		Dynaterm		CEG "Unimorando"	CEG "Unimorando"	
		Acuatubular		BR C024	BR C041	
Quantity		1		1	1	
Fuel		Coal		Crude Oil	Crude Oil	
Calorific Power		460 BHP		1'380.000 kcal/h	1'380.000 kcal/h	
Fuel consumption		302,55 ton/month		10.520 gal/month	10.520 gal/month	
NEW EQUIPMENT INVENTORY						
Process	SHAPING	DRYING		FIRING		
Equipment	Caldera	Burner	Burner	Burner	Burner	Burner
Characteristics	Power-master	CEG "Unimorando"	Wayler	Morando	Morando	Morando
	Pirotubular	Air Vein (Category)	Air Vein (MJ3H)	Impulses	Impulses	High speed
Quantity	1	1	2	2	2	8
Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Calorific Power	100 BHP	1'204.000 kcal/h	2'000.000 kcal/h	960.000 kcal/h	960.000 kcal/h	160.000 kcal/h
Estimated natural gas consumption	40.560 m^3/month	26.000 m^3/month	52.000 m^3/month	45.000 m^3/month	45.000 m^3/month	4.500 - 12.000 m^3/month
Operational starting	Sep-06	Sep-06	Sep-06	Jan-06	Jan-07	Apr-06

USME 2				
SUBSTITUTED EQUIPMENT				
Process	SHAPING	DRYING	FIRING	
Equipment		Hornilla	Carbojet	
Characteristics		-	-	
		-	-	
Quantity		1	6	
Fuel		Coal	Coal	
Calorific Power		400.000 Kcal/h	600.000 Kcal/h	
Fuel consumption		38,35 (Ton/month)	58,37 (Ton/month)	
NEW EQUIPMENT INVENTORY				
Process	SHAPING	DRYING	FIRING	
Equipment	Boiler	Burner	Burner	Burner
Characteristics		Wayler	Morando	Bernini
	Pirotubular	Air vein (MJ3)	High speed	Impulses
Quantity	1	2	16	6
Fuel	Natural gas	Natural gas	Natural gas	Natural gas
Calorific power	100 BHP	2'000.000 kcal/h	160.000 kcal/h	902.400 kcal/h
Estimated natural gas consumption	40.560 m^3/month	33.000 - 150.000 m^3/month	4.500 - 12.000 m^3/month	46.000 - 70.000 m^3/month
Operational starting	Ago-06	Ago-06	Ago-06	Dic-06

USME 3				
SUBSTITUTED EQUIPMENT				
Process	SHAPING	DRYING	FIRING	
Equipment			Carbojet	
Characteristics			-	
			-	
Quantity			12	
Fuel			Carbon	
Calorific Power			600.000 Kcal/h	
Fuel consumption			58,37 (Ton/month)	
NEW EQUIPMENT INVENTORY				
Process	SHAPING	DRYING	FIRING	
Equipment			Burner	Burner
Characteristics			Morando	Bernini
			High speed	Impulse
Quantity			32	12
Fuel			Natural gas	Natural gas
Calorific power			160.000 kcal/h	902.400 kcal/h
Estimated natural gas consumption			4.500 - 12.000 m3/month	46.000 - 70.000 m3/month
Operational starting			Ago-06	Dic-06

Equipments already running on natural gas already are showing an adequate performance in terms of energy efficiency and quality of the final product but higher operating costs. Probably, in the mid term, more equipment will be substituted, and, progressively, a higher percentage of liquid and fossil fuels will be replaced by natural gas, allowing additional GHG reductions. These additional modifications are not already defined, and will be established considering the experience of the first stages of the project and the financial situation of the company Ladrillera Santafé[5].

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Next table shows the estimated GHG reductions considering the equipment already planned.

[5] The installation of equipments in the Soacha 2 plant is being analyzed actually.

EMISSIONS REDUCTION (tCO2e)											
PLANT	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
AS1	4.624	4.624	4.624	4.624	4.624	4.624	4.624	4.624	4.624	4.624	46.237
AS2	5.719	5.719	5.719	5.719	5.719	5.719	5.719	5.719	5.719	5.719	57.194
S1	3.217	3.217	3.217	3.217	3.217	3.217	3.217	3.217	3.217	3.217	32.173
S3	6.816	6.816	6.816	6.816	6.816	6.816	6.816	6.816	6.816	6.816	68.162
U2	5.735	5.735	5.735	5.735	5.735	5.735	5.735	5.735	5.735	5.735	57.346
U3	17.944	17.944	17.944	17.944	17.944	17.944	17.944	17.944	17.944	17.944	179.437
TOTAL	44.055	44.055	44.055	44.055	44.055	44.055	44.055	44.055	44.055	44.055	440.548

A.4.4. Public funding of the small-scale project activity:

The project activity is not provided with any type of public financing.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Appendix C of the simplified modalities and procedures for the small-scale CDM project activities, the project activity is not a part of a larger project activity because there isn't a registered small scale CDM project activity or an application to register another small-scale project activity:

- with the same project participants; and
- in the same project category and technology/measure; and
- registered within the previous 2 years; and
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology

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

AMS-III.B. Switching fossil fuels / Version 11

B.2 Justification of the choice of the project category:

The project activity qualifies as project *TYPE III-OTHER PROJECT ACTIVITIES* and category *III.B switching fossils fuels* because the next conditions are fulfilled:

- The project activity comprises replacing coal and crude for natural gas in industrial applications. Energy efficiency could be also be improved as a consequence of the fuel switching, but the primary aim of the project activity is to reduce emissions through the fuel switching.

- The project has estimated an annual emission reductions of 44.055 tCO_2e per year, therefore emissions reductions are less than 60.000 CO_2e, qualifying the project as a small scale project[6].

B.3. Description of the project boundary:

As stated by AMS- III.B, the project boundary is the physical, geographical site where the fuel combustion affected by the fuel-switching measure occurs. Thus, for the purpose of determining project activity emissions, carbon dioxide emissions of fuel in each element process are considered in the calculations so the project activity encompasses the physical, geographical area of the installations of Arcillas de Soacha, Soacha and Usme.

Conforming to the guidelines and rules for small-scale project activities, the emissions related to production, transport and distribution of the fuel used in the power plants in the baseline are not included in the project boundary, as these do not occur at the physical and geographical site of the project. For the same reason, emissions related to the transport and are also excluded from the project boundary.

B.4. Description of baseline and its development:

The emissions baseline is calculated as the current emissions of each element process that would occur in absence of the project activity. Thus, the emissions baseline is expressed as a ratio of emissions per unit of relevant output for each element process (tonnes of bricks delivered to logistic department).

The ratio of emissions per unit output is calculated as follows:

$$R_{baseline,i} = \frac{CO_{baseline,i} \cdot NCV_{CO} \cdot EF_{CO} + C_{baseline,i} NCV_{C} \cdot EF_{C} + DO_{baseline,i} NCV_{DO} \cdot EF_{DO}}{OP_{baseline,i}}$$

Where:

$R_{baseline,i}$	Ratio of emissions per unit relevant output for the element process (tonne of final product) for the element process *i* in the baseline.
$CO_{baseline,i}$	Average yearly quantity of crude oil combusted in the element process *i* in tonnes
NCV_{CO}	Average net calorific value of the crude oil in TJ/tonnes (corrected by fuel burning efficiency factor)
EF_{CO}	Emission factor of the crude oil in tCO_2/TJ
$C_{baseline,i}$	Average yearly quantity coal combusted in the element process *i* in tonnes.
NCV_{C}	Average net calorific value of coal in TJ/tonnes (corrected by fuel burning efficiency factor)
EF_{C}	Emission factor of coal in tCO_2/TJ

[6] The estimation of project emissions during the crediting period is listed in section A.4.3.1.

$DO_{baseline,i}$	Average yearly quantity diesel oil combusted in the element process *i* in tonnes.
NCV_{DO}	Average net calorific value of diesel oil in TJ/tonnes (corrected by fuel burning efficiency factor)
EF_{DO}	Emission factor of the diesel oil tCO_2/TJ
$OP_{baseline,i}$	Average yearly quantity of relevant output form the process *i* (tonnes of final product)

Average yearly quantity of each fuel and production were calculated from averages of monthly data to obtain baseline emission factors per ton of final product.(see Annex III).

BASELINE EMISSIONS						
Plant	AS1	AS2	S1	S3	U2	U3
tCO2/t of final product	0,227	0,222	0,207	0,288	0,260	0,222

Emission factors and NCVs applied in these calculations are country specific and provided by a recognized sources. Coal NCV has been obtained from assays performed by the Colombian Geological Service. The rest of net calorific values and the emissions coefficients have been taken from the electronic document "*Factores de emisión para los combustibles colombianos",* elaborated by FECOC, UPME and the Colombian Science Academy. Densities of ACPM and Crude oil have been obtained from the document "*Portafolio Colombiano de Proyectos para el MDL – Sector energía*" and from Ecopetrol webpage[7].

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 small-scale CDM project activity:

The project activity involves a fuel switch to natural gas in industrial equipments that historically used more carbon intensives fuels like crude oil , coal and diesel oil (also called ACPM). The fuel switch started in January 2005, when the replacement of the equipments that used crude by new ones running on natural gas was completed in Soacha 1 and Soacha 3 plants. In 2006 and 2007 other fuel changes were implemented. The industry considered that, by the end of 2007, about 40% of the total energy consumption of the industries will be covered by gas.

The Project Developers took the decision to move ahead considering CDM benefits under the Kyoto Protocol. During the gas delivery negotiations between the industrial facility (Ladrillera Santafé) and the natural gas supplier (Gas Natural ESP), this last offered the assistance in developing the project as a CDM project[8] applying its knowledge in this field.[9]

[7] See http://www.ecopetrol.com.co/contenido.aspx?catID=210&conID=36446&pagID=127939

[8] This negotiation was carry out by Mauricio Daza (Gas Natural ESP) and members of Ladrillera SantaFé.

[9] Gas Natural ESP had already considered this factor in other fuel switching initiatives, appreciating that the CER revenue could alleviate the investment barriers associated to implementation of more efficient technologies[9].

Because of the actual difference in costs between natural gas and other fossil fuels, besides investment assumed during this period, Ladrillera Santafé do not consider any more fuel switching in a medium term. In this sense, the CDM project could promote the use of a less carbon intensive fuel such as gas.

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small scale project activities, evidence as to why the proposed project is additional can be shown by conducting an analysis of any of the following: (1) investment barriers, (2) technological barriers, (3) prevailing practice or (4) other barriers.

The "Fuel switching to Natural Gas in Ladrillera Santafé Project" would have not occurred without the CDM because of the existence of (1) investment barriers. Additionally, it is worth pointing out that the project activity could not be considered as a prevailing practice (3).

(1) Investment barriers

Nowadays natural gas is a non-traded energy on a global scale in Colombia. It competes in price with the crude oil. In case of the coal, the cost is historically a third part of the price of the natural gas. Diesel oil or ACPM (Spanish abbreviation of "combustible oil for engines") is a very expensive energy source and, generally, only used in emergency or to star up some equipments.

Energy prices in the Bogotá area	
Energy source	US$/MWh
Diesel (ACPM)	54,21
Crude oil	32,48
Natural gas	27,05
Mineral Coal	7,42

Source: *Canasta de Energéticos Colombianos. Precios Bogotá D.C.* December 11th, 2006

Due to the importance of switching from coal to natural gas, overall combustible cost in the project scenario is higher than in the baseline one. Considering last four years data from the factories involved and the fuel costs shown above, it is possible to determine that fuel costs will increase in approximately 5,25 million US$/year.

Additionally, the projects demands investment associated with the equipments that must be substituted in the plants. To be conservative there are only considered changes planned until June 2007.

The project will also involve product stoppages due to the assembly of the new equipments and the execution of the infrastructures needed. Investments in other fields (formation, new procedures development, etc) will be also necessary. These aspects are not considered in the financial analysis.

Considering this information, a cost analysis of the investment associated to the project provide a negative value of NPV even bearing in mind the income provided by the selling of CERs (about -37,9 millions US$). Without considering this income, a NPV of -40,3 millions US$ is obtained[10].

Considering these values, the project is not financially attractive, but its registration as small scale CDM will allow minimizing its economic disadvantages. Therefore, it is possible to conclude that it is an additional project from the point of view of the financial analysis.

(3).- Prevailing practices

The development of the natural gas industry in Colombia is recent. Although there were limited uses of this combustible from the 50s, its common use began in the middle of the 70s, with the use of the gas discovered in the Atlantic area of the country (The Guajira) in order to replace exportable fuel oil that was consumed in the thermal generation of the Atlantic Coast.

During the year 2005, of an entire final energy consumption of 227.114 Teracalories, the participation of the natural gas in the national energy basket was 9,1 %, oil and derivatives 43,2 %, electricity 14,7 %, mineral coal 7,2 %, firewood and bagasse 10,7 %, alcohol fuel 0,1 %, and another fuels 14,9 %.

Considering the Colombian brick sector individually, the use of natural gas could be clearly identified as an uncommon practice. This sector could be considered immature in comparison to international standards. Thanks to the increasing demand during the 90´s an important modernization was registered. This process supposed the use of more efficient kilns, processes and fuels.

However, the economic recession of the beginning of the 21st century, forces this sector to considerer most polluting fuels due to their lower prizes. This situation is analyzed by UPME in the document "*Determinación de la Eficiencia Energética del Subsector Industrial de Ladrillo, Vidrio y Cerámica*", where natural gas is not identified as a fuel in this kind of industrial facilities, and an important opportunity to modernize processes is highlighted for this sector.

Additionally, the document "*Portafolio colombiano de proyectos para el MDL*" indicates that switching from crude to natural gas in industrial facilities located in the Bogotá area is considered environmentally and economically additional. Therefore, the analysis of similar activities point out that it is not necessary to consider the project to be a common practice and, therefore, it is possible to assume that it is not a "*business as usual scenario*".

Table below summarizes the result of the analysis regarding the barriers faced by each of the plausible scenarios. In this analysis, prevailing practices is not considered as a project barrier, but confirm that the project scenario is not the same as the baseline scenario.

[10] This calculation has considered the next additional values: IRR: 15%, CDM certification costs of 16.400 $/year, a 35% taxation of the investments, an operational life of 20 years and a revenue of 10 €/CER. The value of NPV varies significantly if these variables are changed, but it keeps negative if reasonable values are used. Cost associated to processes stoppages, have not been taken into account. Annex 5 includes more details of this calculation.

Barrier Evaluated		Scenario 1 continuation of the usage of more intensive fossil fuels	Scenario 2 project activity with fuel switch to natural gas
1.	Financial / Economical	No	Yes
2.	Technical / Technological	No	No
3.	Prevailing Business Practice	No	No
4.	Other Barriers	No	No

The planned registration as a CDM activity of the Ladrillera Santafé Natural Gas Fuel Switch Project and the resulting revenue streams derived from the project activity will alleviate the barriers indicated above and enable the project to be undertaken.

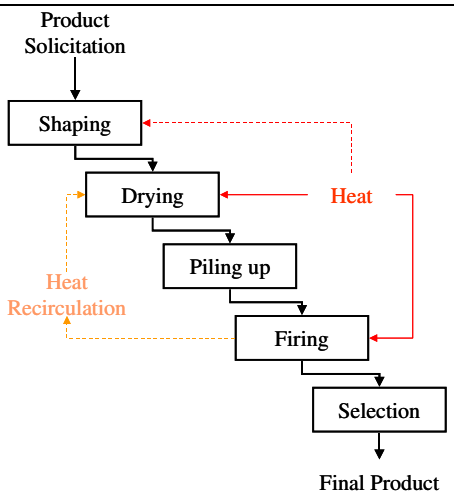
B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The methodology "III.B. Switching fossil fuels", which also includes the monitoring methodology, have been applied to determine emission reductions.

The plants involved in the project activity use an important part of the heat generated in the main process (firing) to reduce the fuel consumption in other previous stages. A hot air recirculation from the main furnace to the drying process is the most common practice implemented in this field.

Plant functioning flowchart:



Therefore, fuel switching doesn't affect only the element process where equipments are replaced, and modify overall efficiency of the plant. Considering this situation, every plant involved in the project is considered as a single element process in order to calculate GHG emissions.

Baseline is calculated considering the relation between the energy consumption and the production of final product.

Baseline emissions

During the crediting period, the baseline emissions per unit output for each plant are calculated as follows using the historical ratio of emissions per unit output and the monitored output quantity of bricks produced in each element process (see chapter B.4).

$$BE_{i,y} = OP_{i,y} \cdot R_{baseline,i}$$

Where:

$BE_{i,y}$	Baseline emissions in process *i* during the year *y*.
$R_{baseline,i}$	Ratio of emissions per unit relevant output for the element process (tonnes of final product) for the element process *i* in the baseline.
$OP_{baseline,i}$	Average yearly quantity of relevant output form the process *i* (tonnes of final product)

Project emissions

Project activity direct emissions consist of those emissions related with the use of fossil fuel after the fuel switch. During the project activity, project emissions $PE_{i,y}$ will be calculated as follows based on monitored data of natural gas and other fossils fuels usage in each element process.

$$PE_{i,y} = CO_{project,i} \cdot NCV_{CO} \cdot EF_{CO} + C_{project,i} NCV_{C} \cdot EF_{C} + DO_{project,i} NCV_{DO} \cdot EF_{DO} + NG_{project,i} EF_{NG} NCV_{NG}$$

$PE_{i,y}$	Project activity emissions in element process *i* during the year *y*
$CO_{project,y}$	Quantity of crude oil combusted in the element process *i* in tonnes
NCV_{CO}	Average net calorific value of crude oil in TJ/tonnes
EF_{CO}	Emission factor of the crude oil in tCO_2/TJ
$C_{baseline,i}$	Quantity coal combusted in the element process *i* in tonnes.
NCV_{C}	Average net calorific value of coal in TJ/tonnes
EF_{C}	Emission factor of coal in tCO_2/TJ
$DO_{baseline,i}$	Quantity diesel oil combusted in the element process *i* in tonnes.
NCV_{DO}	Average net calorific value of diesel oil in TJ/tonnes

EF_{DO}	Emission factor of the diesel oil tCO_2/TJ
$NG_{project,y}$	Quantity of natural gas combusted in the element process *i* during the year y
NCV_{NG}	Average net calorific value of natural gas
EF_{NG}	Emission factor of natural gas in tCO_2/TJ

Leakage

According to AMS-III.B. Switching fossil fuels no leakage calculation is required

Emission reduction calculations

$$ER_y = \sum_i (BE_{i,y} - PE_{i,y})$$

Where:

ER_y	Annual emissions reductions in the year *y*, in tCO_2e
$BE_{i,y}$	Baseline emissions in process *i* during the year *y*, in tCO_2e
PE_y	Project activity emissions in element process *i* during the year *y*, in tCO_2e

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

Data / Parameter:	NCV_{NG}
Data unit:	MWh/m^3 (natural gas)
Description:	Average net calorific value of natural gas (corrected by fuel burning efficiency factor)
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	0,0093889
Justification of the choice of data or description of measurement methods and procedures actually applied:	For natural gas, this parameter could vary considerably depending on its composition. The NCV considered is very similar to that provided by the natural gas supplier (Gas Natural ESP).
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

Data / Parameter:	NCV_{CO}
Data unit:	TJ/kt
Description:	Average net calorific value of crude oil
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	39,64
Justification of the choice of data or description of measurement methods and procedures actually applied:	Country specific value provided by recognized sources.
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

Data / Parameter:	NCV_{C}
Data unit:	TJ/kt
Description:	Average net calorific value of coal
Source of data used:	Average value registered from January 2003 to September 2006 .
Value applied:	31,09
Justification of the choice of data or description of measurement methods and procedures actually applied:	The Net Calorific Value of this fuel is measured by the Direction of the Geological Service, so this value provide more accuracy to GHG calculations than country standards.
Any comment:	Two assays (one in Usme plants and other in Soacha plants) have been developed. Both have obtained very similar figures, so main values are applied in GHG calculations. Original values indicates GCV that have been converted to NCV applying the equation included in page 1.17 of "*2006 IPCC Guidelines for National Greenhouse Inventories*".

Data / Parameter:	NCV_{DO}
Data unit:	TJ/kt
Description:	Average net calorific value of diesel oil (ACPM)
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	42,37
Justification of the choice of data or description of measurement methods and procedures actually applied:	Country specific value provided by recognized sources.
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

Data / Parameter:	EF_{NG}:
Data unit:	$kgCO_2/GJ$
Description:	Emission factor of natural gas.
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	55.101
Justification of the choice of data or description of measurement methods and procedures actually applied:	Country specific value provided by recognized sources.
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

Data / Parameter:	EF_{CO}:
Data unit:	$kgCO_2/GJ$
Description:	Emission factor of crude oil
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	77.956
Justification of the choice of data or description of measurement methods and procedures actually applied:	Country specific value provided by recognized sources.
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

Data / Parameter:	EF_C
Data unit:	$kgCO_2/GJ$
Description:	Emission factor of coal
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	97.257
Justification of the choice of data or description of measurement methods and procedures actually applied:	Country specific value provided by recognized sources.
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

Data / Parameter:	EF_{DO}
Data unit:	$kgCO_2/GJ$
Description:	Emission factor of coal
Source of data used:	FECOC, UPME and The Colombian Science Academy: *Factores de emisión para los combustibles colombianos.*
Value applied:	74.869
Justification of the choice of data or description of measurement methods and procedures actually applied:	Country specific value provided by recognized sources.
Any comment:	Value indicated in SIAME (http://www.upme.gov.co/sima/index.aspx)

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante emission reductions from the project activity are calculated as follows:

1. Average historical yearly output for each element process *i* is used in place of the actual yearly output, which will be monitored.

2. The quantity of natural gas combusted in each element process *i* in project scenario, (to be monitored) is estimated, considering the average energy consumption of the substitute equipments.

3. The quantity of other fossil fuels combusted during the project activity (to be monitored) is calculated based on the average quantity of each fossil fuel used per year in the baseline.

Project scenario is estimated with the new ratio of emissions in each element process *i* in each year of project activity considering average historical output for each element process:

$$R_{PS,i} = \frac{CO_{PS,i} NCV_{CO} \cdot EF_{CO} + C_{PS} NCV_{C} \cdot EF_{C} + DO_{PS} NCV_{DO} \cdot EF_{DO} + NG_{PS,i} NCV_{NG} \cdot EF_{NG}}{OP_{baseline,i}}$$

Thus the ex-ante emission reductions will be:

$$R_{PS,i} = \frac{CO_{PS,i} NCV_{CO} \cdot EF_{CO} + C_{PS} NCV_{C} \cdot EF_{C} + DO_{PS} NCV_{DO} \cdot EF_{DO} + NG_{PS,i} NCV_{NG} \cdot EF_{NG}}{OP_{baseline,i}}$$

Thus:

$$ER = OP_{baseline,i} \cdot (R_{baseline,i} - R_{PS,i})$$

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

BASELINE EMISSIONS							
Year	**AS1**	**AS2**	**S1**	**S3**	**U2**	**U3**	**Total**
2008	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2009	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2010	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2011	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2012	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2013	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2014	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2015	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2016	10.667	13.427	28.082	39.084	17.182	55.196	163.639
2017	10.667	13.427	28.082	39.084	17.182	55.196	163.639
Total	106.672	134.268	280.822	390.841	171.820	551.965	1.636.387

PROJECT EMISSIONS							
Year	**AS1**	**AS2**	**S1**	**S3**	**U2**	**U3**	**Total**
2008	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2009	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2010	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2011	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2012	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2013	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2014	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2015	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2016	6.043	7.707	24.865	32.268	11.447	37.253	119.584
2017	6.043	7.707	24.865	32.268	11.447	37.253	119.584
Total	60.435	77.074	248.650	322.679	114.474	372.528	1.195.840

EMISSIONS REDUCTIONS							
Year	**AS1**	**AS2**	**S1**	**S3**	**U2**	**U3**	**Total**
2008	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2009	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2010	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2011	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2012	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2013	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2014	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2015	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2016	4.624	5.719	3.217	6.816	5.735	17.944	44.055
2017	4.624	5.719	3.217	6.816	5.735	17.944	44.055
Total	46.237	57.194	32.173	68.162	57.346	179.437	440.548

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

B.7.1 Data and parameters monitored:

Next tables show the data and parameters that shall be monitored.

Data / Parameter:	$OP_{i,y}$
Data unit:	Tonnes of final product
Description:	Final product delivered to logistic departments during the year *y* for each element process *i*
Source of data to be used:	Recorded monthly following the procedures actually established.
Value of data	-
Description of measurement methods and procedures to be applied:	Production is actually recorded following the procedures established in the plants.
QA/QC procedures to be applied:	Monitoring production for each element process is a usual practice in the industrial plants.
Any comment:	Data of tonnes delivered to the Logistics Department are used to calculate this data.

Data / Parameter:	$NG_{project,i,y}$
Data unit:	m^3 (natural gas)
Description:	Quantity or natural gas combusted during year *y* in each element process *i*
Source of data to be used:	Natural gas consumption will be monitored through gas meters and invoices
Value of data	N/A
Description of measurement methods and procedures to be applied:	Measure gas flow continuously with the gas meters. Archive electronically and paper. Values recorded are compared with invoices from the natural gas supplier.
QA/QC procedures to be applied:	Natural flow meters shall be calibrated by laboratories accredited by the Ministerio de Economía de Colombia. The measurements can be compared to the invoices of the local seller
Any comment:	-..

Data / Parameter:	$C_{project,i}$
Data unit:	Tonnes
Description:	Quantity or coal combusted during year *y* in each element process *i*
Source of data to be used:	Recorded monthly following the procedures actually established.
Value of data	-
Description of measurement methods and procedures to be applied:	Consumption is actually recorded following the procedures established in the plants where this fuel is used.
QA/QC procedures to be applied:	Monitoring production for each element process is a usual practice in the industrial plants.
Any comment:	-

Data / Parameter:	$CO_{project,i}$
Data unit:	Gallons
Description:	Quantity or crude oil combusted during year *y* in each element process *i*
Source of data to be used:	Recorded monthly following the procedures actually established.
Value of data	-
Description of measurement methods and procedures to be applied:	Consumption is actually recorded following the procedures established in the plants where this fuel is used.
QA/QC procedures to be applied:	Monitoring production for each element process is a usual practice in the industrial plants.
Any comment:	-

Data / Parameter:	$DO_{project,\ i}$
Data unit:	Gallons
Description:	Quantity of ACPM combusted during year *y* in each element process *i*
Source of data to be used:	Recorded monthly following the procedures actually established.
Value of data	-
Description of measurement methods and procedures to be applied:	Consumption is actually recorded following the procedures established in the plants where this fuel is used.
QA/QC procedures to be applied:	Monitoring production for each element process is a usual practice in the industrial plants.
Any comment:	-

B.7.2 Description of the monitoring plan:

The monitoring plan fit the requisites established by the methodology *III.B /Version 11: Switching fossil fuels*:

- Monitoring of the fuel use and output prior to the fuel switch being implemented: this operations has been completed and the data obtained are included in the present document.
- Monitoring fuel use and output after fuel switch has been implemented: will be developed during the crediting period.

The monitoring of the fixed parameters used to value GHG emissions (as emission factors or average net calorific values) is not considered to be precise, although any of the parameters can be checked if new values clearly discordant are published or obtained from recognized sources.

All data shall be archived electronically. The recording frequencies are:

- $FF_{project,i,y}$: (fuels consumption): monthly[11].
- OP_y: (production delivered to logistics department): monthly[12].

In order to assure QC and QA, monitoring task will be clearly defined by the independent document described in the Annex 4.

[11] Measured continuously in some cases but always recorded monthly in electronic spreadsheets.

[12] Measured continuously in some cases but always recorded monthly in electronic spreadsheets.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion of the application of the baseline study and monitoring methodology: Con formato

21th February, 2007

Name of the responsible person(s)/entity(ies): Con formato

Jorge Paz Jiménez,
NOVOTEC CONSULTORES S.A.
Dpto. Medio Ambiente - AA.PP. y Utilities
C/ Campezo, 1
Edificio 4, Planta 1
28022 Madrid
España
Tel.: +34 91 210 79 00
Fax: +34 91 210 79 03
E-mail: jpaz@novotec.es

Pablo Cesar Sierra Sierra
APPLUS NORCONTROL COLOMBIA LTDA
Environment Division
Carrera 11 No. 73-32, Piso 2
Bogotá
Colombia
PBX: +57 (571) 376 50 00
Fax: + 57 (571) 376 50 05
E-mail: psierra@appluscorp.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

Con formato

C.1.1. Starting date of the project activity:

First natural gas equipments have started operating throughout the year 2005.

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

More than 20 years

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

A fixed crediting period has been selected. .

C.2.1. Renewable crediting period

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

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2008

C.2.2.2. Length:

Ten years

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The project activity contemplates the replacement of equipments of combustion that previously were operating with liquid and/or solid fossil fuels by new equipments that will use natural gas as combustible. This modification will not increase the global capacity of the plants and, in addition to the reduction of the emission of GHGs, will generate several additional environmental benefits.

Due to its positive effect, the analysis of the environmental impacts of the project is not required by the host Party. However it is possible to stress the next circumstances in this way:

- Between the environmental benefits that the project will bring to the local population, it is possible to emphasize the reduction of the pollutants' emission with effects of local type. The crude oil is a fuel with calorific properties comparable to those of the fuel oil, but with higher contents in sulfur and heavy metals, for what its combustion involves the liberation of important quantities of these compounds and particulate matter (PM). The coal is also a fuel with high specific emission, being possible to stress its emissions of oxides of nitrogen (NO_X), sulphur compounds (SO_X), carbon monoxide (CO) and particulate matter (PM). Thanks to its composition and a cleaner combustion, the utilization of natural gas in these equipments will suppose a drastic reduction of the emission of PM, heavy metals, CO, SO_X and other atmospheric pollutants. The use of this fuel also will allow to reduce the emission of NO_X, that are between the most important pollutants both at a local and a regional level, since they are important tropospheric ozone precursors.
- This reduction of the emission is especially important for the population of the area where the facilities are located. As consequence of the accumulation of industries and other polluting sources, the air quality of the south zone of the metropolitan region of Bogotá is seriously threatened. Between the most important sources it is possible to emphasize the numerous industries of the region, of which it is suspected that sometimes they do not fulfill with the values legally established[13].
- The project activity also constitutes an example of good environmental practices for the rest of the industrial present plants in the zone. At the same time, as a consequence of the execution of the project activity, the natural gas network is reinforced, and connections of other industrial facilities are facilitated in the future.
- It is necessary to emphasize that in Usme there is located one of the scarce spaces protected in the region of Bogotá, (called *Entrenubes*), which also will be beneficed from the improvement of the air quality and the reduction of the pollutants' deposition in its water and terrestrial ecosystems.

[13] This aspect is analyzed in the *Resolution Nº 1386 of 2006* of the Autonomous Regional Corporation of Cundinamarca.

- At the same time, on the surroundings of Soacha a heavy vehicular traffic has become an increasing problem. The use of a canalized fuel as the natural gas will allow reducing the transit of heavy vehicles used in the coal and crude oil distribution, avoiding completely the atmospheric and acoustic emission associated to their activity and diminishing the risk of associate accidents.
- The negative aspects associated with the execution and operation of the project activity are slightly important. The most important ones are the construction of a natural gas supplying pipeline and the material and energy consumptions associated to the preoperational stages. The importance of these aspects is clearly lower than the social and environmental benefits that the project activity brings.

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

The environmental impacts associated with the project activity are positive. In accordance with the Colombian legislation, this kind of projects does not imply the development of an environmental impact assessment.

SECTION E. Stakeholders' comments

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

Local stakeholders´ comments have been obtained trough the development of a consultation process. This process has included the following stages.

Selection of the stakeholders:

The implicated agents have been selected among these categories:

- Universities
- Other Industrial Companies
- Industrial associations
- Public administrations
- NGOs
- Factory neighbors

Design of the questionnaire to be submitted

A questionnaire has been designed to obtain the stakeholders comments. This document has the next contents:

- Brief introduction of the climate change process and its impacts on a global and a local scale.
- Description of the project activity.
- Presentation of the project participants.
- Questions about the environmental, economic and social implications of the project.
- Contact information.

The questions included in this document are the following ones:

- In accordance with the information which you have, indicate briefly your opinion about the project.
- Do you think that this project contributes to the social, economic and environmental development of the Department of Cundinamarca?
- Do you think that this project contributes to the social, economic and environmental development of Colombia?
- How do you consider that will affect to you the development of the project? (Indicate if the effect is positive or negative and the causes).

- Do you think that, in general terms, the project is positive and it should be repeated in other industries?
- Indicate any additional comment.

Delivering of the questionnaires

The questionnaires have been sent to the selected stakeholders. Most of them have been sent by e-mail, but fax and conventional mail have also been used in some cases.

Compilation of the responses

Responses have been received by e-mail or by conventional mail. At the moment, eleven stakeholders have answered the consultation.

Organization	Name	Surname	Position	City	Answer received
Acuaviva Sociedad Anónima E.S.P.	Álvaro	Arbelaez Sans	General Manager	Palmira	
Aseo Técnico de la Sabana S.A. E.S.P.	Carlos Germán	Arroyave Zuluaga	General Manager	Bogotá	
Aseo Urbano S.A. E.S.P.	Ángel Uriel	Garcia Torres	Manager	Cúcuta	
Ciudad Limpia Bogota S.A. E.S.P.	Gina	Lasso Silva	Environmental professional	Bogotá	Yes
CODENSA S.A. ESP	Magda Patricia	Diaz Muñoz	Environment Unit Manager	Bogotá	
Consorcio Lime S.A. E.S.P	Julio Cesar	Hernandez	General Manager	Bogotá	
E.P.M. Bogota Aguas S.A. E.S.P.	Víctor Rodrigo	Velez	President	Bogotá	
Trans Gases del Interior	Jairo	Jaimes	Environment Unit Manager	Bucaramanga	Yes
Empresa de Acueducto y Alcantarillado de Bogotá E.S.P.	Sonia Raquel	Duarte Cely	Environmental Department Technical Director	Bogotá	
Empresa de Energía de Bogotá S.A. E.S.P.	Lucy	Vileikis	Environmental Director	Bogotá	
Interconexión Eléctrica S.A.	Dario	Castrillón	Environmental Analyst	Medellín	Yes
Proactiva Doña Juana S.A. ESP	Manuel Vicente	Barrera Medina		Bogotá	Yes
Corporación Autónoma Regional de Cundinamarca	Edgar	Erazo	Development Sub director	Bogotá	
Universidad del Rosario	Beatriz	Londoño			Yes
Asociación Nacional de Industriales	Carlos	Herrera			Yes

Organization	Name	Surname	Position	City	Answer received
Asociacion Nacional de Empresas Prestadoras de Servicios Públicos Domiciliarios	Mónica	Uribe			
Empresa de Energía de Bogota S.A. E.S.P.	Etelvina	Mendez			Yes
Empresa Colombiana de Petróleos	Wilson	Zapata	Business Management Engineer		
Cámara de la Construcción en Colombia	María Paula	Camacho	Legal Studio Director	Bogotá	Yes
Junta de Acción Comunal	Hernando	Sopho	JAC Member	Soacha	
Junta de Acción Comunal	Gloria Miriam	Vega	Vice-President JAC	Bogotá	Yes
Conjunto de la Vega del Bosque. Etapa I	Luís Alfonso	Riveros Martínez	Factory neighbor	Bogotá	Yes
	Ricardo	Montaño	Factory neighbor	Bogotá	Yes
Secretaría Distrital de Ambiente. Oficina de Control de Emisiones	Eder	Pedraza	Funcionario	Bogota	Yes

Analysis of the received responses

Received questionnaires have been recorded electronically in a database. Answers have been compared and differences highlighted. The grade of participation and the received responses are analyzed in the next paragraph.

E.2. Summary of the comments received:

Half of the consulted stakeholders have returned their questionnaires. The answers received includes institutional and private agents, constituting a cross section of selected stakeholders.

All questionnaires received indicate that project provide important benefices to the local stakeholders. Air quality improvement and climate change mitigation have been highlighted as the main benefices.

Public administration indicates that the project will bring an environmental impacts reduction, contributing to the sustainable development. The responses received from the industrial sector have also stressed that fuel switching and technological updating contribute to mitigate the impact generated by the emissions from coal and other fuels, improving working conditions and local air quality.

Factory neighbours responses emphasize the benefices for children's and senior citizens from cleaner air. These questionnaires also indicate that, developing the project, Ladrillera Santafé makes a great contribution to the social and economic development of the town and the department, and several responses consider that the project should be replicated in other industrial facilities.

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

All the comments received indicate that the project is completely beneficial for the community. If questionnaires received during the next days reflect that any aspect of interest has not been considered in this PDD, this shall be modified appropriately in future versions of this document.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Gas Natural SDG
Street/P.O.Box:	Plaça del Gas, 1.
Building:	Gas Natural
City:	Barcelona
State/Region:	Barcelona
Postfix/ZIP:	08003
Country:	Spain
Telephone:	+34 93 402 5179
FAX:	
E-Mail:	mbeltran@gasnatural.com
URL:	www.gasnatural.com
Represented by:	
Title:	Head of Energy Efficiency & CDM projects
Salutation:	Ms
Last Name:	Beltrán
Middle Name:	
First Name:	Montserrat
Department:	Energy Efficiency & CDM projects
Mobile:	
Direct FAX:	+34 93 402 9300
Direct tel:	+34 93 402 5615
Personal E-Mail:	

Organization:	Gas Natural S.A E.S.P.
Street/P.O.Box:	Calle 71a # 5-38
Building:	Edificio Calimas
City:	Bogotá
State/Region:	Cundinamarca
Postfix/ZIP:	
Country:	Colombia
Telephone:	00 (57) 1- 3485500
FAX:	00 (57) 1-3485512
E-Mail:	
URL:	www.gasnatural.com
Represented by:	
Title:	
Salutation:	
Last Name:	Daza
Middle Name:	
First Name:	Mauricio
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Ladrillera Santafé
Street/P.O.Box:	Carrera 9 No. 74 – 08. Oficina 602
Building:	
City:	Bogotá,
State/Region:	Bogotá, D.C.
Postfix/ZIP:	
Country:	Colombia
Telephone:	00 (57) 1- 31 90 330
FAX:	00 (57) 1- 31 90 330
E-Mail:	crojas@santafe.com.co
URL:	http://www.santafe.com.co/
Represented by:	
Title:	
Salutation:	Mr
Last Name:	Rojas
Middle Name:	
First Name:	Carlos
Department:	Vicepresidencia de Planeación y Desarrollo
Mobile:	
Direct FAX:	
Direct tel:	Ext. 1121
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project is not provided with public financing.

Annex 3

BASELINE INFORMATION

1. - Raw data

Arcillas de Soacha 1

Year	Months reported	Production (t)
2003	10	37,518
2004	12	61,832
2005	12	41,144
2006	9	20,183
Total	43	160,677
Average		44,840

Coal				
	t	Process	MWh	MWh/ton
2003	2.615	Coc	22.586.92	0,602
2004	4.002	Coc	34.563.61	0,559
2005	3.743	Coc	32.329.96	0,786
2006	1.689	Coc	14.586.06	0,723
Total	12.048		104.066.55	0,648
Average	3.362		29.041.83	0,648

	Total				
	MWh	TJ	MWh/ton	TJ/ton	kJ/ton
2003	22.587	81	0,602	0,002	2,167
2004	34.564	124	0,559	0,002	2,012
2005	32.330	116	0,786	0,003	2,829
2006	14.586	53	0,723	0,003	2,602
Total	104.067	375	0,648	0,002	2,332
Average	29.042	105	0,648	0,002	2,332

Arcillas de Soacha 2

Year	Months reported	Production (t)
2003	10	47,960
2004	12	68,713
2005	12	58,456
2006	9	41,219
Total	43	216,347
Average		**60,376**

Coal				
	t	Process	MWh	MWh/ton
2003	3.323	Coc	28.702	0,598
2004	4.349	Coc	37.568	0,547
2005	4.387	Coc	37.892	0,648
2006	3.147	Coc	27.185	0,660
Total	15.207		131.348	0,607
Average	4.244		36.655	0,607

ACPM				
	gallon	Process	MWh	MWh/ton
2003	26.895	Coc	1.223	0,026
2004	37.613	Coc	1.711	0,025
2005	48.226	Coc	2.193	0,038
2006	60.565	Coc	2.754	0,067
Total	173.299		7.881	0,036
Average	48.363		2.199	0,036

	Total				
	MWh	TJ	MWh/ton	TJ/ton	kJ/ton
2003	29.925	108	0,624	0,002	2,246
2004	39.279	141	0,572	0,002	2,058
2005	40.086	144	0,686	0,002	2,469
2006	29.940	108	0,726	0,003	2,615
Total	139.230	501	0,644	0,002	2,317
Average	38.855	140	0,644	0,002	2,317

Soacha 1

Year	Months reported	Production (t)
2003	12	79.413
2004	12	141.874
2005	12	115.915
2006	9	90.718
Total	45	427.920
Average		114.112

Coal				
	t	Process	MWh	MWh/ton
2003	1.143	Coc	9.869	0,124
2004	1.655	Coc	14.293	0,101
2005	671	Coc	5.794	0,050
2006	525	Coc	4.532	0,050
Total	3.993		34.488	0,081
Average	1.065		9.197	0,081

Crude oil				
	gallon	Process	MWh	MWh/ton
2003	183.273	Sec/Coc	6.348	0,080
2004	346.298	Sec/Coc	11.994	0,085
2005	108.240	Sec/Coc	3.749	0,032
2006	1.772	Sec/Coc	61	0,001
Total	639.583		22.151	0,052
Average	170.556		5.907	0,052

Coal (no substituted)				
	t	Process	MWh	MWh/ton
2003	3.748	Coc	32.371	0,408
2004	6.871	Coc	59.350	0,418
2005	5.827	Coc	50.328	0,434
2006	4.628	Coc	39.978	0,441
Total	21.074		182.028	0,425
Average	5.620		48.541	0,425

Natural Gas				
	m^3	Process	MWh	MWh/ton
2003	-		-	-
2004	-		-	-
2005	678.549	Sec/Coc	6.371	0,055
2006	1.167.862	Sec/Coc	10.965	0,121
Total	1.846.411		17.336	0,041
Average	492.376		4.623	0,041

	Total				
	MWh	TJ	MWh/ton	TJ/ton	kJ/ton
2003	48.587	175	0,612	0,002	2.203
2004	85.637	308	0,604	0,002	2.173
2005	66.242	238	0,571	0,002	2.057
2006	55.537	200	0,612	0,002	2.204
Total	256.003	922	0,598	0,002	2.154
Average	68.267	246	0,598	0,002	2.154

Soacha 3

Year	Months reported	Production (t)
2003	12	127.640
2004	12	102.432
2005	12	123.918
2006	9	99.462
Total	45	453.451
Average		120.920

Coal				
	t	Process	MWh	MWh/ton
2003	4.316	Sec	37.275	0,292
2004	3.245	Sec	28.031	0,274
2005	3.342	Sec	28.863	0,233
2006	2.454	Sec	21.193	0,213
Total	13.356		115.362	0,254
Average	3.562		30.763	0,254

Crude oil				
	gallon	Process	MWh	MWh/ton
2003	318.885	Sec/Coc	11.044	0,087
2004	235.721	Sec/Coc	8.164	0,080
2005	221.787	Sec/Coc	7.681	0,062
2006	6.701	Sec/Coc	232	0,002
Total	783.094		27.122	0,060
Average	208.825		7.232	0,060

Coal (no substituted)				
	t	Process	MWh	MWh/ton
2003	6.024	Coc	52.034	0,408
2004	6.536	Coc	56.453	0,551
2005	6.802	Coc	58.753	0,474
2006	5.439	Coc	46.977	0,472
Total	24.801		214.217	0,472
Average	6.614		57.124	0,472

Natural Gas				
	m^3	Process	MWh	MWh/ton
2003	-		-	-
2004	-		-	-
2005	168.411.45	Sec/Coc	1.581	0,013
2006	831.874.14	Sec/Coc	7.810	0,079
Total	1.000.286		9.392	0,021
Average	266.743		2.504	0,021

	Total				
	MWh	TJ	MWh/ton	TJ/ton	kJ/ton
2003	100.353	361	0,786	0,003	2.830
2004	92.649	334	0,904	0,003	3.256
2005	96.878	349	0,782	0,003	2.814
2006	76.212	274	0,766	0,003	2.758
Total	366.092	1.318	0,807	0,003	2.906
Average	97.625	351	0,807	0,003	2.906

Usme 2

Year	Months reported	Production (t)
2003	12	81.631
2004	12	71.142
2005	12	58.680
2006	9	14.136
Total	45	225.590
Average		60.157

Coal				
	t	Process	MWh	MWh/ton
2003	7.054		60.924	0,746
2004	5.316		45.920	0,645
2005	5.464		47.197	0,804
2006	1.585		13.694	0,969
Total	19.420		167.736	0,744
Average	5.179		44.730	0,744

	Total				
	MWh	TJ	MWh/ton	TJ/ton	kJ/ton
2003	60.924	219	0,746	0,003	2.687
2004	45.920	165	0,645	0,002	2.324
2005	47.197	170	0,804	0,003	2.896
2006	13.694	49	0,969	0,003	3.487
Total	167.736	604	0,744	0,003	2.677
Average	44.730	161	0,744	0,003	2.677

Usme 3

Year	Months reported	Production (t)
2003	12	123,844
2004	12	129,907
2005	12	151,195
2006	9	141,707
Total	45	546,653
Average		145,774

Coal				
	t	Process	MWh	MWh/t
2003	10.503		90.715	0,732
2004	8.999		77.726	0,598
2005	10.652		92.005	0,609
2006	11.419		98.632	0,696
Total	41.572		359.077	0,657
Average	11.086		95.754	0,657

	Total				
	MWh	TJ	MWh/ton	TJ/ton	kJ/ton
2003	90.715	327	0.732	0,003	2.637
2004	77.726	280	0.598	0,002	2.154
2005	92.005	331	0.609	0,002	2.191
2006	98.632	355	0.696	0,003	2.506
Total	359.077	1.293	0.657	0,002	2.365
Average	95.754	345	0.657	0,002	2.365

2.- Baseline definition

The years 2003, 2004, 2005 and the first nine months of the year 2006 have been examined to define the baseline. In the case of Soacha 1 and Soacha 2 years 2005 and 2006 are not considered because natural gas was used.

	Average production	Coal			Crude oil			ACPM			Coal (no substituted)			Total	
	t/year	MWh	MWh/ ton	%	MWh	MWh/ ton	%	MWh	MWh/ ton	%	MWh	MWh/ ton	%	MWh	MWh/ ton
AS1	44.840	9.042	0,648	100%										29.042	0,648
AS2	60.376	36.655	0,607	94%				2.199	0,036	6%				38.855	0,644
S1	110.643	2.081	0,109	18%	9.171	0,083	14%				45.861	0,414	68%	67.112	0,607
S3	115.036	2.653	0,284	34%	9.604	0,083	10%				4.244	0,472	56%	96.501	0,839
U2	60.157	44.730	0,744	100%										4.730	0,744
U3	145.774	95.754	0,657	100%										5.754	0,657

3.- Baseline calculations

The specific emissions by ton of final product have been obtained applying the methodology indicated in the paragraph B.6.3. The values indicated in the next table are used in ex-ante calculations and will be assumed in monitoring tasks.

BASELINE EMISSIONS						
Plant	**AS1**	**AS2**	**S1**	**S3**	**U2**	**U3**
Baseline emission (tCO2/ton of final product)	0,227	0,222	0,207	0,288	0,260	0,230

Annex 4

MONITORING INFORMATION

The Monitoring Plan (from here on MP) describes the procedure for data collection, and auditing required determining and verifying emissions reductions achieved by the project during it crediting period. It fulfills the CDM Executive Board requirement that CDM projects have a clear, credible, and accurate set of monitoring procedures. The purpose of these procedures is to direct and support continuous monitoring of project performance and periodic auditing, verification and certification activities to determine project outcomes, in particular in terms of greenhouse gas (GHG) emission reductions. The MP is a vital component of project design, and as such is subject to a formal third-party validation process.

The MP described in the present document will be documented in specific procedures that will be integrated into QA and QC systems of the plants. These independent procedures shall be present during the crediting periods in the factories involved. They shall establish responsibilities in a workflow that includes the necessary steps for the periodic publication of monitoring reports that will evaluate the performance of the project activity.

Following these procedures, since the starting date of the project activity, managers of the project shall maintain themselves credible, transparent on adequate data estimation, measurement, collection, and tracking systems. The project will require only very straightforward collection of data, described below, most of which is already collected routinely by the staff of the industrial facilities where the proposed CDM project is to be implemented. Only two kinds of data will be monitored: energy efficiency and fuel consumption[14]. These data shall be recorded adequately and accompanied with additional information that makes them transparent and credible (as purchasing records, QA and QC procedures, calibration documents, etc.).

These records and monitoring systems are needed to subsequently allow an Operational Entity to verify project performance as part of the verification and certification process. In particular, this process reinforces the fact that GHG reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs). This set of information will be needed to meet the evolving international reporting standards developed by the UNFCCC.

The methodology indicated above shall be applied through an electronic spreadsheet model with the next characteristics:

- Parameters contemplated by the MP should be introduced manually in the designated cells.
- It realizes the corresponding calculations applying the methodologies indicated below to account the reduction of the emission associated with the registered parameters.

[14] The rest of the data involved in GHG calculations during monitoring are defined in this PDD. They are listed in the paragraph B.6.2.

The staff responsible for Project monitoring must complete these electronic worksheets on a yearly basis. The spreadsheet automatically provides monthly totals in terms of GHG reductions achieved through the project. To reduce the margin of error of calculations next characteristics have been implemented in the worksheets:

1. It contains a series of worksheets with different functions:
    - Data entry sheet (Natural Gas Consumption, Efficiency)
    - Calculation sheets (Baseline Emissions and Project Emissions)
    - Result sheet (Emission Reductions)
2. There are worksheets where the user is allowed to enter data. Even in these sheets, only those cells where the staff of each plant is required to enter data have been left unblocked. All other cells contain model fixed parameters or computed values that cannot be modified by the staff.
3. A color-coded key is used to facilitate data input. The key for the code is as follows:
    - Input Fields: Pale yellow fields indicate cells where project operators are required to supply data input. These data are fuel consumptions and overall productions on a monthly basis.
    - Result Fields: Green fields display key result as calculated by the model.

During the first years of the monitoring period liquid and solid fuels will be used in conjunction with natural gas. Additionally, biomass must be checked to verify that its consumption is not reduced as a consequence of project activity. Considering this requisites, the methodology implemented in this spreadsheets works as follow:

1. Calculates project emissions from the quantities of fuel introduced in the model. These emissions are denominated Project Emissions.
2. Calculates baseline emissions from the productions introduced in the sheet. This operation is performed applying the values of *Ton CO_2 e / ton of final product* indicated in the Annex 3.
3. Calculates leakage emissions associated to the baseline and project scenarios.
4. Obtains the final value of GHG emissions reductions. (Project emissions minus baseline emissions and minus leakage emissions).

Actually electronic spreadsheets are prepared for that plants indicated in the tables included in the paragraph A.4.3. If additional equipments that fulfils with the conditions listed in paragraph B.2 of this PDD are modified to use natural gas in other plants, new spreadsheets will be prepared following the methodology explained above.

All electronic data will be backed up on a monthly basis, and two electronic copies of each document will be kept in different locations (the plant and its respective Head Office). These data will be archived for two years following the end of the crediting period.

Annex 5

NPV CALCULATIONS

The Net Present Value (NPV) has been calculated in order to determine the economic viability of the project. Three options have been considered:

- Absence of CERs revenues
- 10 €/tCO_2 scenario
- 15 €/tCO_2 scenario

In these three situations the next assumptions have been done:

- IRR: 15% - 10%
- CDM certification costs of 16.400 $/year
- a 35% taxation of the investments
- an operational life of 20 years
- a exchange rate of 0,77 €/USD

Cost associated to processes stoppages have not been taken into account.

The value of NPV varies significantly if these variables are changed, but it keeps negative[15] because CERs revenues obtained by the project activity are always smaller than increasing combustible costs associated to fuel switching.

Next table shows NPV calculations[16].

[15] If reasonable values are used.

[16] All the values included in US$

NPV calculation considering CERs revenue (15€/CER) and an IRR of 15%

Con formato

1) Cash flows

	year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
Positive																					
CERs revenue			858,210	858,210	858,210	858,210	858,210	858,210	858,210	858,210	858,210	858,210									
Residual value																					0
Amortization of investments (S1)		61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43
tax savings (stage1)		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05
Total		21,411	879,621	879,621	879,621	879,621	879,621	879,621	879,621	879,621	879,621	879,621	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411
Negative																					
Initial investments	1,223,489																				
Combustible price		5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
CDM Verification			16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400									
Taxation of investments		35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Total	1,223,489	5,244,796	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
Net cash flow	-1,223,489	-5,223,385	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385

2) VAN Calcultions (from net cash flows)

	Year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
IRR	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Descount factor	1.00	0.87	0.76	0.66	0.57	0.50	0.43	0.38	0.33	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
VAN 36,648,935	-1,223,489	-4,542,074	-3,313,100	-2,880,957	-2,505,180	-2,178,417	-1,894,276	-1,647,196	-1,432,345	-1,245,517	-1,083,058	-1,083,058	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141

NPV calculation considering CERs revenue (15€/CER) and an IRR of 10%

1) Cash flows

	year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
Positive																					
CERs revenue			858,210	858,210	858,210	858,210	858,210	858,210	858,210	858,210	858,210	858,210									
Residual value																					0
Amortization of investments (S1)		61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43
tax savings (stage1)		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05
Total		21,411	879,621	879,621	879,621	879,621	879,621	879,621	879,621	879,621	879,621	879,621	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411
Negative																					
Initial investments	1,223,489																				
Combustible price		5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
CDM Verification			16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400									
Taxation of investments		35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Total	1,223,489	5,244,796	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
Net cash flow	-1,223,489	-5,223,385	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-4,381,575	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385

2) VAN Calcultions (from net cash flows)

	Year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
IRR	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Descount factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
VAN 48,725,508	-1,223,489	-4,748,532	-3,621,136	-3,291,942	-2,992,675	-2,720,613	-2,473,285	-2,248,441	-2,044,037	-1,858,216	-1,689,287	-1,689,287	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841

NPV calculation considering CERs revenue (10€/CER) and an IRR of 15%

Con formato

1) Cash flows

	year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
Positive																					
CERs revenue			572,140	572,140	572,140	572,140	572,140	572,140	572,140	572,140	572,140	572,140									
Residual value																					0
Amortization of investments (S1)		61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43
tax savings (stage1)		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05
Total		21,411	593,551	593,551	593,551	593,551	593,551	593,551	593,551	593,551	593,551	593,551	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411
Negative																					
Initial investments	1,223,489																				
Combustible price		5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
CDM Verification			16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400									
Taxation of investments		35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Total	1,223,489	5,244,796	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
Net cash flow	-1,223,489	-5,223,385	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385

2) VAN Calcultions (from net cash flows)

	Year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
IRR	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Descount factor	1.00	0.87	0.76	0.66	0.57	0.50	0.43	0.38	0.33	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
VAN 37,906,609	-1,223,489	-4,542,074	-3,529,410	-3,069,052	-2,668,741	-2,320,645	-2,017,952	-1,754,741	-1,525,861	-1,326,836	-1,153,770	-1,153,770	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141

NPV calculation considering CERs revenue (10€/CER) and an IRR of 10%

Con formato

1) Cash flows

	year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
Positive																					
CERs revenue			572,140	572,140	572,140	572,140	572,140	572,140	572,140	572,140	572,140	572,140									
Residual value																					0
Amortization of investments (S1)		61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43
tax savings (stage1)		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05
Total		21,411	593,551	593,551	593,551	593,551	593,551	593,551	593,551	593,551	593,551	593,551	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411
Negative																					
Initial investments	1,223,489																				
Combustible price		5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
CDM Verification			16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400	16,400									
Taxation of investments		35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Total	1,223,489	5,244,796	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,261,196	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
Net cash flow	-1,223,489	-5,223,385	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-4,667,645	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385

2) VAN Calcultions (from net cash flows)

	Year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
IRR	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Descount factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
VAN 50,333,513	-1,223,489	-4,748,532	-3,857,558	-3,506,871	-3,188,064	-2,898,240	-2,634,764	-2,395,240	-2,177,491	-1,979,537	-1,799,579	-1,799,579	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841

NPV calculation without considering CERs revenue and an IRR of 15%

Con formato

1) Cash flows

	year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
Positive																					
CERs revenue			0	0	0	0	0	0	0	0	0	0									
Residual value																					0
Amortization of investments (S1)		61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43
tax savings (stage1)		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05
Total		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411
Negative																					
Initial investments	1,223,489																				
Combustible price		5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
CDM Verification			0	0	0	0	0	0	0	0	0	0									
Taxation of investments		35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Total	1,223,489	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
Net cash flow	-1,223,489	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385

2) VAN Calcultions (from net cash flows)

	Year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
IRR	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Descount factor	1.00	0.87	0.76	0.66	0.57	0.50	0.43	0.38	0.33	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
VAN -40,349,858	-1,223,489	-4,542,074	-3,949,629	-3,434,460	-2,986,487	-2,596,945	-2,258,213	-1,963,664	-1,707,534	-1,484,812	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141	-1,291,141

NPV calculation without considering CERs revenue and an IRR of 10%

Con formato

1) Cash flows

	year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
Positive																					
CERs revenue			0	0	0	0	0	0	0	0	0	0									
Residual value																					0
Amortization of investments (S1)		61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43	61,174.43
tax savings (stage1)		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05	21,411.05
Total		21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411	21,411
Negative																					
Initial investments	1,223,489																				
Combustible price		5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
CDM Verification			0	0	0	0	0	0	0	0	0	0									
Taxation of investments		35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Total	1,223,489	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796	5,244,796
Net cash flow	-1,223,489	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385	-5,223,385

2) VAN Calcultions (from net cash flows)

	Year 0	2008 Year1	2009 Year2	2010 Year3	2011 Year4	2012 Year5	2013 Year6	2014 Year7	2015 Year8	2016 Year9	2017 Year10	2018 Year11	2019 Year12	2020 Year13	2021 Year14	2022 Year15	2023 Year16	2024 Year17	2025 Year18	2026 Year19	2027 Year20
IRR	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Descount factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
VAN -53,457,338	-1,223,489	-4,748,532	-4,316,847	-3,924,406	-3,567,642	-3,243,311	-2,948,465	-2,680,422	-2,436,748	-2,215,225	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841	-2,013,841

- - - - -