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:

"Improving energy efficiency in a new Gas Plant in Gibraltar-Colombia"
Version 5
14/01/2013

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

ECOPETROL S.A. is a Colombian global energy and petrochemical company, with emphasis in oil, gas and alternative fuels; it is recognized for its competitiveness, world class human talent and social responsibility. ECOPETROL S.A. is a Mixed Economy Company, with a commercial orientation, organized as an "Anonymous Society" (equivalent to a Corporation) of a national level, under the Ministry of Mines and Energy, in accordance with the dispositions set forth by Law 1118 from 2006[1].

ECOPETROL S.A. is the owner of the Gibraltar facility in which the project activity is implemented, and is located between the Municipality of Toledo (North of Santander department) and the municipality of Cubará (Boyacá department).

Today ECOPETROL S.A. works in Colombia with the following technologies on different gas fields in a direct form and also joined with other non-Colombian companies, as indicated:

- One Turbo- Expander with a capacity of 70 MMSCFD (Million standard cubic feet day).
- One Joule-Thompson with a capacity of 40 MMSCFD.
- Five Mechanical Refrigeration plants with a capacity between 5 and 40 MMSCFD.
- Four Absorption Plants with capacities ranging between 8 and 110 MMSCFD.
- Other Mechanical Refrigeration plants from minor size with capacities of 3 MMSCFD.

This system provides the treatment for the gas obtained from these recently discovered wells and of great importance of quantity of reserves. The project activity is about the treatment of 33[2] MMSCFD[3] of associated gas from the field of Gibraltar through a more efficient technology (System TWISTER) adapted for the gas characteristics of the field.

Before the project activity, there were done only explorations of the gas wells in the specified location.

[1] This is governed by the Social Statutes which are an integral part of Public Document No. 5314 from December 14th, 2007, issued by the Second Notary Office of the Bogotá D.C. Circle.
[2] In order to obtain 30.3 MSCFD of sell gas (value indicated in document "Contract Nº5203383 - Financing, design, purchase of equipment, supplies, construction, testing, operation and maintenance for 15 years of surface facilities for treating Gibraltar gas field, belonging to the vice president of Ecopetrol S.A. production".
[3] Now the project activity proposed will treat 5MSCFD additional associated gas using technology Joule Thompson, the reasons are explained in the following paragraphs and the letter "Treatment of additional gas in plant Gibraltar".

The conventional system to process natural gas is performed by Mechanical Refrigeration Plants, Joule-Thompson, Turbo Expansion and Absorption Plants, which are well-known and the mostly used technologies regarding the natural gas treatment activity. Also, this conventional system is considered as the baseline scenario and not the proposed technology (System Twister).

The Twister System bases its operation on the principle of cooling by expansion coupled with the effect of gravitational separation. Twister technology consists of a static tubular mechanism (no moving parts which reduces maintenance costs and energy consumption) that contains a fixed set of linear blades to divert the flow of gas into a rotary flow. The gas enters the twister unit, and expands at a supersonic speed (Mach 1). Using static blades drawn, the gas entering acquires a turbulent motion. The expansion (typically 30 to 45% of the inlet pressure) causes a rapid drop in temperature that could be within -20 to -40 ° F, depending on the expansion ratio used. This leads to the formation of microscopic droplets composed mainly by heavy hydrocarbons and water. The centrifugal forces are around 500,000 g. This is enough to force the drops to join the tube walls. A simple pipe configuration is capable of separating dry gas (primary current) and liquid (high current). The separated products are re-compressed in a diffuser. Reducing the speed recovers much of the pressure (usually 70 to 80% of the inlet pressure).

It is necessary to point out that within the processing of Gibraltar gas, there is a facility that gives flexibility to the operation because it can provide the function of the plant starter when the entry gas load is low[4] and complements the processing capacity of the load to the system Twister when the volume of processed gas is high, due to the system (Twister) does not work properly with gas loads below 20 nor above 34 MMSCFD. It should be noted, that due to a refining reservoir model on the Gibraltar field and the current fulfilment with the gas sale clients (35 MMSCFD), the project participant decided to use the starter facility (Joule-Thompson valvule) as a complement of the missing sale gas flow, in such a way that 5 MSCFD of associate gas will be treated with the Joule-Thompson technology[5] and others 31-33 MMSCFD with the system Twister.

Due to the introduction of this new technology, CO_2 emissions will be lower than with traditional technology (Turbo-Expander, Joule-Thompson, Mechanical Refrigeration and Absorption). The fuel economy is estimated at about 4,619.91 tons of fuel per year. In this case, natural gas, and thus reducing the emission of gases like CO_2 that contribute to global warming. Emission reduction regarding the project activity implementation would reach an amount of 13,089.92. tCO_2e/year.

The project activity contributes to sustainable development, due to the reduction of fossil fuel used with conventional technologies, and, therefore, reducing CO_2 emissions to the atmosphere.

A.3. Project participants:

[4] That is, at the moment of the plant starter, a 20 MSCFD flow it is not immediately (minimum processing capacity with which the Twister system is designed), therefore, it was considered a Joule-Thompson valvule of maximum capacity 5MSCFD as a facility in order to receive the entry gas load in the starting moment and so, ensure the pre-treatment of this gas. To increase progressively the gas flow, this valve can be by-pass or it can be working along with the twister system.

[5] The project participant not considered using mechanical refrigeration technology because it involves an additional cost by the implementation of additional equipment and facilities expansion, which was not worth taking because it had an equipment to make this work.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host country)	ECOPETROL S.A. (public entity)	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.		

Table 1. Project Participants of the Project Activity

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.:

Between the Municipality of Toledo (North of Santander department) and the municipality of Cubará (Boyacá department).

A.4.1.3. City/Town/Community etc:

Pathway Cedeño from Gibraltar township.

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

The Gibraltar Gas Field has 118.16 ha, and is located in the pathway Cedeño from Gibraltar Township. The project activity is located at the following UTM coordinates:

Point	East	North
A	878,509.78	1,269,792.58
B	879,421.53	1,270,145.95
C	879,421.53	1,271,039.62
D	878,527.86	1,271,039.62
E	878,174.42	1,270,660.54

Table 2. Coordinates Campo Gibraltar Field

The location of the project activity is illustrated in the following figures:

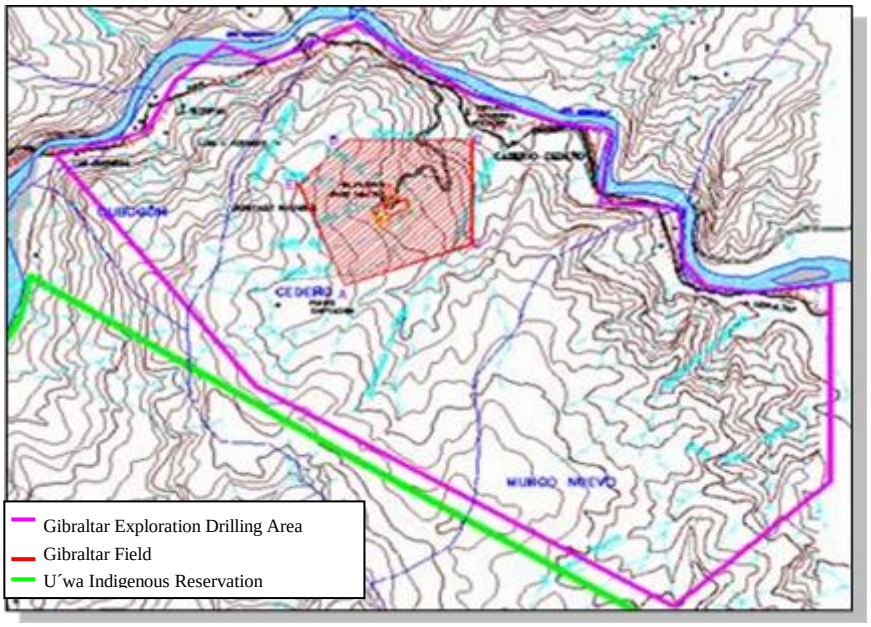


Figure 1. Location of Gibraltar Field

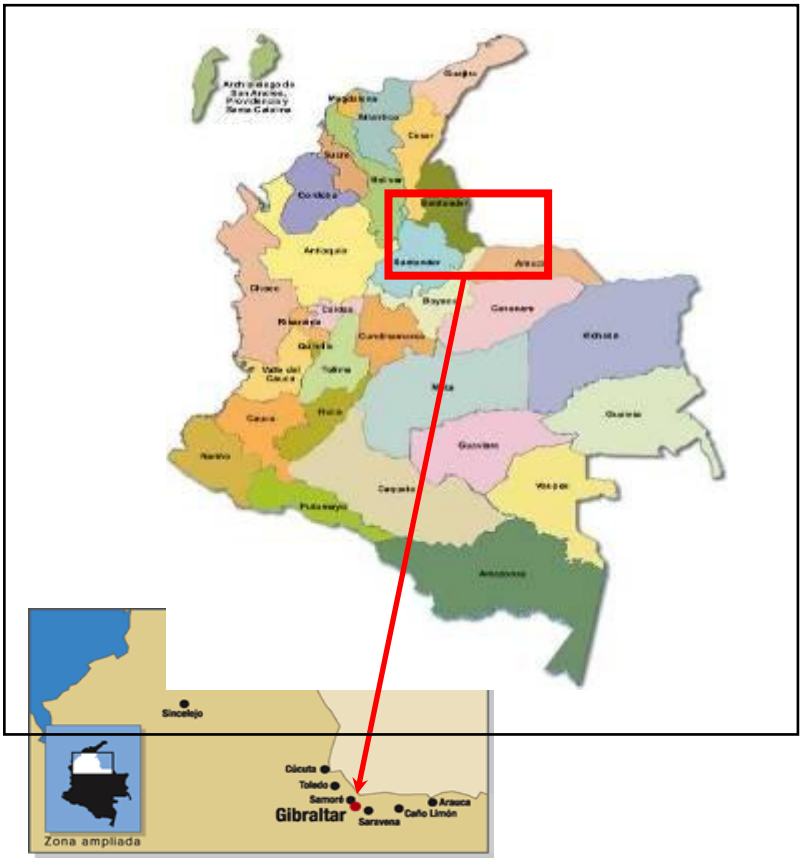


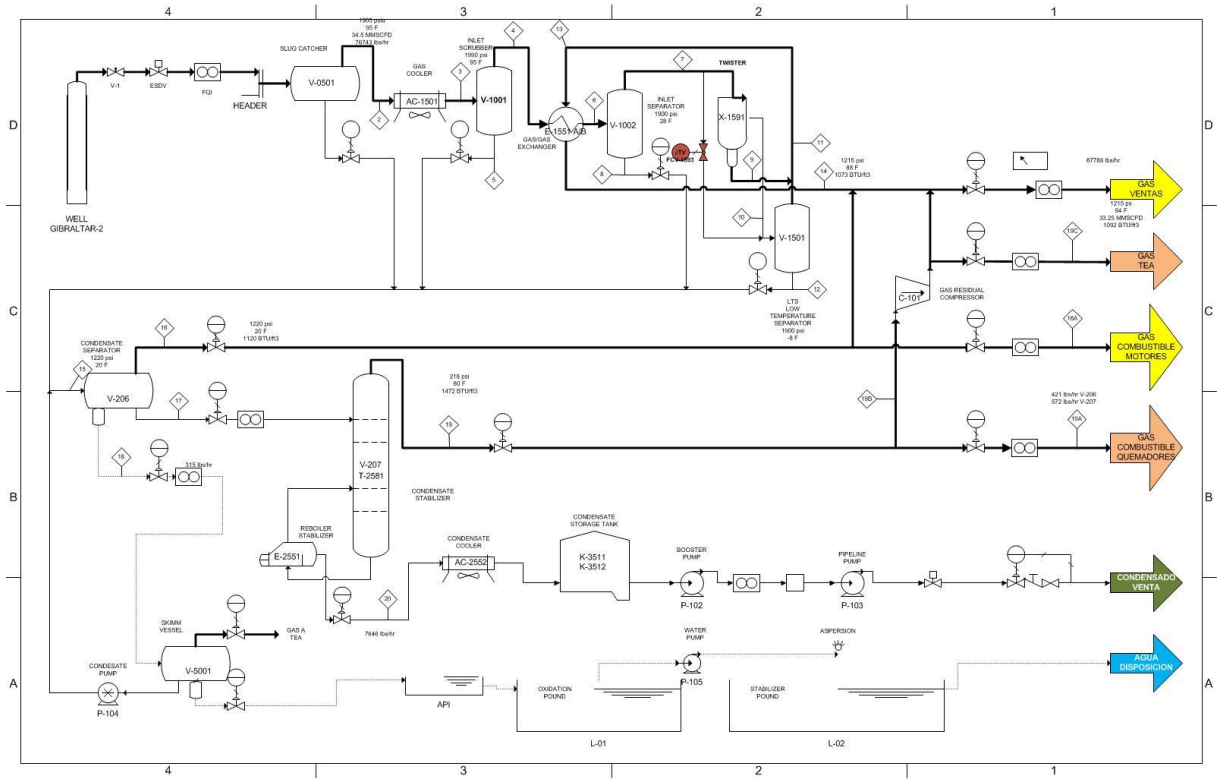
Figure 2: Location of the project activity

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

The project activity belongs to the sectorial scope 4: Manufacturing Industries. The technology is developed in Annex I country (Netherland, homeland of Twister B.V.). The technology provider (TWISTER B.V.) promotes a system which is secure on its operation and also reduces the fuel consumption, being in consequence environmentally safely.

The Twister System bases its operation on the principle of cooling by expansion coupled with the effect of gravitational separation. Twister technology consists of a static tubular mechanism (no moving parts which reduces maintenance costs and energy consumption) that contains a fixed set of linear blades to divert the flow of gas into rotary flow. The gas enters the twister unit (see figure below), expands at a supersonic speed (Mach 1), using static blades drawn. The gas entering acquires a turbulent motion. The expansion (typically 30 to 45% of the inlet pressure) causes a rapid drop in temperature that could be between -20 to -40 ° F, depending on the expansion ratio used. This leads to the formation of microscopic droplets composed mainly by heavy hydrocarbons and water. The centrifugal forces are around 500,000 g, enough to force the drops to join the tube walls. A simple pipe configuration is capable of separating dry gas (primary current) and liquid (high current). The separated products are re-compressed in a diffuser. Reducing the speed recovers much of the pressure (usually 70 to 80% of the inlet pressure).

On the following diagram, the Twister system is properly described:



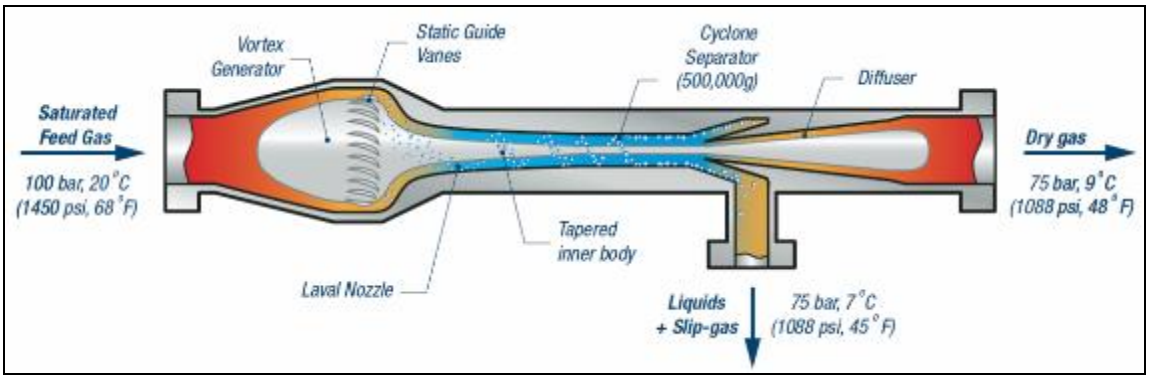


Figure 3: Cross-section of a Twister Tube with typical process conditions

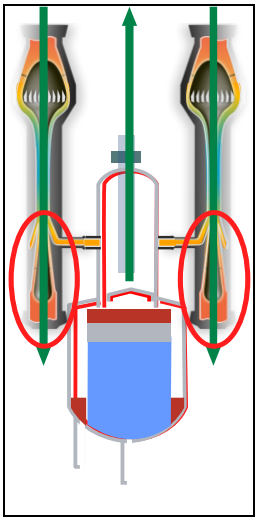


Figure 4: Twister configuration (green lines indicates flow of extracted gas)

Figure 5: Real Image of a twister tube

The liquid separated in the twister system contain a portion of gas, typically 30 to 35% of the total flow of gas which is separated into a pot of low temperature (LTS) and re-combined with the primary dry gas. The temperature reached within the twister is below the hydrate formation temperature. However, due to the very short residence time and high shear forces, hydrate deposits do not cause clogging.

This technology offers space savings required for equipment in comparison with conventional technologies for the treatment mechanism. It is basically a tube with some internal configurations, is environmentally friendly because the noise generated is low and does not use chemical treatment systems, or energy consumption or environmental emissions associated with the regeneration of these systems.

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

In accordance with the AMS – II.D, v.12 (EB 51) the implementation of the project will reduce 13,088.53 tCO_2e/year. Based in this estimated annual CO_2e reduction of the project activity, the reduction over the 10 year crediting period[6] will be of 130,885.25 tCO_2e.

Years	Estimation of annual emission reductions in tonnes of CO_2e
2012	10,907.10
2013	13,089.92
2014	13,089.92
2015	13,089.92
2016	13,089.92
2017	13,089.92
2018	13,089.92
2019	13,089.92
2020	13,089.92
2021	13,089.92
2022	2,181.42
Total estimated reductions (tonnes of CO_2e)	**130,899.2**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tonnes of CO_2e)	**13,089.92**

(*) ten months and (**) two months

Table 3: Estimation of emission reductions of CO_2 per year

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

No public funding was considered for the project activity.

[6] Reference: item II.b-"Guidelines on additionality of first-of-its-kind project activities, v 01.0", *Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal.*

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 Small-Scale CDM project activities for "Determining the occurrence of debundling", the proposed small-scale project is not be deemed to be a debundled component of a large project activity under the CDM because there is not a registered small-scale similar to the project activity under the CDM, or an application to register another similar small-scale project under the CDM with the same project participants within the previous two years, whose project boundary is within 1 km of the project boundary of the proposed small-scale project activity under the CDM 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:

The baseline methodology and monitoring approved by the UNFCCC that apply to the project is version 12 of AMS II.D "Energy efficiency and fuel switching measures for industrial facilities".

This methodology is applicable to project activities related to energy efficiency and fuel switching measures implemented in an independent industrial plant or mining or mineral production. These measures can be implemented in a new facility such as the new plant in Gibraltar.

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

Project proponent justifies the choice of the project type and category (hereafter referred to as "project category") for the proposed project activity. It has to be demonstrated that the project activity qualifies as a small-scale project activity and that it will remain under the limits of small-scale project activity types during every year of the crediting period:

For Type II: Project proponent demonstrates that the annual energy savings on account of efficiency improvements will not exceed 60 GWh (or an appropriate equivalent unit) in any year of the crediting period. Due to a lower consumption of fuels by the project activity (which is estimated to be dropped in around 4,619.91ton of fuel per year), and this considered an estimated of 13,088.53 tCO_2e/year which is lower than the threshold for this type of projects.

B.3. Description of the project boundary:

The project boundary is the Physical location of the project activity's facility and comprises the Twister system for Natural Gas treatment, located on the wells of the Gibraltar project.

B.4. Description of baseline and its development:

For determining the baseline scenario, the methodology AMS.IID v.12 states: the energy baseline consists of facility that would otherwise be built; the most plausible baseline scenario for the project activity shall be evaluated based on the related and relevant requirements in the General Guidance for SSC methodologies, where the following steps are established:

Step 1: Identify the various alternatives available to the project proponent that deliver comparable level of service including the proposed project activity undertaken without being registered as a CDM project activity.

The next two options are the only alternatives identified:

a. The project activity proposed without being registered as CDM (is installing of new gas treatment plant that uses a modern technology called "Twister").
b. Gas treatment plant using technology traditional (Mechanical Refrigeration, Turbo-Expander, Joule-Thompson and Absorption).

Step 2: List the alternatives identified per Step 1 in compliance with the local regulations (if any of the identified baseline is not in compliance with the local regulations, then exclude the same from further consideration).

All the alternative scenarios identified in step 1 fulfill with current local regulations in Colombia for plant of treatment by what they all are considered real and believable alternatives of the project.

Step 3: Eliminate and rank the alternatives identified in Step 2 taking into account barrier tests specified in attachment A to Appendix B of the simplified modalities and procedures of SSC CDM.

Barrier due to prevailing practice	**This barrier is identified for the alternative (a)** Twister technology used for the treatment of natural gas in the gas field of Gibraltar is not prevailing practice in Colombia and Latin America. Such technology consumes less energy in the process those others. Traditional technologies: Mechanical Refrigeration, Turbo-Expander, Joule-Thompson and Absorption are the prevailing practices in Colombia, this is because among other reasons: lower investment, developed local capacities, etc.

Of the previous analysis it can be detected that there exist barriers that prevent or make the implementation of the project without MDL (Barriers due to prevailing practice), therefore the above mentioned alternative would discard in this step. In case of the alternative (b), this one is not disabled for the stated barriers since at national level the traditional technology is that of major use and it would not present risks in its implementation.

Step 4: If only one alternative remains that is:
• Not the proposed project activity undertaken without being registered as a CDM project activity; and
• It corresponds to one of the baseline scenarios provided in the methodology; then the project activity is eligible under the methodology.
If more than one alternative remain that correspond to the baseline scenarios provided in the methodology, choose the alternative with the least emissions as the baseline.

According to that identified in step 3, there is only one alternative scenario "Plant of gas treatment using traditional technology" that there are no obstacles and not the proposed project, which would be the baseline scenario.

For the type of gas to be treated in the proposed project activity, the mechanical refrigeration is the best alternative applicable in traditional technology because it does not require large pressure losses (lower energy consumption). Others alternatives that may be applicable, are either the "Joule-Thompson expansion" or "Turboexpansión" technologies; but, these technologies produce sharp falls in pressure that would demand the use of compressors (energy-consuming equipment) for pressure recovery so they could deliver the gas for sale at a pressure of 1,200 psig (value required by the regulations RUT-Unique Vehicle regulatory, and the supply contract for sale of gas conditioning). There are also other traditional alternative technologies (such as absorption and adsorption), but these technologies are old and require a greater amount of processing equipment, more space for the installation, and increased energy consumption for gas conditioning. For these reasons, the traditional technology "Mechanical Refrigeration" is the best alternative to be used for the proposed project activity because it requires a low energy consuming equipment compared to other traditional technologies. The above is also evident in the proposals submitted in the prequalification concourse PRECGEA-512215.

The calculations of associated baseline emissions will be determined based on emissions that would generate the Mechanical Refrigeration plant in the treatment of the natural gas from the Gibraltar field.

These parameters are not known ex-ante but were obtained from the project owner based on a tender requested by them to provide an efficient system to treat the gas from the Gibraltar field (prequalification concourse PRECGEA-512215). The information available for the baseline calculation is taken from the analysis of the better traditional technology offer for Mecánicos Asociados S.A. (MASA S.A.)[7], which used the Mechanical Refrigeration process; such offer was evaluated based on the following indices:

- Volumetric Efficiency Index, greater volume of gas available for sale (Unit: lb mass inlet gas / lb mass sales gas).
- Stabilized Condensate Recovery Index, greater volume of stabilized condensate (Unit: lb mass of C3+ inlet gas in process / lb mass of C3+ stabilized condensate).
- Energy Efficiency Index, lower energy consumption (Unit: MBTU consumed in process / lb mass inlet gas)

[7] Evaluation Committee Report of the prequalification concourse PRECGEA-512215 "Financing, design, purchase of equipment, supplies, construction, testing, operation and maintenance for 15 years of surface facilities for treating Gibraltar gas field, belonging to the vice president of Ecopetrol production. (Informe Comité Evaluador del Concurso de Precalificación PRECGEA-512215 "Financiación, diseño, compra de equipos, suministros, construcción, pruebas, operación y mantenimiento por 15 años de las facilidades de superficie para el tratamiento del gas del campo Gibraltar perteneciente a la vicepresidencia de producción de Ecopetrol S.A.)

It should be noted that Ecopetrol S.A. established the above mentioned indexes in base the gas composition of Gibraltar and the profitability of the project (i.e., maximizing the production of higher value products), considered as better alternative the gas treatment production in accordance with government specifications (sales and / or supply) and liquids of greater value, In accordance with the indicated, 4 of the proponents presented in the concourse considered that the technology that allowed them to perform better in the indexes established by Ecopetrol S.A. is mechanical refrigeration compared to other traditional technologies[8].

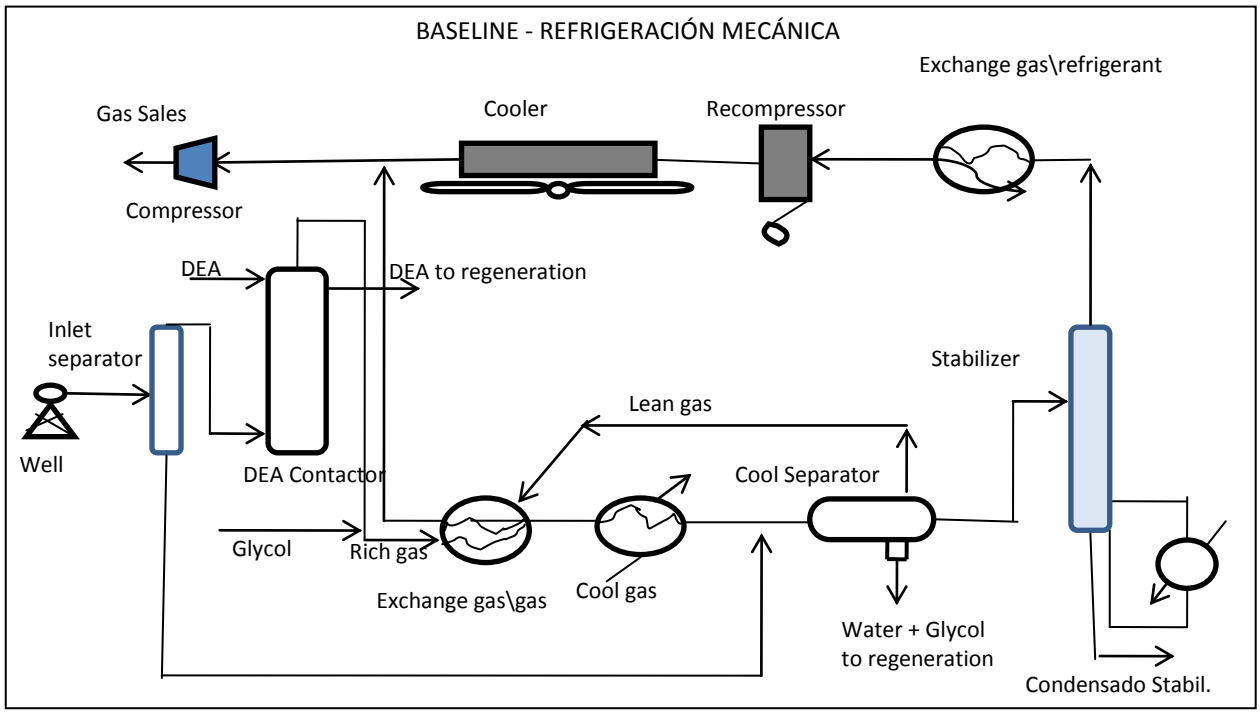


Figure 6. Flow Diagram Baseline

On the following table are shown greenhouse gas included or excluded on the calculation of the baseline and project emissions:

	Source	Gas	Included	Justification/Explanation
Baseline	Fuel Gas used for traditional technology operation	CO_2	Yes	Main emission source.
		CH_4	No	This gas is considered as negligible.
		N_2O	No	This gas is considered as negligible.
Project	Fuel Gas used for the project	CO_2	Yes	Main emission source.

[8] Ecopetrol SA in the letter "Letter Ecopetrol _technologies.pdf" explains the differences in the use of each of the traditional technologies of gas treatment and the reasons why the indexs were considered.

	activity operation	CH_4	No	This gas is considered as negligible.
		N_2O	No	This gas is considered as negligible.

Table 4. Emission sources and gases included in the project boundary for the purpose of calculating project emissions and baseline emissions

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:

CDM Consideration

- August 14th, 2006, Ecopetrol S.A. informs to "Environmental, Housing, and Territorial Development Ministry" on your interest to start structuring a portfolio of CDM projects and requested the support of Group Mitigation of Change Climate[9].
- March 19th, 2008. Ecopetrol S.A. signed a collaboration agreement with the Inter-American Development Bank for the identification and development under the CDM of potential emission reduction projects associated with its activities.
- March 27th, 2008. Global Environmental License for the Project "Gibraltar gas field".
- May 29th, 2008. Evaluation Committee Report of the prequalification concourse PRECGEA-512215".
- September 19th, 2008. Contract Nº5203383 of "Financing, design, purchase of equipment, supplies, construction, testing, operation and maintenance for 15 years of surface facilities for treating Gibraltar gas field, belonging to the vice president of Ecopetrol production" between Ecopetrol and Union Temporary Gas Gibraltar (UTGG)[10] was signed. Clause 6. Special obligations of the contractor, paragraph 39: "Delivery to Ecopetrol, the information that it requires, with the purpose of to advance before the pertinent entities to Clean Development Mechanism – CDM". → Start date of the project activity
- December 4th, 2008. Project Idea Note (PIN) for the Gibraltar Project.
- December 9th, 2008. Letter to the DNA with the intention of Ecopetrol S.A. of submitting the project to the CDM.
- December 23th, 2008. No objection Letter from the DNA for the project in analysis[11].
- May 26th, 2010. Colombian LoA reception[12].
- June 16th, 2010. Global Public Stakeholder Process was opened in UNFCCC website[13].

Additionality Assessment

[9] The Ministry denied the support.
[10] Conformed for the companies: Montecz S.A. (50%), Conequipos Ingenieros LTDA (40%), Gasmocam S.A. (5%) and Twister BV (5%).
[11] This letter is a mechanism established by the DNA to give early warning of interest to consider the CDM to develop a project.
[12] Reference: "260510 Carta de Aprobación – Gibraltar.pdf" or "260510 Letter of Approval – Gibraltar.pdf"
[13] http://cdm.unfccc.int/Projects/Validation/DB/IV7Q13RMWDDELWX6UJA3H55W5TBQ0R/view.html

According to the simplified procedures for small-scale (attachment A to Appendix B), project proponent must demonstrate that the project has not been implemented anyway (without CDM), because it faces barriers to its implementation. At least one of the following barriers must be demonstrated:

(a) Investment barriers
(b) Technological barriers
(c) Barriers due to prevailing practice
(d) Other barriers

Barriers (c) will be used to demonstrate additionality.

(c) Barrier due to prevailing practice

As stated on the Methodology AMS II.D version 12, Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions.

The four traditional most used technologies (Turbo - Expander, Joule-Thompson, Mechanical Refrigeration and Absorption) are the prevailing practices in Colombian gas fields. As informed by ECOPETROL S.A. they specifically works in Colombia with the following technologies on different gas fields in a direct form and also joined with other non-Colombian companies:

- One Turbo- Expander with a capacity of 70 MMSCFD.
- One Joule-Thompson with a capacity of 40 MMSCFD.
- Five Mechanical Refrigeration plants with a capacity between 5 and 40 MMSCFD.
- Four Absorption Plants with capacities ranging between 8 and 110 MMSCFD.
- Other Mechanical Refrigeration plants from minor size with capacities of 3 MMSCFD.

On the other hand according to information provided by ECOPETROL S.A. from other gas fields in Colombia, shown in the figure 8 below. Also in the figure 9 to shown the percentage distribution of existing natural gas treatment technologies, on the total of 30 gas plants, of which are owned by Ecopetrol S.A. 12 plants.

Figure 8: Natural Gas Fields and gas ducts distribution in Colombia (Source: ECOPETROL).

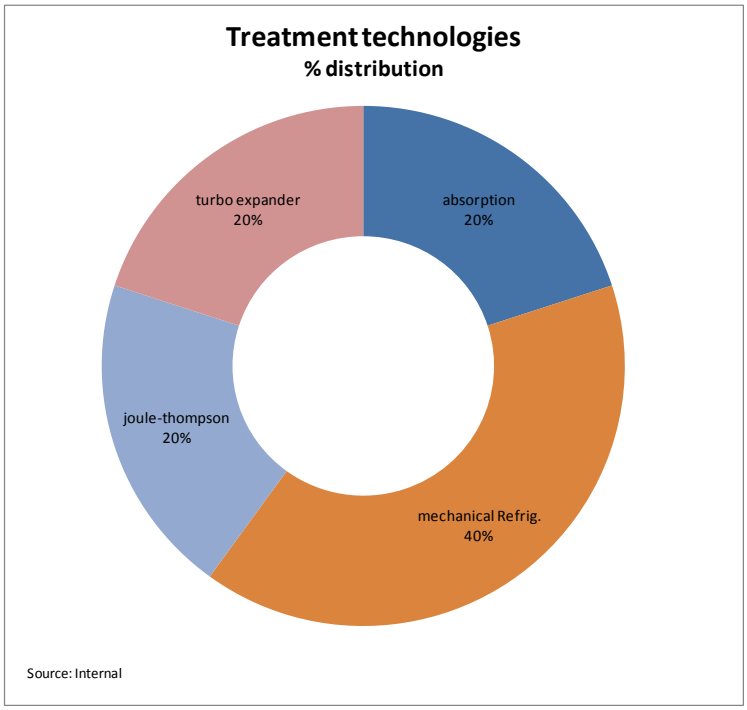


Figure 9. Percentage distribution of existing natural gas treatment technologies in Colombia

The Twister technology for the treatment of natural gas is not the prevailing practice in Colombia or in Latin America for that activity as informed by the provider (see www.twisterBV.com) and ECOPETROL S.A.[14]. Regionally, in Brazil there is an onshore pilot project which is testing this technology. But for a mass level extracting activity, such as the project activity described on the present section, Gibraltar would be the first-of-its-kind to regional level (geographical area), then, conventional technology is the prevailing practice.

As indicated in the "Guidelines on additionality of first-of-its-kind project activities, v01.0" (EB63) a project activity that was identified as the First-of-its-kind project activity is additional. The proposed project activity is located within one of the measures covered in the framework established in this guideline: *(b) Switch of technology with or without change of energy source (including energy efficiency improvement).*

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

[14] Letter from "Ecopetrol Letter_Twister Technology_100211.pdf", which explains on it, that Twister gas processing is not yet commercially available and this opens the opportunity to the Gibraltar project activity, to be the first project on the region (Latin America) for be the first of its kind.

Due to the project was not implemented up to date and the gas wells, were recently surveyed, and not yet exploited, the development of the baseline will be estimated on the most common used technology for this type of gas well which is the Mechanical Refrigeration technology.

The data used is provided by ECOPETROL S.A. and was the same to evaluate the different alternatives which were analyzed during the tender process to provide the technology to optimize the gas treatment of the Gibraltar Gas field.

Emission reductions

Emission Reduction estimations of the project activity were considered as indicated below:

Baseline emissions

Baseline emissions (BEy) are obtained as:

$$BE_y = (Q_{BE,FG,G} + Q_{BE,FG,H} + Q_{BE,FG,F} + Q_{BE,FG,T}) \times NCV_{FG,BE} \times EF_{CO2,NG} / 1{,}000{,}000$$

Where:

BE_y (tCO_2/year): *the baseline emission of the Mechanical Refrigeration process if this technology were used instead of the project activity.*
$Q_{BE,FG,G}$ (tonne/year): *Yearly fuel gas consumption by the Mechanical Refrigeration process for electricity generation.*
$Q_{BE,FG,H}$ (tonne/year): *Yearly fuel gas consumption by the Mechanical Refrigeration process for heat.*
$Q_{BE,FG,F}$ (tonne/year): *Yearly fuel gas consumption by the Mechanical Refrigeration process for flare.*
$Q_{PE,FG,T,y}$ (tonne/year): *Yearly fuel gas consumption by the treatment of additional gas.*
$NCV_{NG,BE}$ (TJ/Gg): *Net calorific value of Fuel Gas (FG.)*
$EF_{CO2,NG}$($kgCO_2/TJ$): *CO_2 emission factor for NG.*

Project emissions

Project emissions (PEy) are obtained as:

$$PE_y = (Q_{PE,FG,G,y} + Q_{PE,FG,H,y} + Q_{PE,FG,F,y} + Q_{PE,FG,T,y}) \times NCV_{FG,PE,y} \times EF_{CO2,NG} / 1{,}000{,}000$$

Where:

PE_y (tCO_2/year): *the project emission of the Twister process of the project activity.*
$Q_{PE,FG,G,y}$ (tonne/year): *Yearly fuel gas consumption by the project activity for electricity generation..*
$Q_{PE,FG,H,y}$ (tonne/year): *Yearly fuel gas consumption by the project activity for heat.*
$Q_{PE,FG,F,y}$ (tonne/year): *Yearly fuel gas consumption by the project activity for flare.*
$Q_{PE,FG,T,y}$ (tonne/year): *Yearly fuel gas consumption by the treatment of additional gas.*
$NCV_{FG,PE,y}$ (TJ/Gg): *Yearly Net calorific value of Fuel Gas (FG).*

$EF_{CO2,NG}$(kgCO_2/TJ): *CO_2 emission factor for NG.*

Leakage (L_y)

As newly built gas treatment plants, there is no energy generating equipment be transferred from another activity and no existing equipment be transferred to another activity involved in the Project activities. No leakage needs to be considered in the Project.

Emission Reductions

The annual emission reductions ER_y for the Project activity are calculated as the Baseline emissions minus the Project emissions. The final GHG emission reductions are calculated as follows:

$$ER_y\ (tCO_2e/y) = BE_y - PE_y - Ly$$

Where:

ER_y: *Emission reductions*
BE_y: *Baseline emissions in year y in tCO_2e;*
PE_y: *Project emissions in year y in tCO_2e;*
L_y: *Leakage of the project in tCO_2e*

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

Data / Parameter:	**$NCV_{FG,BE}$**
Data unit:	TJ/Gg
Description:	Net calorific value of Fuel Gas (FG)
Source of data used:	ECOPETROL S.A. (Pre-qualification concourse N°PRECGEA-VPR-512215).
Value applied:	47.11
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value was presented by MASA S.A. in the moment of concourse prequalification (project to be build instead of the project activity).
Any comment:	No comments.

Data / Parameter:	**$Q_{BE,FG,G}$**
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the Mechanical Refrigeration process for electricity generation (project to be build instead of the project activity).
Source of data used:	ECOPETROL S.A. (Pre-qualification concourse N°PRECGEA-VPR-512215).
Value applied:	3,663.33 tonne/year
Justification of the choice of data or description of	Value used for baseline emissions estimations. Spreadsheet with the source of calculation will be available for the validation process.

measurement methods and procedures actually applied :	
Any comment:	No comments.

Data / Parameter:	$Q_{BE,FG,H}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the Mechanical Refrigeration process for heat (project to be build instead of the project activity).
Source of data used:	ECOPETROL S.A. (Pre-qualification concourse N°PRECGEA-VPR-512215).
Value applied:	3,513.23 tonne/year
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value used for baseline emissions estimations. Spreadsheet with the source of calculation will be available for the validation process.
Any comment:	No comments.

Data / Parameter:	$Q_{BE,FG,F}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the Mechanical Refrigeration process for flare (project to be build instead of the project activity).
Source of data used:	ECOPETROL S.A. (Pre-qualification concourse N°PRECGEA-VPR-512215).
Value applied:	259.46 tonne/year
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value used for baseline emissions estimations. Spreadsheet with the source of calculation will be available for the validation process.
Any comment:	No comments.

Data / Parameter:	$Q_{BE,FG,T}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the treatment of additional gas.
Source of data used:	ECOPETROL S.A.
Value applied:	0.55 tonne/year
Justification of the choice of data or description of measurement methods and procedures actually applied :	Yearly fuel gas consumption for the treatment of additional gas in the baseline scenario was included under the assumption that the project would not be implemented, since this requirement was subsequent to the development of the project using the Twister technology. The value will be estimated as follows: it determines the volume ratio of glycol that is injected to natural gas before to go through the JT valve, the same ratio will be applied to energy consumption required in the glycol regeneration tower (which has the function of regenerating all the glycol used in the process) and thus would have the measure of energy consumption of JT valve.

Any comment:	No comments.

Data / Parameter:	**$EF_{CO2,NG}$**
Data unit:	$kgCO_2/TJ$
Description:	CO_2 emission factor for Natural Gas (NG).
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	54,300.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	The 2006 IPCC values are formally valid for the CDM projects.
Any comment:	Natural gas is the fuel used for the project activity. Nonetheless it is used as fuel for the traditional Technology (Mechanical refrigeration), the efficiency of the project activity means lower consumption of fuel.

B.6.3. Ex=ante calculation of emission reduction:

As described in section B.6.1 the ex ante calculation for the project activity are calculated as follows:

Baseline emissions

Using

$$BE_y = (Q_{BE,FG,G} + Q_{BE,FG,H} + Q_{BE,FG,F} + Q_{BE,FG,T}) \times NCV_{FG,BE} \times EF_{CO2,NG}/1{,}000{,}000$$

Replacing on the equation the information provided:

$$BE_y = (3{,}663.33+3{,}513.23+259.46+0.55) \times 47.1\ (TJ/Gg) \times 54{,}300\ (kgCO_2/tJ))/1{,}000{,}000$$

$$BE_y = 19{,}022.78\ tCO_2e$$

Project emissions

Using

$$PE_y = (Q_{PE,FG,G,y} + Q_{PE,FG,H,y} + Q_{PE,FG,F,y} + Q_{PE,FG,T,y}^{15})\ (tonne/year) \times NCV_{NG}(TJ/tonne) \times EF_{CO2,NG}\ (kgCO2/TJ))/1{,}000{,}000$$

Replacing on the equation the information provided:

[15] $Q_{PE,FG,T,y}$, Energy consumption from the use of Joule Thompson (JT) valve cannot be measured separately from the energy consumption of Twister technology, but will be estimated as follows: it determines the volume ratio of glycol that is injected to natural gas before to go through the JT valve, the same ratio will be applied to energy consumption required in the glycol regeneration tower (which has the function of regenerating all the glycol used in the process) and thus would have the measure of energy consumption of JT valve.

PE_y = (2,044.83+547.65+233.06+0.57) (tonne/year) x 38.80 (TJ/Gg) x 54,300 ($kgCO_2$/TJ))/1,000,000

PE_y = 5,932.85 tCO_2e

Leakage

As described in section B.6.1, the leakage of the Project (L_y) will be 0 tCO_2e.

Therefore, L_y = **0**

Emission reductions

Using the equation in section 6.1emission reductions are calculated as follows:

ER_y (tCO_2e/y) = BE_y – PE_y - Ly

Replacing values from above equations:

ER_y (tCO_2e/y) = 19,022.78 - 5,932.85 - 0

ER_y (tCO_2e/y) = 13,089.92

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

Year	Estimation of project activity emissions [tCO_2e]	Estimation of baseline emissions [tCO_2e]	Estimation of leakage [tCO_2e]	Estimation of overall emission reductions [tCO_2e]
2012(*)	4,944.04	15,852.31	0	10,907.10
2013	5,932.85	19,022,78	0	13,089.92
2014	5,932.85	19,022,78	0	13,089.92
2015	5,932.85	19,022,78	0	13,089.92
2016	5,932.85	19,022,78	0	13,089.92
2017	5,932.85	19,022,78	0	13,089.92
2018	5,932.85	19,022,78	0	13,089.92
2019	5,932.85	19,022,78	0	13,089.92
2020	5,932.85	19,022,78	0	13,089.925
2021	5,932.85	19,022,78	0	13,089.92
2022(**)	988.81	3,170.46	0	2,181.42
Total [tCO2e]	**59,328.54**	**190,227.7**	**0**	**130,899.2**

(*) ten months and (**) two months

Table 5: Ex-ante estimation of emission reductions

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{PE,FG,G,y}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the project activity for electricity generation.
Source of data to be used:	Normalized mass – flow meter readings at the project activity site.
Value of data	2,044.83
Description of measurement methods and procedures to be applied:	Measured diary from the beginning of the crediting periodic determining by weighted average annual values. Measurements will be undertaken in line with the standard AGA Report No. 3 "Orifice Metering of natural Gas" Part3 "Natural Gas Applications" or its equivalent API Manual of Petroleum Measurement Standards, Chapter 14 "Natural Gas Fluids Measurement Section 3 "Concentric Square Edged Orifice Meters".
QA/QC procedures to be applied:	Trained staff is responsible for recording data outputs from fuel gas consumption used for electricity generation. The calibration shall be performed initially once a month depending on the results it can spread. The calibration procedure shall be in accordance with equipment manufacturer recommendations. All this documents should be available on each verification.
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period.

Data / Parameter:	$Q_{PE,FG,H,y}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the project activity for heat.
Source of data to be used:	Normalized mass – flow meter readings at the project activity site
Value of data	547.65
Description of measurement methods and procedures to be applied:	Measured diary from the beginning of the crediting periodic determining by weighted average annual values. Measurements will be undertaken in line with the standard AGA Report No. 3 "Orifice Metering of natural Gas" Part3 "Natural Gas Applications" or its equivalent API Manual of Petroleum Measurement Standards, Chapter 14 "Natural Gas Fluids Measurement Section 3 "Concentric Square Edged Orifice Meters".
QA/QC procedures to be applied:	Trained staff is responsible for recording data outputs from fuel gas consumption used for electricity generation. The calibration shall be performed initially once a month depending on the results it can spread. The calibration procedure shall be in accordance with equipment manufacturer recommendations. All this documents should be available on each verification
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period.

Data / Parameter:	$\mathbf{Q_{PE,FG,F,y}}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the project activity for flare.
Source of data to be used:	Normalized mass – flow meter readings at the project activity site
Value of data	259.46
Description of measurement methods and procedures to be applied:	Measured diary from the beginning of the crediting periodic determining by weighted average annual values. Measurements will be undertaken in line with the standard AGA Report No. 3 "Orifice Metering of natural Gas" Part3 "Natural Gas Applications" or its equivalent API Manual of Petroleum Measurement Standards, Chapter 14 "Natural Gas Fluids Measurement Section 3 "Concentric Square Edged Orifice Meters".
QA/QC procedures to be applied:	Trained staff is responsible for recording data outputs from fuel gas consumption used for electricity generation. The calibration shall be performed initially once a month depending on the results it can spread. The calibration procedure shall be in accordance with equipment manufacturer recommendations. All this documents should be available on each verification
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period.

Data / Parameter:	$\mathbf{Q_{PE,FG,T,y}}$
Data unit:	tonne/year
Description:	Yearly fuel gas consumption by the treatment of additional gas.
Source of data to be used:	Energy consumption from the use of Joule Thompson (JT) valve cannot be measured separately from the energy consumption of Twister technology, but will be estimated by Ecopetrol S.A.
Value of data	0.57
Description of measurement methods and procedures to be applied:	The value will be estimated as follows: it determines the volume ratio of glycol that is injected to natural gas before to go through the JT valve, the same ratio will be applied to energy consumption required in the glycol regeneration tower (which has the function of regenerating all the glycol used in the process) and thus would have the measure of energy consumption of JT valve.
QA/QC procedures to be applied:	Trained staff is responsible for estimating data outputs from fuel gas consumption used for the treatment of additional gas based on the proportion of glycol injected JT valve.
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period.

Data / Parameter:	$\mathbf{NCV_{FG,PE}}$
Data unit:	TJ/Gg
Description:	Net calorific value of Fuel Gas (FG) in year *y*.
Source of data to be used:	Values provided by Ecopetrol S.A. for Gibraltar gas plant. Chromatographic analysis – equipment readings at the project activity site.
Value of data	38.80

Description of measurement methods and procedures to be applied:	The values are calculated using standard ISO 6976 "Natural Gas – Calculation of calorific value, density and relative density" from the results of chromatographic analysis realized according to the standard GPA 2261 "Analysis for Natural Gas and similar Gaseous Mixtures by Gas Chromatographic". Measured weekly from the beginning of operation of the project, will be determined by weighted average annual values.
QA/QC procedures to be applied:	Trained staff is responsible for recording data outputs from Net calorific value natural gas consumption. The standard used for calibration of chromatograph is the standard GPA 2261 "Analysis for Natural Gas and Similar Gaseous Mixtures by Gas Chromatographic". All this documents should be available on each verification.
Any comment:	Data will be archived electronically and kept at least for two years after the end of the crediting period.

B.7.2 Description of the monitoring plan:

As stated on the Methodology AMS II.D version 12 a monitoring plan should be developed to include all parameters to be monitored, as described on previous sections. All data could be cross checked and stored on a secure media. Data will be kept during two years after crediting period.

Specifically for this project activity (new facility) monitoring shall consist of:

i. Metering the energy use of the equipment installed;
ii. Calculating the energy savings due to the equipment installed

The monitoring for the project activity is based on measuring and recording fuel gas consumption in:

- Fuel gas for electricity generation.
- Fuel gas for heat.
- Fuel gas for flare.
- Fuel gas for the treatment of additional gas.

The fuel savings shall be determined by comparison with the fuel gas consumption of conventional technology.

An internal operational management would be developed, in which a solid QC should be implemented, so to avoid any risk of data lost by the different devices which are part of the Monitoring system. Emission reduction will be acquired with a complete procedure which defines critical devices, calibrations, troubleshooting procedures, and management of the monitoring activities, defining responsibilities, on a flowchart. Each responsible, should inform to the project manager, of any problem or news regarding the operation of the project activity.

As stated on the Methodology, no leakage will be considered, because the technology is new, and all equipment is also brand new.

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

The date of completion of the application of the methodology to the project activity was on 28/05/2012.

Name of person/entity determining the baseline:

Company: Deuman
Telephone number: + 51 1 593 6531
E-mail: info@deuman.com

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:

The starting date of the CDM project activity is September 19th, 2008. In that date, the contract 5203383 of "Financing, design, purchase of equipment, supplies, construction, testing, operation and maintenance for 15 years of surface facilities for treating Gibraltar gas field, belonging to the vice president of Ecopetrol S.A. production" between Ecopetrol S.A. and UTGG was signed. This has been established as the earliest real action for the implementation of the project activity. The project activity will start its operations on October 1st, 2011.

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

The operational lifetime of the project is 21 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:

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:

The estimated date for the beginning of the crediting period is March 1st, 2011 but the project plans to start its Monitoring and Crediting period only as soon as it is officially registered as a CDM activity.

C.2.2.2. Length:

As indicated in the "Guidelines on additionality of first-of-its-kind project activities, v01.0" the project participants selected a crediting period for the project activity that is "a maximum of 10 years with no option of renewal". Therefore, the credit period considered for the proposed project activity is 10 years and 0 months no renewable.

SECTION D. Environmental impacts

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

An Environmental Impact Assessment (EIA), titled "Estudio de Impacto Ambiental Para Las Actividades De Explotación De Gas Del Campo Gibraltar" in English "Environmental Impact Assessment for the Exploitation Activities of the Gibraltar Gas Field" was performed according to local laws and was approved according to the following environmental permit "Global Environmental Permit for the Gibraltar Gas Field", Resolution No. 0502 issued on March 27th, 2008 by the Ministry of Environment, Housing and Territorial Development from the Colombian Republic.

According to the EIA, several impacts were analyzed and the most remarkable, as stated on it, and on the environmental permit are the following:

- Environmental Zoning and Management
- Significant impacts
- Identified environmental conflicts
- Demand of resources
- Water grants
- Discharge permits
- Forestry achievement
- Construction materials
- Waterbed occupancy
- Air emission permits
- Handling, treatment and final disposal of solid waste
- Environmental management plan
- Tracking and monitoring
- Monitoring of social management
- Contingency plan
- Abandonment and final restoration plan
- Investment Plan 1%

All the documentation performed by ECOPETROL S.A. is available for the DOE which would perform the Validation activity. Also permits and additional information regarding the EIA is available. The project complies with all national regulation and the activity is sustainable based on the developed documentation.

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:

All impacts are treated accordingly to local regulation and solved in the same manner. Environmental commitments were defined on the Resolution and should be followed by the project proponent as stated on this permit i.e. to inform the local authorities (municipalities) regarding the project and their scope, to

look forward the necessary specific permits to execute the project civil works; priority from ECOPETROL S.A. for local hiring; in case of archaeological vestiges discoveries, ECOPETROL S.A. should perform an archaeological prospection by specialists and should develop a study to be submitted to the Colombian Institute of Anthropology and History of de Ministry of Culture. Based on it the Institute would perform a campaign of excavations or archaeological rescue.

SECTION E. Stakeholders' comments

The stakeholder process in Colombia is a requirement based on a procedure defined for the CDM activities, by the local Designated National Authority (Environmental, Housing, and Territorial Development Ministry). This procedure is described on the resolution 0551 from 2009 from this Ministry. The results from this obligatory activity were sent to the Environmental authority which seeks the national approval from them. The procedure described includes an invitation to all stakeholders among others: government, NGOs, educational, private, local authorities, etc. and people (community leaders, union representatives, and community in general), which are living in the area of influence of the project.

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

A stakeholder consultation process[16] was developed in order to invite local stakeholders to express their comments regarding the project "Improving energy efficiency in a new Gas Plant in Gibraltar-Colombia". According to the Resolution 0551 of 2009 emitted by the Ministry of Environment, Housing and Territorial Development, any CDM project must send to the municipal ombudsman office, a document with a description of the project and a letter inviting local stakeholders to participate in a meeting in order to provide information of the project to them and obtain their comments.

The project description and the invitation letter were published at the office of the municipality from October 28th, 2009 until the day of the meeting[17]. In order to assure the participation of as many stakeholders as possible, the project developer announced the meeting in the local radio station. In addition, personal invitations were sent to community leaders, local people, local authorities, committee representatives, media, etc.

The meeting was held at the community hall on November 11th, 2009, at 2:00 pm and was attended by the project owner representatives, project consultant and the stakeholders described in the attendance list. A second meeting was held on November 12th, 2009, at 1:00 pm with representatives of the native community UWA and was attended by the project owner representatives, project consultant and the stakeholders (composed mainly of leaders of the tribe) listed in the attendance list. During the meeting several presentations were made by the project owner and consultants who outlined the planned project activity in a non-technical manner (including environmental, social and technological considerations), climate change, the role of the Clean Development Mechanism and annual emission reductions potential. Also, the presentation was followed by an open period for questions and comments from the participants, as well as time for the respective answers from the project developers.

[16] All physical documents from the stakeholder process would be available for the validation and registration process.
[17] Certification letter signed by the municipal ombudsman – Municipality.

The main objective of the meetings was to clarify and inform the communities about the main characteristics of the project. In addition the meetings allowed stakeholders invited to understand the basic concepts related to the project to be implemented considering the CDM and how the local communities living in the area around the project would be considered.

Figure 10. Stakeholders meeting

All participants were dully registered in appropriate documents. A total of 55 persons from several institutions and communities attended the first meeting and 17 attended the second meeting. All opinions were collected by means of questionnaires fulfilled by the participants. All documents regarding the meeting are available in annex 5.

E.2. Summary of the comments received:

The consultation gave an opportunity for the stakeholders to fully understand the project and how they are going to be part it. The comments from the various assistants to the project presentation were obtained from the survey and directly from comments taken during the presentation. Questions were taken in writing under a predefined format, given to all the assistants, and are compiled and analysed to give an answer to all questions from the stakeholders. The comments received from representatives of the local communities are summarized in the following points expressing their general opinions. The comments during the meeting were related to:

Environmental aspects such as:

- Other residues that could be generated for the project activity.
- Other environmental licence or permits required for the new project configuration.

Social aspects such as:

- Continuation of the social investment in the communities linked during exploration stage.
- Instruments to identify the needs of the community in social investment.

Operational aspects such as:

- The final availability for the community of the gas treated by the plant.
- Application of procedures such as gas flaring during the plant operation.
- Responsibilities for the operation and maintenance of the gas plant and the gas pipeline.
- Final conditions of the soil after gas extraction.

In addition, the local stakeholders were asked to submit their opinion regarding to the project activity by completing a questionnaire handed out by the project developer. The survey shows the stakeholders believe that the proposed CDM project activity will have positive impacts on the local, ecological, environmental, employment, and social life. All stakeholders expressed their support for the proposed project. The complete information of each stakeholder will be provided to the DOE during the validation process.

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

As a result, the comments received by local stakeholders were highly positive about the implementation of the project activity. All written inquiries received and made during the presentation were compiled, organized by topic, and answered in fully by the project developer. During the meeting the project owner assured that:

- Residues different from process water will not be generated. The wastewater would be treated before its final disposition.
- The construction and operation of the project (including the use of the Twister technology) would be in line with the environmental and health laws of the country. The project activity is included in the environmental license granted to the gas plant.
- The current environmental license is being modified to include in the social aspects, the urban area of the communities of Cubará.
- The project developer will develop social programs in the community, considering all communities in the area (regional programs).
- The project developer invited the communities to present social investment projects.
- It is necessary to develop a meeting with other communities and companies working in the area to define the priority projects for the community.
- The social investment will be applied to regional projects to benefit the major quantity of actors.
- Exists the possibility to distribute the gas into the community; however it is necessary to develop a feasibility survey to determine the viability.
- The gas treatment has different process in comparison with the "gas extraction" reason for why during the plant operation will not be gas being burnt.
- Only a minimum quantity of condensates and gas will be flared for security or during emergencies.
- The project developer assures that a company “Union Temporal Gibraltar - UTG” will be created for the operation and maintenance of the plant (and the Twister technology). The transportation and marketing of the gas will be developed by other oil companies.
- Ecopetrol will be in charge of the surveillance of the performance of UTG and only can response regarding situations related with the gas plant.
- After the gas extraction, the empty space (occupied before by gas) will be occupied naturally by underground water and other constituents. There is no risk for the communities or the environment.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ECOPETROL S.A.
Street/P.O.Box:	Carrera 7 No.37 – 65.
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State/Region:	N/A
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URL:	www.ecopetrol.com.co
Represented by:	N/A
Title:	Environmental Theme Leader
Salutation:	Mr.
Last Name:	Leal
Middle Name:	Alberto
First Name:	Luis
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Direct FAX:	+57 1 2344405
Direct tel:	+57 1 2344433
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was considered for the project activity

Annex 3

BASELINE INFORMATION

In the next tables the most relevant input data used to estimate the emission reductions are presented:

Data used for calculating emissions

Data/Parameter	Value		Data Unit	Source of Data
	Baseline	Project		
NCV (BTU/SCF)(*)	1523,18	1254,48	BTU/SCF	Ecopetrol S.A.
NCV (TJ/Gg)	47,11	38,80	TJ/Gg	
Weight Molecular Fuel Gas (lb/lbmol) (*)	28,37	24,39	lb/lbmol	Ecopetrol S.A.
EF_{CO2} ($kgCO_2$/TJ) (**)	54.300	54.300	$kgCO_2$/TJ	IPCC

(*) Supporting Documents:
"Anexx 2.pdf": Simulation Results Mechanical Refrigeration Technology (company MASA SA).
"Anexx 3.pdf": Simulation Results Twister Technology (company UTGG).
(**) 2006 IPCC Guidelines for National Greenhouse Gas Inventories, CHAPTER 1, Table 1.4 (lower limit of the 95% confidence intervals)

Fuel Gas Consumption for Technologies

	Traditional Technology: Mechanical Refrigeration		New Technology: Twister	
Fuel Gas consumption	**BTU/h**	**tonne/year**	**BTU/h**	**tonne/year**
Fuel Gas for electricity generation	19,010,908	3,663.23	10,165,854	2,044.83
Fuel Gas for heat	18,231,960	3,513.23	2,722,630	547.65
Fuel Gas for flare		259.46		223.06
Fuel Gas for the treatment of additional gas			2,837	0.57
Total Fuel Gas		**7,436.02**		**2,816.11**

Emissions Calculation

	New Technology	Traditional Technology
Fuel Gas Consumption (tonne/year)	2,861.11	7,436.02
Baseline Emissions (tCO_2/year)	BE_y =	19,021.38
Project Emissions (tCO_2/year)	PE_y =	5,932.85
Leakage (tCO_2/year)	L_y =	0.00
Emissions Reductions (tCO_2/year)	ER_y =	**13,088.53**

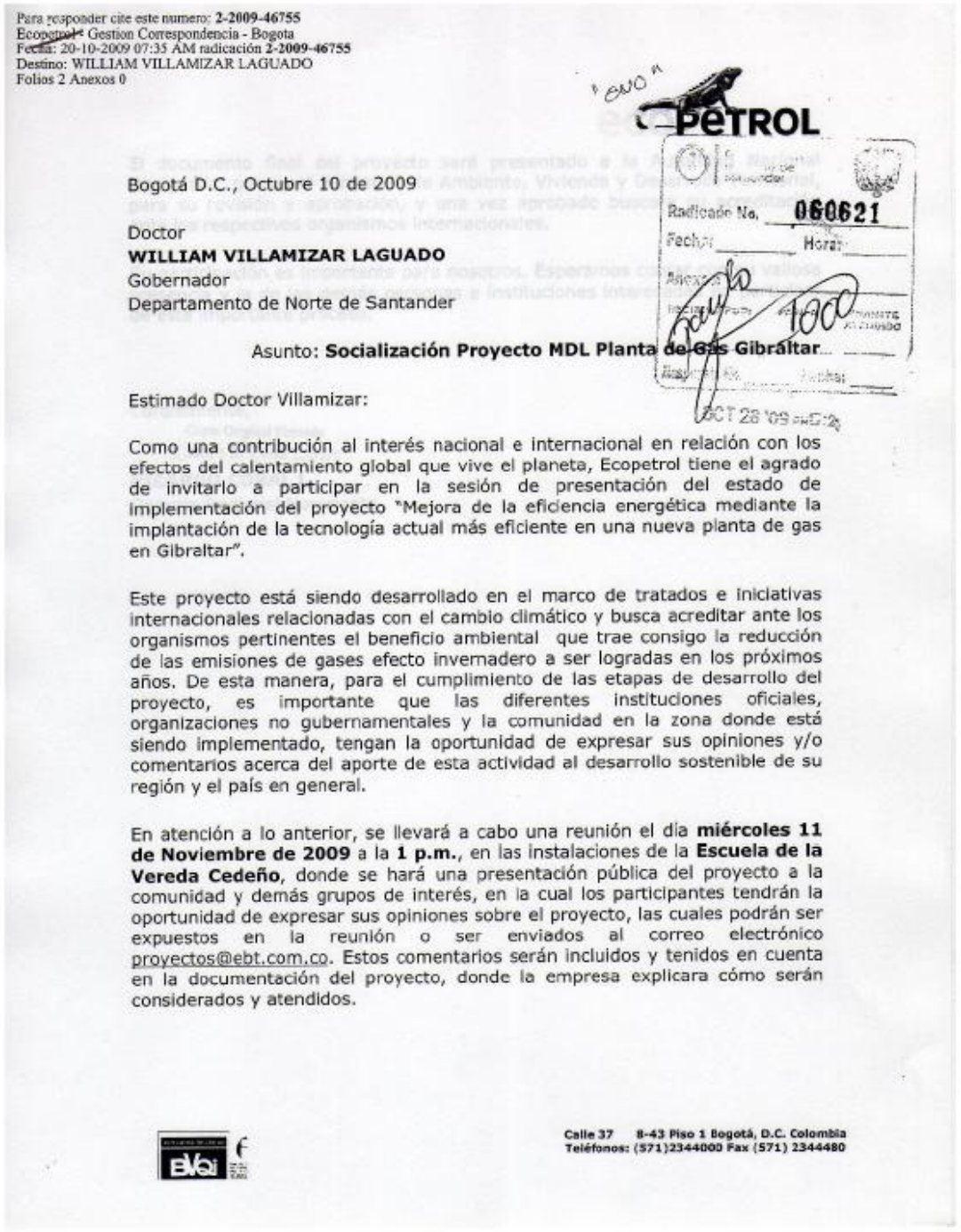
Annex 4

MONITORING INFORMATION

All relevant information has been presented in Sections B.7.

Annex 5

STAKEHOLDERS COMMENTS INFORMATION



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Fecha: Hora:

Bogotá D.C., Octubre 10 de 2009

Doctor
WILLIAM VILLAMIZAR LAGUADO
Gobernador
Departamento de Norte de Santander

Asunto: **Socialización Proyecto MDL Planta de Gas Gibraltar**

Estimado Doctor Villamizar:

Como una contribución al interés nacional e internacional en relación con los efectos del calentamiento global que vive el planeta, Ecopetrol tiene el agrado de invitarlo a participar en la sesión de presentación del estado de implementación del proyecto "Mejora de la eficiencia energética mediante la implantación de la tecnología actual más eficiente en una nueva planta de gas en Gibraltar".

Este proyecto está siendo desarrollado en el marco de tratados e iniciativas internacionales relacionadas con el cambio climático y busca acreditar ante los organismos pertinentes el beneficio ambiental que trae consigo la reducción de las emisiones de gases efecto invernadero a ser logradas en los próximos años. De esta manera, para el cumplimiento de las etapas de desarrollo del proyecto, es importante que las diferentes instituciones oficiales, organizaciones no gubernamentales y la comunidad en la zona donde está siendo implementado, tengan la oportunidad de expresar sus opiniones y/o comentarios acerca del aporte de esta actividad al desarrollo sostenible de su región y el país en general.

En atención a lo anterior, se llevará a cabo una reunión el día **miércoles 11 de Noviembre de 2009** a la **1 p.m.**, en las instalaciones de la **Escuela de la Vereda Cedeño**, donde se hará una presentación pública del proyecto a la comunidad y demás grupos de interés, en la cual los participantes tendrán la oportunidad de expresar sus opiniones sobre el proyecto, las cuales podrán ser expuestos en la reunión o ser enviados al correo electrónico proyectos@ebt.com.co. Estos comentarios serán incluidos y tenidos en cuenta en la documentación del proyecto, donde la empresa explicara cómo serán considerados y atendidos.

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Figure 10. Invitation letter model.

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Fecha: 11 Noviembre 2009	Lugar: Salón Parroquial - Samoré	Ponente: Consorcio Deman - Ecopetrol

Titulo: Presentación del proyecto "Mejora de la eficiencia energética mediante la implantación de la tecnología actual más eficiente en una nueva planta de gas en Gibraltar" aplicando los instrumentos del mercado del carbono (MDL).

No.	NOMBRE	ENTIDAD	CARGO	E-MAIL	TELÉFONO
	Jose de Jesus Gonzalez	J 46 Gibraltar	Presidente		3733924682
	Yolman Albeiro Ramirez Gonzalez	88 033 106 JAC	Troya		3125465785
	Jose German Guerrero	Uncacias	tesorero		374278506
	Samuel Perez	94657726	delegado		3724477264
	Cipriano Torres Lizcano	J.A.C El Limoncito	Presidente		3144658932
	Samuel Gonzalez	JAC Bongota	precidente		312 418 4384
	Humberto Mendez Garcia		soldado		310 2449361
	Orlando Mendoza				88155168
	Jorge Duran Peña		soldador		3138724794
	David Contreras	73354725	Delegado		
	Eduardo Parra	88161282	Delegado lechero		
	Luz Mary Parra Paez	27881096	V. Presidenta.	[illegible]	3123795107
	Genaro Perez Valencia	9466083	Presidente		3138333118
	Jose Evangelista Fonseca	1758436	Presidente		3208589121
	Ana Lizarazo C	JUNTA CORTINAS	PRESIDENTE.	lizarazoana@Hotmail.com	[illegible]
	Misael Valencia	9466688 santamarta	delegado		3133984859.
	Luz Arminda Valencia B	33416095	delegada		3208355406
	Gladys Duarte	Secretario	Secretario	gladys duarte	3137716997
	Maria Hipolita Toro	Delegada JAC porvenir			3133136488
	Leonor Ortiz M.	33515459.	Delegado JAC.	Vda california	3142407899
	Edwin Aguillón Tarazona	Alcaldía	Inspector Policía		3124675563
	Jose E Caicedo Duque	5.779.907	Afiliado		3107689113.
	José David Vera R.	88306634	Presidente Junta		3204342161
	Raquel Arias Castañeda	JAC Cedeño	Delegada		3134535240
	Ana Rosa Jaimes	28076249	CCC		3134430199
	Inés Vera Vera	60257139	Socio		3134211238
	[illegible] Duarte	9460.142	Fiscal		3134381817

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Fecha: 11 Noviembre 2009	Lugar: Salón Parroquial - Samoré	Ponente: Consorcio Deman - Ecopetrol

Titulo: Presentación del proyecto "Mejora de la eficiencia energética mediante la implantación de la tecnología actual más eficiente en una nueva planta de gas en Gibraltar" aplicando los instrumentos del mercado del carbono (MDL).

No.	NOMBRE	ENTIDAD	CARGO	E-MAIL	TELÉFONO
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	Elio Guerrero Archila	JAC Vereda cedeño	presidente.	Eliosalud@gmail	310 5851724
	Honorio Peña Cereda	vereda la pista	delegado	Honorio P	3144350908
	[illegible]	Vereda Troya	Vicepresidente		3138152185
	[illegible]	Santa Maria.	Socio.		
	[illegible] Lizarazo	Vda. La China	delegado.	[illegible]	3123491672
	Jose H. Madrona	ECP	Tecnico	Luis Madrona Ecp	3103313538
	Alexander Posada M.	Vda Rio negro	VicePresidente	[illegible]	313.3614357
	[illegible]	PTE Vereda Porvenir	Presidente JAC	[illegible]	3133983707
	Jesús Odmar Acevedo	Ecopetrol	Sup. Operaciones	jesus.acevedo@ecopetrol.	5760260
	Eliecer Florez	Cedeño			3149129096
	Jorge Alexander Garcia T.	Ved. Rio Negro	Socio	— o —	3133714530
	Teofilo Fonseca	Santamaria	delegado	[illegible]	[illegible]
	Juan Pablo Garcia V	9467281 de cu	Asesor comu.		
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	Jesus Ivan Quiñonez V.	9466552	Del. Asuntos Cubará		3138310939
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	German Mendez Fontana	SAMORE	Delegado	— o —	3133832382.
	[illegible]	Samoré	Delegado	— o —	88155168
	Gladys Yolanda Caceres	VED el diamante	Secretaria.	— o —	3138143237
	Ilan Yolanda [illegible]	Pienda de [illegible]	[illegible]		
	Jader Javier Ruiz Ibarra	Limoncito	Fiscal		3744329270
	Humberto Mendez Garcia	V. Santa Maria			3102449361
	Alcides Villamizar	88 5449999	Presidente		3202928119
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Fecha: 12 Noviembre 2009	Lugar: Saravena	Ponente: Ecopetrol - Devon.

Titulo: Presentación del proyecto "Mejora de la eficiencia energética mediante la implantación de la tecnología actual más eficiente en una nueva planta de gas en Gibraltar" aplicando los instrumentos del mercado del carbono (MDL).

No.	NOMBRE	ENTIDAD	CARGO	E-MAIL	TELÉFONO
1.	Kuangkuso Tegria	Asou'wa	—	carosou'wa@yahoo	—
2.	María Luisa Santander T.	Asou'wa	—	malusauzi@yahoo.com	—
3	Bladimir [illegible]	Asou'wa	Vicepresidente		3103691178
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5	NELSON MENDOZA E	C62008	INGENIERO CIVIL	nelsonmendoza[illegible]@hotmail.	—
6	Victor Hugo Amaya	C9147615	DAS-GNO	victorhamaya[illegible]	—
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15	Paulina Roldán Hernandez	Coord. [illegible]	[illegible]	[illegible]@hotmail.c	3212009512
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Figure 11. List of participants to the project presentation