Project design document form
(Version 10.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	Cucuana Hydroelectric Power Plant
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	05
Completion date of the PDD	02/04/2019
Project participants	Empresa de Energía del Pacífico S.A. E.S.P (EPSA E.S.P.)
Host Party	Colombia
Applied methodologies and standardized baselines	ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”
Sectoral scopes linked to the applied methodologies	1:“Energy industries (renewable - / non-renewable sources)”
Estimated amount of annual average GHG emission reductions	88,250 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The purpose of this project is to build a Hydroelectric Power Plant, with a nominal water capacity of 55 MW (total installed capacity of 58.16 MW), with the aim of making use of the capacity of the Cucuana and San Marcos rivers (San Marcos is a tributary of the Cucuana River). The ultimate objective of the project is not to simply build a power plant to cover the expected increase in demand for electricity, but to contribute to the improvement in the efficiency of the electricity system in general; increasing the electricity service in the department of Tolima, while contributing to the sustainable development of the region with the reduction of CO_2 emissions.

The Cucuana Hydroelectric Power Plant project is located in the middle section of the basin of the Cucuana River, between points 2,200 and 1,500 metres above sea level, in the eastern slope of the Central mountain range, in the municipality of Roncesvalles in the department of Tolima. The power plant obtains water at 2,170 metres above sea level in the Cucuana River with a mean flow of 7.0m^3/s, and at 2,179.5 metres above sea level in San Marcos River with a mean flow of 2.7 m^3/s. The water which has been obtained in San Marcos river is driven through a free-flow diversion tunnel until the Cucuana river, where it is delivered into the calming tank located upstream of the sand trap of the Cucuana river. From here, both water flows will be driven with pressure systems to the engine house, located in the point 1,454.5 metres above sea level, where four Pelton turbines in tandem configuration, with an installed capacity of 29.07 MW and a design hydraulic power of 27.5 MW each tandem, will make use of the kinetic energy to generate electrical energy through a clean energy system that is free from greenhouse gas emissions. The power plant will supply to the Colombian electricity system 252 GWh annually.

The spatial extension of the project boundary includes the physical location of the project (Cucuana power plant) and all plants connected to the electricity system (National Interconnected System of Colombia). The electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin, which is considered the baseline scenario.

Said electrical energy with a hydraulic origin will replace energy that, in the absence of the power plant, would be partially produced by fossil fuel consuming plants that emit greenhouse gases. Therefore, the result of the commissioning of this power plant will reduce the global greenhouse gas emissions (the project activity is expected to reduce 88,250 t CO_2e/year or 617,750 t CO_2e during the first crediting period of 7 years) of the Colombian power plant infrastructure, reducing its contribution to the global climate change.

The power plant's characteristics are as follows:

Type of regulation: ....Run-of-river
Capacity of Cucuana distribution point (m^3/s):...7.0
Capacity of San Marcos distribution point (m^3/s): 2.7
Turbines design flow (m^3/s)... 9.7
Elevation of Cucuana distribution point (metres above sea level): 2,170
Elevation of San Marcos distribution point (metres above sea level): 2,179.5
Length of the San Marcos tunnel (m):... 1,076
Length of the Cucuana tunnel (m):... 1,698
Length of the La Ensillada pipe (m):... 137.7
Length of the La Ensillada tunnel (m):... 1,700.9
Length of the load pipe (m):... 1,596
Maximum gross drop (m):.. 714
Maximum net drop (m): 698
Generators installed capacity (MW)... 58.16
Turbines installed capacity (MW):.. 58.14
Design Hydraulic capacity (MW)...55
Number of generators..2
Number and type of turbines:..................................... 4 turbines in tandem, Pelton

Project Background

In August 2000, Generadora Unión S.A. E.S.P. applied to Cortolima for the authorization for the study of the natural resources of the Cucuana river basin, in which a high hydroelectric potential for the development of projects of 10 and 100 MW had been identified. In November 2000, Cortolima approved this authorization.

In April 2005, Generadora Unión transferred to the municipality of Roncesvalles the authorization for studies of the Cucuana river basin.

At the end of 2005, the municipality of Roncesvalles offered Empresa de Energía del Pacífico S.A. E.S.P (EPSA) to transfer the rights in order to develop a hydroelectric project in the Cucuana river basin. In November 2007, Cortolima accepted through resolution to transfer to EPSA the rights that allow the municipality of Roncesvalles the hydraulic exploitation of the Cucuana river basin, in order to get on with hydroelectric projects.

EPSA agreed to study the exploitation of the Cucuana River through hydroelectric power plants with minimum environmental problems, and with economic viability, taking into consideration the new financing resulted from the certified emissions reductions (CERs) market.

Contribution to Sustainable Development

Hydroenergy is a source of energy that is free of greenhouse gas emissions, so that the on-site project emissions are almost zero. The electric energy generated from renewable energy sources supplied to the National Interconnected System (NIS) by the power plant of Cucuana will partially shift the energy coming from thermal power plants. Since the fossil fuel consuming plants will stop operating or will decrease their rate of activity, the project shall entail a global reduction of the greenhouse gas emissions in the Colombian infrastructure of electric energy generation plants.

In particular, the Project of the hydroelectric power plant of Cucuana contributes to the fulfilment of the following national sustainable development priorities:

- Reduction in the atmospheric contamination (NO_X, SO_X, COV_s and suspended particles) and contamination of water.
- Reduction in the consumption of fossil fuels.
- Increase in the use of renewable energy sources.

To sum up, the Hydroelectric Power Plant of Cucuana shall add 55 MW of capacity to the Colombian electricity generation system and will provide a response to the following objectives set forth:

- To cater for the electricity generation and supply requirements of Tolima with an environmentally sustainable method and with the use of non-intensive carbon energy resources in the area, thus preventing the dependence on fossil fuels.
- Contribute towards the sustainable development priorities of the Department of Tolima with the corresponding environmental and economic benefits for the country in general and for the project area in particular, both in the medium and long-term.
- Stimulate the transfer of clean technologies from the most developed countries, while attracting investment flows to Colombia, thus encouraging the sustainable development of the country.
- Reduce the level of global greenhouse gas emissions from the national Colombian electricity system, thus mitigating the medium and long-term effects of the global climate change. Therefore, this type of project will establish the bases to share the financial burden derived from the need to assume an active role in the fight against the global climate change between developed and developing countries.

The power plant will be of the run-of-river type with the purpose of minimising environmental impact. Therefore, the water collection area will not require an accumulation reservoir. The absence of regular reserves of water will condition the production of electricity to the availability of water. However, the power plant will generate a lower visual impact and enable the Cucuana River to maintain its environmental and social functions.

The project also has an important social component. The power plant will be located in an area with a low standard of living, with a very low level of community equipment[1], and thus the basic needs (sanitation, education, etc.) will not be adequately satisfied in the area. The project contributes to regional development, consolidating the local and regional administrations in institutional terms. Its operation will provide direct financing to the municipalities that are directly affected[2], which will allow them to assume the development of their own projects, thus contributing directly to the improvement in the standard of living of the communities affected.

Apart from the said financing schemes, the execution of the project will contribute to the creation of jobs. Therefore, the project will offer jobs in three areas:

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[1] For example, we can highlight that 3 out of 10 children with school age in the direct area of influence of power plant 3 are out of the educational system and in most nearby towns and villages the supply systems do not have a treatment plant and the community infrastructures are restricted to a community hut.

[2] In this sense, we can highlight article 45 of Act 99 of 1993, which establishes that the energy generation companies must transfer, in the case of hydroelectric power plants, up to 6% of the gross energy sales of each power plant to the municipalities and regional autonomous corporations that are located on the area of the hydrographical basin that supplies the reservoirs and which are on the reservoir areas. Therefore, the power plant's operation will generate an amount for local corporations, so that they can exploit the sustainable development advantages.

1- Construction: the offer will include 316 direct jobs (266 workers, 41 technicians and 9 professionals) and 600 indirect jobs. For the operating phase, 20 direct jobs will be created, including administrative and operating staff. In addition, a training program will be implemented for the different project's occupations.
2- Execution of activities of the Environmental Handling plan: 10 direct and 20 indirect jobs will be created.
3- Execution of 1% of the Investment Plan: 15 direct and 15 indirect jobs will be created for the execution of the plan, using local labour for some of these jobs.

Relating to the sustainable contribution, EPSA is going to make different kinds of donation. Some of them are mandatory by the national regulation and others are voluntary and include the investment in social projects identified and prioritised by the community.

1. Investment in communities, environment and protection of the river basin:
   - Performance of the Mandatory Plan of the 1%: provide support to the formulation of the handling plan of the river basin, environmental training, institutional strengthening of the cleaning up policies and conservation of the river basin.
   - Environmental Handling Plan (mandatory): physic, biotic and socioeconomic components and the monitoring plan.
   - Voluntary investment plan: include infrastructure projects (construction of children's parks, rural aqueducts, irrigation district, septic tanks), environmental projects (water source isolation, tree planting) and revenue generation projects (cultivation of vegetables, fish farming, agro-industrial processes, milk trade, extraction of materials from the river by hand).
2. Transferences to CORTOLIMA, municipalities and communities:
   - Mandatory transferences by the law 99/1993: within the mandatory contributions, it will be transferred a 3% of the investment to the affected municipality (Roncesvalles) and a 3% of the investment to the *Corporación Autónoma Regional del TOLIMA, (CORTOLIMA)*.
   - CDM benefits (voluntary): additionally, EPSA will donate to the affected communities a 25% of the revenue obtained from the sale of the Certificate Emission Reductions (CERs).

Therefore, the hydroelectric power plant project of Cucuana contributes from the social, environmental and economic point of view to the development of Tolima, so that we can affirm that this is an eligible project in terms of the methods and procedures of the clean development mechanism (CDM) set forth by the UNFCCC.

The participant of the host country is EPSA, Empresa de Energía del Pacífico S.A. E.S.P. (Pacific Energy Company). It is a private Colombian company, incorporated in 1995 with the purpose of assuming the electric energy generation, transmission, distribution and marketing functions that were previously in the hands of the Regional Autonomous Corporation of the Cauca Valley. This company is the distribution network operator in all municipalities of the Department of Valle del Cauca, except for Cali, Yumbo and Cartago. From its origins, the Company has been very beneficial to the region, while delivering other benefits to its strategic partners, such as CVC, Emcali, the municipalities of Suarez and Morales, as well as to its employees and other partners.

A.2. Location of project activity

Republic of Colombia

Department of Tolima

The project of the Hydroelectric Power Plant of Cucuana is an exploitation of the capacity of the Cucuana and San Marcos Rivers (San Marcos is a tributary of the Cucuana River), and is located on the middle section of the basin of the Cucuana River, which include the sub-basin of the San Marcos River. The water flows through the river points 2,200 and 1,500 metres above sea level, in the department of Tolima, municipality of Roncesvalles. The municipality's head is located in the southwest of Ibagué, department's capital, and the access is possible through Ibagué-Rovira-Roncesvalles path within a length of 110 km. A different and longer access is through Espinal-Guamol-Ortega-Chaparral-San Antonio-Roncesvalles path. The engine house is located in the elevation 1,500, before the mouth of the San Marcos tributary into the Cucuana River, in the municipality of Roncesvalles.

In particular, the water intake point is located on the following coordinates in decimal format.

ENGINE HOUSE	4.016247º	-75.526683º

A.3. Technologies/measures

This project has two water catchments, one in the Cucuana River and one in San Marcos River. In the Cucuana River, water is collected in the point 2,170metres above sea level and is driven to an intake chamber, a gravel removal system and from here it is driven through an adduction channel until a calming chamber which also collects the water collected in the San Marcos River at the elevation 2,179.5 metres above sea level and which after passing through a gravel removal system is driven until the calming chamber through the San Marcos tunnel. From this calming chamber, both water flows pass through a sedimentation basin and afterwards are driven through a pressure tunnel (Cucuana tunnel), a pressure pipe (La Ensillada siphon) and a conduction tunnel (La Ensillada tunnel) to finally arrive to the load pipe which split into two flows to distribute to four Pelton turbines in tandem configuration. The turbines are hosted in a surface machine house with their respective generators, valves and control panels. The engine house also hosts the connections yard.

The electrical energy distribution line is rated at 115 KV using a simple circuit with metallic small towers, and it is connected to the sub-station of Mirolindo, located in Ibagué, capital of the department of Tolima. The distribution line is 64.3 km in length, starts in the engine house and pass through rural areas in the municipalities of Roncesvalles, San Antonio, Rovira and Ibagué.

A small explanation of each stage and unit mentioned in the previous paragraph is included below:

- **Collection in Cucuana River**:
    - **Dam**: it is located in the point 2,172metres above sea level and its function is to generate a small damming that will allow the water collection from the river above (its function is not to store water but to make easier the collection of water). It is designed to evacuate a maximum rising tide of the last 1,000 years by the Cucuana River.
    - **Desilting canal**: it is located in the left margin of the Cucuana River and allows the handling of the river during the construction of the dam as well as to establish a fast flow in front of the lateral collection point that will allow sweeping all the sediments aggraded in front of it.
    - **Water collection**: the water intake point or bypass point is a lateral collection point at 2,170 metres above sea level and is formed by two units with gratings leaning 15º with respect the vertical line.
    - **Intake chamber and Gravel removal system**: they act as transition between both the water intake point and the adduction channel and the sedimentation basin. The last one has a structure that allows to discharge the required ecological flow downstream the water collection, especially in the low-water season due to in the high-water season water will run over the dam. The discharge of the ecologic flow will happen downstream the dam in the Cucuana River through the desilting canal.
    - **Adduction channel**: it has a slope of 0.11% and drives water collected in the Cucuana River until the sedimentation basin.
    - **Calming tank**: it also receives the water collected in the San Marcos River. From this point both water flows from the Cucuana and San Marcos rivers are delivered into the sedimentation basin.

- **Collection in San Marcos River**:
    - **Dam**: it is located in the point 2,181.5 metres above sea level and its function is to generate a small damming that will allow the water collection from the river above (its function is not to store water but to make easier the collection of water).It is designed to evacuate a maximum rising tide of the last 1,000 years.
    - **Desilting canal**: it is located in the right margin of the San Marcos River and allows the handling of the river during the construction of the dam as well as to establish a fast flow in front of the lateral collection point that will allow sweeping all the sediments aggraded in front of it.

- **Water collection**: the water intake point or bypass point is a lateral collection point at 2,179.5 metres above sea level and is formed by one unit with gratings leaning 15 º with respect the vertical line.
- **Gravel removal system**: it acts as transition between both the water intake point and the adduction channel to the San Marcos tunnel. The last one has a structure that allows to discharge the required ecological flow downstream the dam through the desilting canal.
- **Connexion channel**: it links the gravel removal system with the San Marcos tunnel and has a slope of 0.64% and 14.1 metres in length.

- **San Marcos tunnel**: it is a free-flow diversion tunnel with 1,076 metres in length, a slope of 0.67% and a horseshoe section. This tunnel delivers the water collected in the San Marcos river into the calming chamber located upstream of the sedimentation basin.

- **Sedimentation basin**: it is a double sand trap that eliminates thin sediments collected in the Cucuana River and the ones diverted from San Marcos River.

- **Cucuana tunnel**: horseshoe section and partially lined tunnel with 1,698 metres in length and a diameter of 3 metres. Its slope is 2% and it delivers to La Ensillada siphon at the point 2,130.43 metres above sea level.

- **La Ensillada pipe**: it is a metallic pressure pipe with 137.7 metres in length and a diameter of 1.75 metres. Its function is to overcome the small plateau that is in the alignment of the conduction tunnel that links the Cucuana River with the load pipe in the engine house. The pipe is superficial and it delivers to La Ensillada tunnel.

- **La Ensillada tunnel**: horseshoe section and partially lined tunnel with 1,700.9 metres in length, a diameter of 3 metres and a slope of 0.4%. At the end of the tunnel there is a holder with a vertical well.

- **Load pipe**: it is 1,596 metres long and is divided in four parts with different diameter. This pipe splits into two flows to distribute to two generation units at the point 1,453 metres above sea level.

- **Engine house**: house of the superficial type that integrates the spaces required to host the two sets of generators with four Pelton turbines of 58.14 MW of installed capacity in tandem configuration and the connection’s yard. The installed capacity of each generator is the same, and is thus equivalent to 50% of the total capacity of 58.16 MW with a water capacity of 55 MW.

MAIN CHARACTERISTICS OF THE TURBINES	
Number of units	4 in tandem configuration
Type	Pelton, horizontal
Gross drop	714m
Maximun net drop	698m
Design flow per tandem (2 turbines)	3.23m^3/s
Installed power per tandem	29.07 MW
Design hydraulic power per tandem	27.5 MW
Nominal speed	720 m^{-1}

- **Discharge structure**: it allows to return the water flow diverted upstream to the Cucuana River. It is formed by a box-culvert, a dissipation chamber and a delivery trapezoidal channel. The discharge takes place at the point 1,443.00 metres above sea level.

- **Electrical distribution line**: The line that enables the connection of the energy generated between the engine house and the sub-station of Mirolindo has the following characteristics:

Nominal voltage	115 KV
Number of circuits:	Simple three-phase circuit
Conductor:	ACSR 556,5 MCM DOVE
Cable guard	Type: Optical Ground Wire(OPGW)
Structures:	Metallic towers in lattice, with a configuration for the one three-phase circuit
Insulating elements:	Polymer based
Length of the line:	64.3 km
Number of structures:	125

The distribution line will pass through rural areas in the municipalities of Roncesvalles, San Antonio, Rovira and Ibagué.

Complementary civil works: access path to the collection, holder, engine house, adaptation of landfills, rehabilitation of current routes, expansion of energy networks for the construction, workshops, offices, concrete and crusher plant and personnel facilities for workers.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (Host)	Empresa de Energía del Pacífico S.A. E.S.P (EPSA E.S.P.)	No

A.5. Public funding of project activity

This project does not include public finance sources.

A.6. History of project activity

A.7. Debundling

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

If we take into account the Colombian energy grid, the type of data available and the CDM project activity, this project activity will be developed in accordance with the approved consolidated baseline and monitoring methodology ACM0002 / Version 13.0.0 “Consolidated baseline methodology for grid connected electricity generation from renewable sources”[3].

This methodology draws upon the following tools:
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- Tool for the demonstration and assessment of additionality (version 0.7.0.0)[4]
- Tool to calculate the emission factor for an electricity system (version 03.0.0)[5]

[3] http://cdm.unfccc.int/filestorage/D/Y/P/DYPFI935XBG274NWH6O8CM1KEZR0VU/EB67_repan13_ACM0002_ver13.0.0.pdf?t=SzV8cHAzZXAxfDAmcrL0EyS7yHGTA1B4drvj

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf

B.2. Applicability of methodologies and standardized baselines

According to the approved consolidated methodology ACM0002, Version 13.0.0 "This methodology is applicable to grid-connected renewable power generation project activities that involves installation of a new hydroelectric power plant".

The project activity is grid connected hydropower project and satisfies the applicability criteria of the methodology, according to the analysis below:

Applicability condition in ACM0002 ver. 13.0.0	Characteristics of the project activity	Applicability criterion met?
The methodology is applicable if the project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The project activity is an installation of a new run of the river type hydro power plant.	Yes
The project activity is a capacity additions, retrofits or replacements (except for capacity addition projects for which use the electric generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	This activity project is not a case of capacity additions, retrofits or replacement.	Not Applicable
In case of hydro power plants, at least one of the following conditions must apply: - The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or - The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity; or - The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2 after the implementation of the project activity.	The project activity results in a new single reservoir having power density more than $4W/m^2$.	Yes
In the case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 after the implementation of the project	The project activity does not use multiple reservoirs	Not Applicable

activity all of the following conditions must apply: - The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2 ; - All reservoirs and hydro power plants are located at the same river and were designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; - The water flow between the multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; - The total installed capacity of the power units, which are driving using water from the reservoirs with a power density lower than 4 W/m^2 , is lower than 15 MW; - The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2 , is less than 10% of the total installed capacity of the project activity of the project activity from multiple reservoirs		
The methodology is not applicable to the following: - Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; - Biomass fired power plants; -A hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.	The proposed project activity does not involve switching from fossil fuels to renewable energy. It is neither a biomass fired power plant nor the power density is more than 4 W/m^2.	Yes
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is .the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.	This activity project is not a case of capacity additions, retrofits or replacement.	Not Applicable

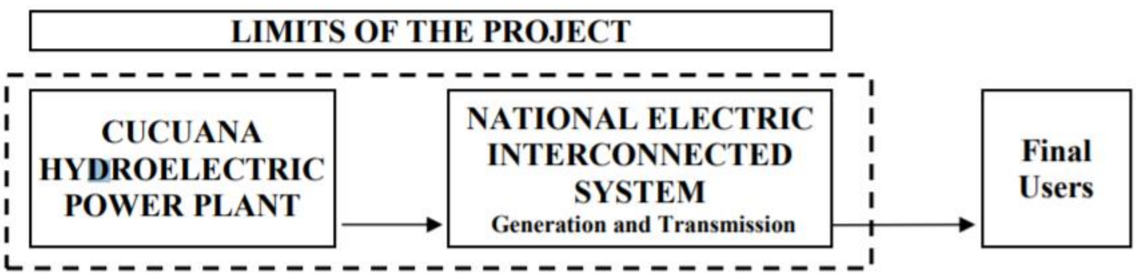
B.3. Project boundary, sources and greenhouse gases (GHGs)

According to ACM0002 Version 13.0.0 the following greenhouse gases and emission sources must be considered to be included or excluded from the project boundary of the proposed project activity:

Source		GHG	Included?	Justification/Explanation
Bas	CO_2 emissions from electricity generation in fossil fuel fired power	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source

	plants that are displaced due to the project activity	N_2O	No	Minor emission source
Project activity	For geothermal power plants fugitive emissions of CH_4 and CO_2 from noncondensable gases contained in geothermal steam	CO_2	No	The project activity is not a geothermal power plant
		CH_4	No	The project activity is not a geothermal power plant
		N_2O	No	The project activity is not a geothermal power plant
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	Yes	The project activity is not a geothermal power plant or a solar power plant
		CH_4	No	The project activity is not a geothermal power plant or a solar power plant
		N_2O	No	The project activity is not a geothermal power plant or a solar power plant
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Minor emission source
		N_2O	No	Minor emission source

The spatial extension of the limits of the project includes the physical location of the project (Power Plant of Cucuana) and all plants connected to the electricity system, which will be connected to the Hydroelectric Power Plant of Cucuana (National Interconnected System of Colombia), as shown on the following figure:



B.4. Establishment and description of baseline scenario

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The hydroelectric power plant project of Cucuana is based on the construction of a new plant that will be integrated in the National Interconnected System of Colombia. The system is composed of a combination of power plants that consume fossil fuels and plants that use renewable energy sources. In accordance with the growth of the expected demand, the system will grow with the integration of new power plants. Therefore, the baseline scenario is the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. Both aspects are depicted in the Combined Margin Emission Factor, which is calculated as shown in the last version of the “Tool to calculate the emission factor for an electricity system” and which calculation is described afterwards.

B.5. Demonstration of additionality

Early consideration of CDM

The following timeline shows the main actions and milestones that prove the priori and parallel consideration of the CDM to the project activity. In order to assure that continued and real actions were taken, the long term decisions and commitments are evidenced:

Timetable including relevant information

Date	Key Event	Evidence
November 2007	Union Fenosa Strategic Plan (BIGGER). Approval of investment.	BIGGER PLAN
17/04/2008	Environmental Impact Assessment	Ingetec S.A.
13/06/2008	Agreement with CDM consultant	Socoin
18/06/2008	Agreement with DOE for validation services	AENOR
21/07/2008	Initial adoption of PDD submitted to DOE for Validation	EPSA
02/08/2008	Public Consultation	UNFCCC website
06/07/2009	No Objection Letter	Colombian DNA
28/09/2010	Starting Date of project activity	Date of purchase of equipment by EPSA
17/03/2011	Beginning of civil works (accesses)	Chronogram

As stated above, the additionality of the project activity has been analysed with the use of the Tool for the demonstration and assessment of additionality", version 07.0.0 These are the steps followed:

Step1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step1a. Define alternatives to the project' activity:

The alternatives defined are the following:

- Continuation of the current trend to add capacity to the system (baseline scenario).
- Execution of the project without its registration as CDM.
- Construct a 55 MW fuel-fired power plant in order to supply this electricity to the Interconnected System.

Building and evaluating a Fuel Power Plant has been considered as an option for supplying energy to the system, as indicated in Reference Expansion Plan Generation - Transmission, 2008-2022, UPME (Chapter 4)[6]. It is also necessary to mention that Colombia is a country with high quality coal and high reserves of this resource (7,063.58 million tons of coal, which correspond to resources and reserves measures, as indicates the Reference Expansion Plan).

Other renewable technologies, as wind or solar, have not been considered in the additionality assessment since these technologies are not suitable in the area for the following reasons:

- The slope of the river is high, turning out to be ideal for hydro generation compared to other renewable technologies.
- Tough orography in the area, so the consideration of wind energy as an alternative is not recommended.
- The average number of days with rain in the area is high, so the consideration of solar energy as an alternative is not recommended.
- Lack of regulation for these technologies in Colombia.

Sub-step 1b. Consistency with mandatory laws and regulations

The aforesaid alternatives and the project's activity comply with the applicable regulatory and planning requirements. The Colombian electricity sector plan is established in the Reference Expansion Plan 2008- 2022. This document establishes the guidelines for the evolution of the Colombian energy generation infrastructure. The following table shows the short and medium-term actions considered in generation expansion in Colombia, according with this document.

Projects included in the Colombian Generation Expansion Plan in the short and medium-term

[6] See Document number 7 from the references list that is included in Annex 5 "Additional Documentation"

PROJECT	CAPACITY (MW)	TYPE	FORECASTED DATE OF COMMISSIONING
Tebsa	45	Gas	Dec.-07
Cartagena 2	63	Fuel-oil	Feb.-08
Mayaguez	18	Cogeneration	Nov.-08
Argos	51	Coal	Dec.-09
Bugalagrande	40.5	Hydro	Dec.-09
Amaime	18.6	Hydro	Dec.-09
Flores IV	160	Gas	Dec.-09
Termocol	210	Fuel-oil	Dec.-09
Guarinó transfer	---	Hydro. (Bypass of the water from the Guarinó river)	Jun.-10
Amoya	78	Hydro	Jul.-10
Porce III	660	Hydro. (Reservoir)	Sep.-10/Ene.-11/Apr.-11/Jul.-11
Manso transfer	---	Hydro. (Bypass of the water to Miel I reservoir)	May.-11
El Manso	27	Hydro.	May.-11
Cucuana	88	Hydro.	Without confirmation
Quimbo	400	Hydro. (Reservoir)	2015
Porce IV	---	Hydro. (Reservoir)	2015
Sogamoso	840	Hydro. (Reservoir)	2015

Source: Reference expansion plan Generation and Transmission, 2008-2022, UPME.

Step 2. Investment analysis

The main analysis in order to assess the additionality of the project activity is the “investment analysis” according to the step 2 of the “Tool for the demonstration and assessment of additionality” version 07.0.0.

Sub-step 2a. Determine appropriate analysis method

Option I (simple cost analysis) is not applicable in this case, since the project will generate other economic and financial benefits that are different to those related to CDM incomes, with the sale of the electricity generated. Option II (investment comparison analysis) has been evaluated but removed since input values would be based on information subject to confidentiality. Option III: “Benchmark analysis” has been chosen.

Sub-step 2b. Option III. Apply benchmark analysis

The financial indicator used has been the post-tax Project IRR.

Sub-step 2c. Calculation and comparison of financial indicators

During the decision-making process of the project of the Hydroelectric Power Plant of Cucuana, the investment profitability analyses carried out by the project participant as the project promoter, included the comparison of the financial indicators listed below and monetization of the CO_2 credits (i.e., certified reductions of emissions or CERs) derived from the project activity.

Calculations have considered the comparison of financial indicator selected for the project activity, with and without income for CERs, and the options of building a fuel-fired power plant.

The cash flows included the following subjects:

- Investment costs (equipment, land, engineering, administration and environmental management and civil works)
- Fixed and variable operating and maintenance costs, from the experience of EPSA in the maintenance and operation of similar plants.

- Regulatory costs, which include the costs of the National Dispatch Centre, financial transactions costs associated with Act 99, Act 56 and Fazni.
- Revenue obtained from the electric energy commercialization. The calculations took into account its change over time depending on the CPI[7].
- Income and expenditure due to the reliability charge.
- In the second case, revenues associated to CER sales.

Cucuana power station has an effective capacity of 55 MW under regular operation. Therefore, production is 252 GWh, which can be obtained based on 52.3 % of the power station load factor. These operation hours result from the studies derived from the EIA and the subsequent estimates made when the power station basic components design were revised. The 121 COP/kWh sell price is considered as the price of the first year of commercial operation and it is indexed to the CPI. This reference results from the analysis of the Colombian market made by EPSA and it can be observed that it is a value included in the scenarios considered by the UPME (Mining-Energy Planning Unit) (Documents for System and Forecast Unit Expansion) on its web site.

In the case of the analysis with revenue of CERs, the investment is lower due to saving from VAT on equipment imported under article 95 of law 788 of 2002

The evaluation period of the project has been seen in 50 years. This period is enough away from the depreciation periods and presently there are many plants both in Colombia and internationally with periods of use of this order. Currently, this period is the one that reflects more accurately the expectation of life with which undertakes the project. EPSA has extensive experience in operating plants that have considerable seniority to reach these conclusions for this project.

Cucuana Hydroelectric Power Plant is subject to income and expenditure due to the reliability charge because its capacity is higher than 20 MW.
The power sales income has been indicated, as well as the income associated with CERs. The sales price of these CERs is 22 USD/Ton.

The costs reflected are Operation and Maintenance costs, estimated based on EPSA's experience in operating and maintaining similar power stations in Colombia. The values are referred to year 2007 current COP, and indexed to CPI. Administration costs have not been included since EPSA absorbs them in the administration of other power stations.

Regulatory costs include:

- National Dispatch Center-CND- Manager of commercial exchanges –ASIC-, (National Distribution Centre, Trading System, CREG 110-206), this cost is indexed on a monthly basis to the PPI
- Property (premises associated to the project), 6‰ over 150% of property's commercial value 4‰ (4 per thousand tax) on financial transactions
- Law 99 (Act 99), to be applied on 6% of total energy sales (Creg 60 1995 and Creg 130 1996), valued at 20,9 COP/kWh (1996) and indexed to the CPI
- Law 56 (Act 56, Industry and Commerce tax), valued at 336 COP/kW (Jan. 2007) and indexed yearly to the CPI.
- FAZNI (Financial Aid Fund for the Provision of Energy Services to Interconnected Areas, Act 1099/2006), valued at 1 COP/kWh (2007) and indexed yearly to the CPI

The line indicated as other costs is derived from CERs, it has been considered different, since part of this income will be used to invest in the area.

As reflected in the annexes of the economic-financial models, the amortization periods for machinery and civil works have been considered 20 years and 5 years for the rest of the concepts of investment. It is clear therefore that the residual value is considered to be zero.

[7] Source: CENTRAL BANK OF COLOMBIA "LA ECONOMÍA COLOMBIANA: SITUACIÓN ACTUAL FRENTE A LOS NOVENTA Y SUS PERSPECTIVAS"2006

The Corporate tax rate imposed is 33%.. With CERs, thanks to savings from VAT on imported equipment obtained by virtue of the tax law, Section 424-5, investment is lower.

The following table shows a comparison between the IRR value obtained with and without the revenue related to the CDM.

	Case 1: Without revenues related to the sale of CERs	Case 2: With revenues related to the sale of CERs
IRR (%)	10.85	12.09

Table: Parameters for IRR calculation

Parameter	Unit	Value
Installed Capacity	MW	58.16
Effective hydraulic capacity	MW	55.0
Annual Generation	GWh/year	252
Energy Sale Price	$COP/kWh	121
Firm Energy for Reliability Charge (ENFICC)	GWh/year	55
Reliability Charge Price	(USD/MWh)	13
Investment	COP M	177.730
Average Annual O&M	COP M	2.718
Project Life	Years	50
Plant Amortization Period	Years	20
CPI (local inflation)	%	3.0
USA CPI (external inflation)	%	1.74
Exchange Rate	COP/USD	1 USD=2.239 COP
Income Tax Rate	%	33
Project IRR	%	10.85

Source: Project Developer

The Project activity is evaluated by comparing its project internal rate of return (IRR) with the benchmark of Commercial average lending rates available from the National Bank of Colombia; from August 2007 to October 2007 it was 13.48%[8].

The best investment profitability, in terms of Project IRR, is obtained from the project scenarios considering the monetization of CERs generated by project activity (12.09%), with respect to the other project scenario in which the monetization of CERs generated by project activity was not considered (10.85%). (See sub-step 2d Sensibility analysis).

It seems clear that IRR of the project without CERs incomes is not attractive enough to implement the project.

The final investment decision was taken after studies dated November 2007, according to the methodology of investment analysis of the project participant. Hence, the input values used in all the investment analysis are valid and applicable at the time of this investment decision taken by the project participant.

The Cucuana Hydroelectric Power Plant for its implementation needs to be registered as a CDM project to obtain financial support from the sale of CERs. In that case, and considering the monetization of the CERs and the tax deductions, the increase in the IRR is big enough to implement the project, and acquires a strategic value that makes it possible to strengthen the strategic positioning of the project participant on climate change and the CDM objectives of the company.

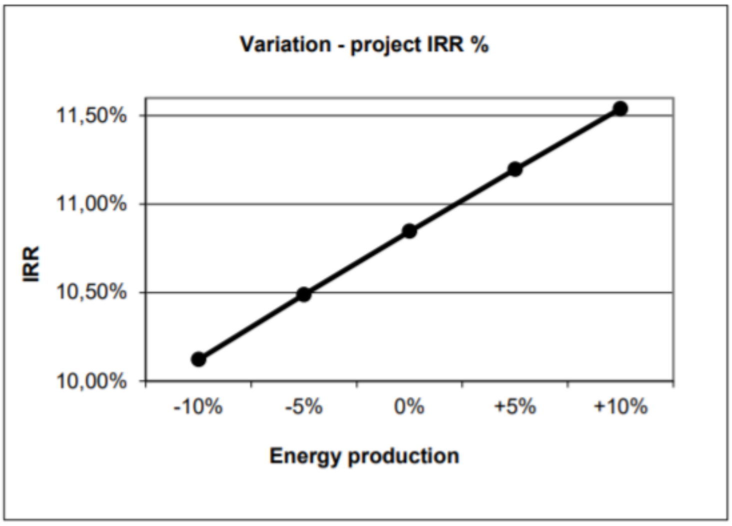
[8] Source: http://www.banrep.gov.co/series-estadisticas/see_tas_inter5.htm

Sub-step 2d. Sensitivity analysis

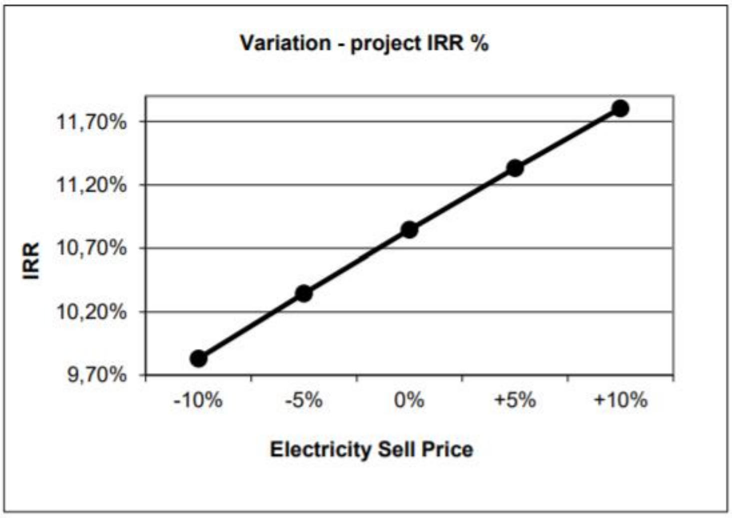
Indicators used for the sensitivity analysis are shown on the next graphs.

The increases in the Project IRR for the different scenarios are shown on the graphs and corresponding tables.

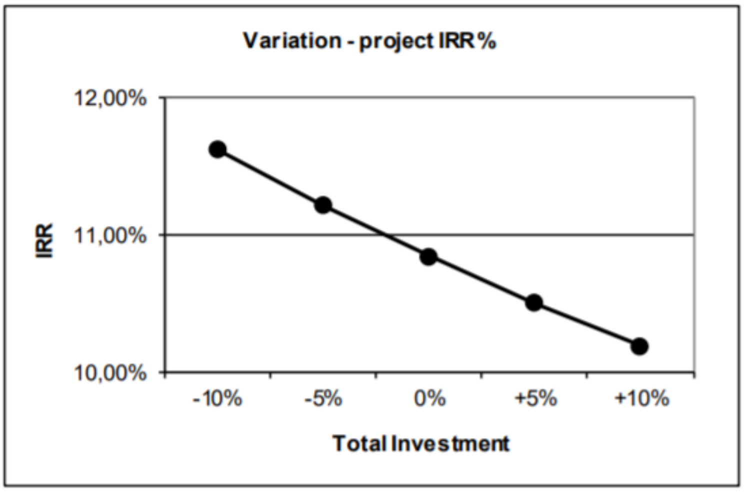
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on power generation



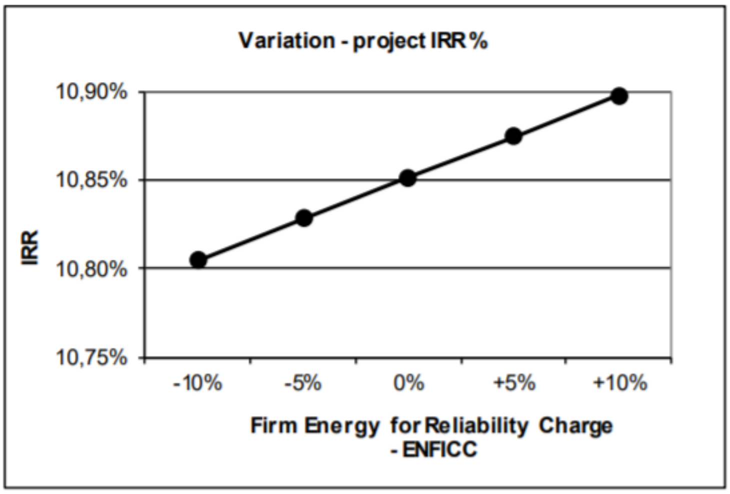
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on the average sale price of electricity



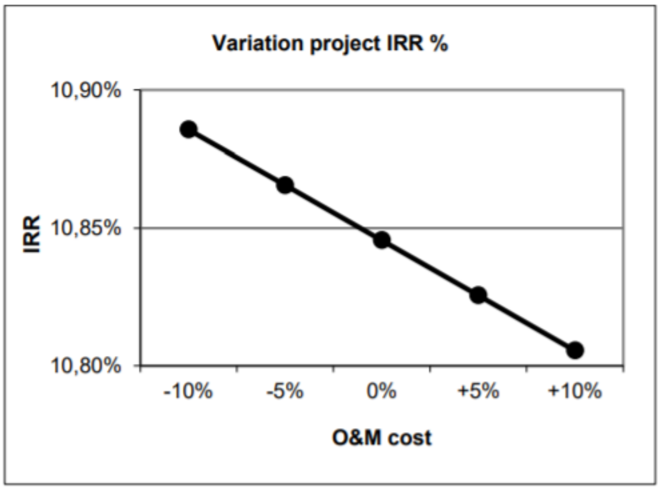
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on Investment



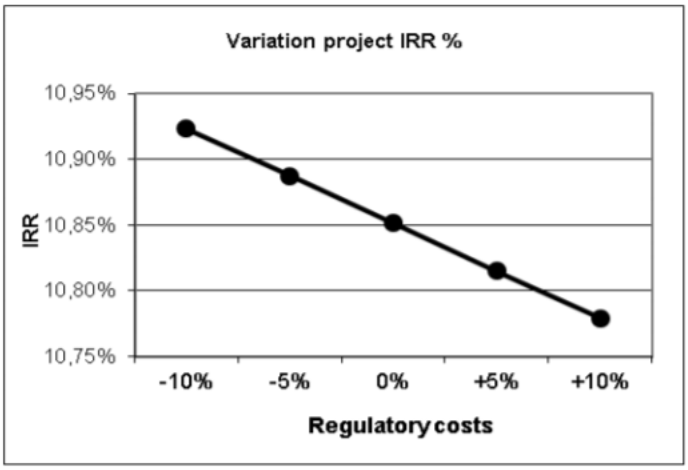
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on Firm Energy for Reliability Charge (ENFICC)



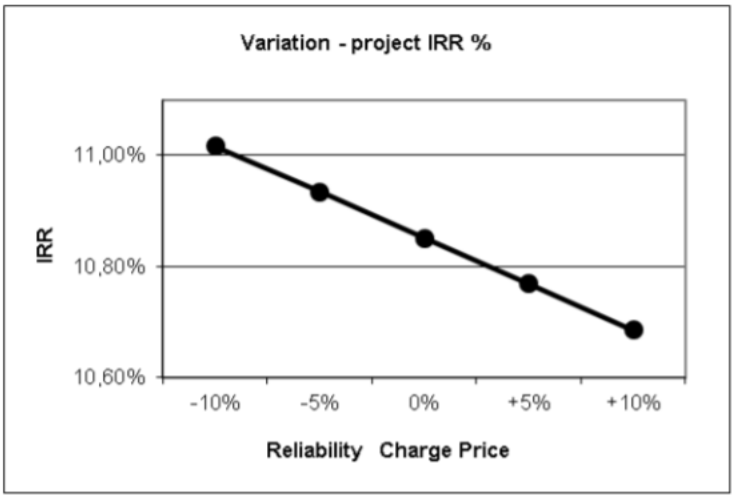
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on O&M cost



- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on Regulatory costs



- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on Reliability Charge Price



Therefore, the IRR decrease-increase for the different scenarios is shown in the following table:

		Sensitivity Analysis Proyect IRR				
		-10%	-5%	0%	+5%	+10%
Items	Energy production	10.13%	10.49%	10.85%	11.20%	11.54%
	Electricity Sell Price	9.84%	10.35%	10.85%	11.34%	11.81%
	Firm Energy for Reliability Charge (ENFICC)	10.80%	10.83%	10.85%	10.87%	10.90%
	Total Investment	11.62%	11.22%	10.85%	10.51%	10.19%
	Reliability Charge Price	11.02%	10.93%	10.85%	10.77%	10.68%
	Regulatory costs	10.92%	10.89%	10.85%	10.82%	10.78%
	O&M cost	10.89%	10.87%	10.85%	10.83%	10.81%

Step 4. Common practice analysis

According with tool for demonstration and assessment of additionally (Version 07.0.0), the measure of the proposed project refers to “Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies”. Thus, sub-step 4a are adopted to take the common practice analysis.

Sub-step 4a. The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above

According to “Guidelines on common practice” (Version 02.0):

Step 1: calculate applicable capacity of output range as +/-50% of the total design capacity or output of the proposed project activity.

The installed capacity of the proposed project is 55 MW and the applicable output range as +/-50% of the capacity range is from 27.5 MW to 82.5 MW.

Step 2: identify similar projects (both CDM and no-CDM) which fulfil all the following conditions:

(a) The projects are located in the applicable geographical area
(b) The projects apply the same measure as the proposed project activity
(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity
(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas as the proposed project plant
(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1
(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

The applicable area geographical covers the entire host country. Similar projects are shown in the table below:

POWER PLANT	TYPE	CAPACITY (MW)	CDM	DATA ENTRY INTO OPERATION	N_{all}	N_{dif}
ESMERALDA	Hydro	30	No	01/01/1963	1	0
TERMOYOPAL 2	Thermal	30	No	29/07/2004	1	1
PAIPA I	Thermal	31	No	01/01/1963	1	1
ZIPAEMG 2	Thermal	34	No	01/01/1964	1	1
PROELECTRICA 1	Thermal	45	No	01/07/1993	1	1
PROELECTRICA 2	Thermal	45	No	01/07/1993	1	1
PRADO	Hydro	46	No	01/01/1973	1	0
TERMODORADA 1	Thermal	51	No	15/09/1997	1	1
TERMOCARTAGENA 2	Thermal	60	No	01/01/1980	1	1
TERMOCARTAGENA 1	Thermal	61	No	01/01/1980	1	1
TERMOBARANQUILLA 4	Thermal	63	No	10/06/1983	1	1
ZIPAEMG 3	Thermal	63	No	01/01/1976	1	1
TERMOBARRANQUILLA 3	Thermal	64	No	01/01/1980	1	1
ZIPAEMG 4	Thermal	64	No	01/01/1983	1	1
ZIPAEMG 5	Thermal	64	No	14/12/1985	1	1
TERMOCARTAGENA 3	Thermal	66	No	01/01/1980	1	1
PAIPA 2	Thermal	70	No	01/01/1975	1	1
PAIPA 3	Thermal	70	No	06/05/1982	1	1

Source: NEON - XM S.A. E.S.P

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

N_{all} =	18

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

N_{diff} =	16

Step 5: calculate factor F=1-Ndiff/Nall representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

N_{all}-N_{diff} =	2
F=	0.11

Results of the analysis.

The proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3. As it is presented, the factor F is 0.11 and N_{all}-N_{diff}=2, so we conclude that the proposed project activity is not a common practice within a sector in the applicable geographical.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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As stated above, the hydroelectric project of Cucuana will be integrated in the National Interconnected System of Colombia. The system is characterised by the generation of conventional hydroelectric energy and the generation of thermal power plants, which represent more than 96% of the installed power and energy generated during 2007[9].

Therefore, the Hydroelectric Power Plant of Cucuana will shift electricity from the supply network that would be supplied and generated by conventional power plants, including GHG producing thermal power plants. The commissioning of the plant will thus entail a lower degree of CO_2 emissions of the system.

The ACM0002 methodology / Version 13.0.0 is applied with the purpose of quantifying the reduction of emissions generated by the project's activity. In accordance with this methodology, the reduction of emissions is the difference between the baseline emissions (characterised by their absence from the project) and the emissions of the project. In this type of renewable energy projects, the direct emissions are non-significant and Project Emissions from the run-off river reservoir are zero since the power density of the project activity is greater than 10 W/m^2 ($PE_{HP,y}$ = 0). Likewise, leakages can also be considered as very low. Therefore, the calculation for the reduction for the reduction of emissions associated to the operation of the project activity only considers the baseline emissions.

- **Baseline Emissions**

The baseline scenario represents the electricity delivery to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. So, the baseline emissions include only CO_2 emissions from electricity generation in fossil fuel power plants that are displaced due to the project activity. The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$ **[Equation 1]**

[9] Source: Report of Operation and Administration System Market 2007, XM. See Annex 5, reference 16.

Where:

- BE_y= Baseline emissions in year y (tCO_2)
- $EG_{PJ,y}$= Quantity of net electricity generation that is produced and fed into the grid as result of the implementation of the CDM project activity in year y (MWh)
- $EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y (tCO_2/MWh)

For the quantity of net energy generation option a) Greenfield renewable energy power plants” is applicable because the project activity is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated, prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$ **[Equation 2]**

Where:

- $EG_{PJ,y}$= Quantity of net electricity generation that is produced and fed into the grid as result of the implementation of the CDM project activity in year y (MWh).
- $EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in the year y (MWh)

Then, the quantity of net energy generation that is produced and fed into the grid for the project activity is 252,000 MWh.

The emission factor has been calculated as a combined margin factor ($EF_{grid,CM,y}$) according to the procedure prescribed in the “Tool to calculate de Emission Factor for an electricity system”, version 03.0.0. This combined margin factor resulting from the weighting of two factors:

- Operating margin emission factor: shows the emissions avoided as a consequence of the electrical energy previously transferred to the system by thermal power plants and which is shifted after the commissioning of the new plant.
- Build margin emission factor: introduces the calculation of GHG emissions avoided as a result of the effects of increasing the capacity by adding plants to the system.

Step 1. Identify the relevant electric power system

Electricity supply in Colombia relies on the National Interconnected System (SIN) and several isolated local systems in the Non-Interconnected Zones (ZNI).All the elements of the SIN are completely interconnected in a single system. SIN encompasses one third of the territory, giving coverage to 96 percent of the population. The ZNI, which covers the remaining two thirds of the national territory, only serves 4 percent of the population.

Colombia is a net power exporter.Transmission in the National Interconnected System is carried out by different public companies, some of them work exclusively in transmission and the remaining are integrated companies that carry out all the activities in the electricity chain (i.e. generation, transmission and distribution).The largest company is Interconexión Eléctrica S.A. (ISA), which belongs to the government.

Step 2. Choose whether to include off-grid power plants in the project electricity system

Choose whether to include off-grid power plants in the project electricity system (optional)Two options are provided in the “Tool to calculate the emission factor for an electricity system” to calculate the operating margin and build margin emission factor:

- **Option I**: Only grid power plants are included in the calculation.

- **Option II**: Both grid power plants and off-grid power plants are included in the calculation.

Option I is chosen for operating margin and build margin emission factor calculation, so only the grid power plants have been included in the calculation of the operating margin and build margin emission factor.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

a) Simple OM
b) Simple adjusted OM
c) Dispatch data analysis OM
d) Average OM

One of the restrictions on the use of the simple method for the calculation of the operating margin factor is that it can only be used when low-cost/must-run plants represent less than 50% of the total generation of the system, using the average of the last five years. In the case of Colombia, this method cannot be used, since this type of plants represents more than 50%.

Therefore, the method selected to calculate the operating margin emission factor is the Simple Adjusted Method, i.e., "option b", for the calculation of the emission factor of the operating margin of the "Tool to calculate the emission factor for an electricity system", version 03.0.0. The Simple Adjusted Method provides a formula for the calculation of the emission factor, taking into account the hourly generation of the system and the % generation provided by the low-cost/must-run power plants.

The operating margin emission factor can be calculated:

- *Ex ante* option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation.
- *Ex post* option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

In this case, the calculation ex-post has been selected for calculating the operation margin emission factor, so it will be recalculated annually.

The National Dispatch Centre, which coordinates the electricity market trade and the operations of the National Interconnected Electricity System of Colombia, and the Mining-Energy Approach Unit of the Ministry of Mines and Energy, provides the data required for the calculation of these two emission factors. With these and other sources, the following information has been gathered:

BASIC INFORMATION FOR THE CALCULATION OF THE BASELINE	
Data	**Source**
Fuel emission factor	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2,

Heat Rate	Associated Services Management, XM Compañía de Expertos en Mercados S.A.E.S.P
Total electricity generated by all power plants connected to the National Interconnected System of Colombia	NEON
Total hourly generation of the System	NEON
Type of fuel used in each plant	UPME / XM

Step 4: Calculate the operating margin emission factor according to the selected method The simple adjusted OM emission factor ($EF_{grid,OM\text{-}adj,y}$) is a variation of the simple OM, where the power plants/units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m). As under option A of the simple OM, it is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM-adj,y} = \left(1-\lambda_y\right) \times \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y \times \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}} \qquad \textbf{[Equation 3]}$$

Where:

- $EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh).
- λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in the year y
- $EG_{m,y}$ =Net quantity of electricity generated and delivered to the grid by plant min year (MWh)
- $EG_{k,y}$ =Net quantity of electricity generated and delivered to the grid by plant kin year (MWh)
- $EF_{EL,m,y}$= CO_2 emission factor of power unit m in year y (t CO_2/MWh)
- $EF_{EL,k,y}$= CO_2 emission factor of power unit k in year y (t CO_2/MWh)
- m = All grid power units serving the grid in year y except low-cost/must-run power units
- k = All low-cost/must-run grid power units serving the grid in year y

The plants registered as CDM project activities have been taken into account for the calculation of the operating margin emission factor, as established by the tool.

$EF_{EL,m,y}$, $EF_{EL.k,y}$, $EG_{m,y}$ and $EG_{k,y}$ have been determined using the same procedures as those for the parameters $EF_{EL,m,y}$ and $EG_{m,y}$ in Option A of the Simple OM method.

The option selected for the calculation of the emission factor for each plant is based on the performance (option A2) of the different plants of the National Electrical System. According to this option, for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of fuel type used and the efficiency of the power unit as follows:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}} = Heat\ rate_m \times EF_{CO_2,m,i,y} \qquad \textbf{[Equation 4]}$$

Where:

- $EF_{EL,m,y}$ =CO_2 emission factor of power unit m in year y (t CO_2/MWh).
- $EF_{CO2,m,i,y}$= Average CO_2emission factor of fuel type i used in power unit m in year y (t CO_2/GJ).
- $\eta_{m,y}$=Average net energy conversion efficiency of power unit m in year y (ratio)

- Heat rate$_m$ = Inverse of the efficiency of power plant m (GJ/MWh)[10]
- $EF_{CO2,m,i,}$ = Quantity of CO_2 emitted by plant m for every GJ fuel used[11] during year y (t CO_2/GJ).

However, for the calculation of the emission factor of each power unit m, the following options should be considered as well according to the availability of information:

Option A1. If for a power unit m data on fuel consumption and electricity generation is available.

If for a power unit m only data on electricity generation is available, **Option A3** has been used as a simple and conservative approach with an emission factor of 0 tCO_2/MWh.

The parameter λ_y is defined as follows:

$$\lambda_y(\%) = \frac{\text{Nº hours low} - \text{cost/must} - \text{run sources are on the margin during the year y}}{8760\ hours..per..year}$$ **[Equation 5]**

Lambda λ_y should be calculated as follows:

- Step (i): Plot a load duration curve. Collect chronological load data (typically in MWh) for each hour of the year y, and sort the load data from the highest to the lowest MW level. Plot MW against 8760 hours in the year, in descending order (the year 2008 is a leap year).

- Step (ii): Collect electricity generation data from each power plant/unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants/units (i.e. $\sum_k EG_{k,y}$).

- Step (iii): Fill the load duration curve. Plot a horizontal line across the load duration curve such that the area under horizontal line and the curve right from the intersection point (MW time hours) equals the total generation (in MWh) from low-cost/must-run power plants/units (i.e. $\sum_k EG_{k,y}$).

- Step (iv): Determine the "Number of hours for which low-cost/must-run sources are on the margin in year y". First, locate the intersection of the horizontal line plotted in Step (iii) and the load duration curve plotted in Step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and λ_y is equal to zero.

After downloading the data corresponding to the year 2007 from NEON and applying the previous steps, we have obtained the following value for the operating margin emission factor:

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[10] The values of all the plants operating were obtained through the Dirección Servicios Asociados, XM Compañía de Expertos en Mercados S.A. E.S.P in units of MBTU / MWh and through an exchange of units have been transformed to GJ / MWh to include in this term. In the case of cogeneration, the *Dirección Servicios Asociados, XM Compañia de Expertos en Mercados S.A. E.S.P.* does not provide such data, so for cogeneration using bagasse fuel, fuel oil and coal + bagasse have been selected the heat rates "Promedios horarios de emisión para el cálculo de la metodología consolidada de línea base ACM0002 para proyectos de generación de escala completa" published by the Energy Mining Planning Unit of the Ministry of Mines and Energy of the Republic of Colombia. For cogeneration using coal as fuel and gas has been taken respectively the average value of all Colombian centrals that use such fuels.

[11] In this case, the values shown on table 1.4 of page 1.23 of the document "2006 IPPC Guidelines for National Greenhouse Gas Inventories" have been used, with the factor applied to each plant, in accordance with the fuel used and the characteristics of the site of origin. In the specific case of the thermal power plants that use carbon, the variety used by each plant has been obtained from the document "The Carbon Chain" of the Energy-Mining Planning Unit of Colombia

$EF_{grid,OM,2007}$ = 0.4659kg CO_2/kWh

Appendix 4 includes more information about the calculations that have been carried out.

Step 5: Calculate the build margin (BM) emission factor

Option 1 of the "Tool to calculate the emission factor for an electricity system", Version 03.0.0, has been selected for the calculation of the build margin emission factor, which states that, for the first crediting period, the build margin emission factor is calculated (ex-ante) based on the most recent information available on units already built at eh time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available at eh time of the submission of request for renewal or the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. So, this option does not required monitoring emission factor during the crediting period.

The sample group (SET_{sample}) of power units m used to calculate the build margin is determined as per the following procedure:

a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$ in MWh);
b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of the AEG_{total}(if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation)($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET>=20\%,}$ in MWh);
c) From ($SET_{5\text{-}units}$) and ($SET_{\geq 20\%}$), select the power units that comprises the larger annual electricity generation (SET_{sample}). Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).
d) Excluded from the SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEGSET_{\text{-}sample\text{-}CDM}$, in MWh). If the annual electricity generation of that set comprises at least 20%of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM}$≥0.2xAEGtotal), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).
e) Include in the sample groups $SET_{ample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation or a unit, the generation of a unit, the generation of that unit is fully included in the calculation).
f) The sample group of power units m used to calculate the build margin is the resulting SET ($SET_{sample\text{-}CMD\text{-}>10\ years}$).

The set of plants used for the calculation of the build margin factor is made up of the alternative that represents the greatest quantity of energy between the five plants that have been built recently,

which generated 20% of the system's energy[12]. None of the power plants included in the SET_{sample} started to supply electricity to the grid more than 10 years ago from the baseline year, so the ($SET_{\geq 20\%}$) has been used. Both cases have not included the plants registered as CDM project activities, as established in the methodology.

Once the option of the number of plants to use is selected, the build margin emission factor will be calculated with the following equation:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad \textbf{[Equation 6]}$$

Where:

- $EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
- $EG_{m,y}$ = Net quantity of energy generated and delivered to the grid by power plant m in year y (MWh). This calculation uses the annual plant generation information, provided by the CND through the NEON system.
- $EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)
- m= Power units included in the build margin
- y = Most recent historical year for which electricity generation data is available

The same units described for OM emission factor calculations have been applied for the equation.

For the year 2007, following the previous steps, we have obtained the following build margin emission factor:

$EF_{grid,BM,2007}$ = 0.2345kgCO_2/kWh

Appendix 4 includes more information about the calculations that have been carried out.

Step 6: Calculate the combined margin emission factor

In accordance with the "Tool to calculate the emission factor for an electricity system", the combined margin emissions factor ($EF_{grid,CM,y}$) is calculated based on one of the following methods:

a) Weighted average CM
b) Simplified CM

The option a (Weighted averaged CM) has been selected. The $EF_{grid,CM,}$ y is calculated with the weighted mean of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$). The weighting factors selected are 0.5 for operating emission CO_2 factor (w_{OM}=0.5) and 0.5 for the build margin emission CO_2 factor (w_{BM}=0.5) for the first crediting period. For the second and third crediting period the weighting factors selected are 0.25 for operating emission CO_2 factor (w_{OM}=0.25) and 0.75 for the build margin emission CO_2 factor (w_{BM}=0.75).

The baseline emission factor (EF_y) is obtained with the combination of the operating and build margin emission factors:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \qquad \textbf{[Equation 7]}$$

Where:

- $EF_{grid,CM,y}$= Combined margin emission factor during year y (tCO_2/MWh).

[12] While the PDD was being drafted, the five plants built most recently generated less than 20% of the system's energy, so that, to carry out the ex-ante calculations of the build margin emission factor, so the set of power capacity additions that comprise 20% or the system generation that have been built most recently was selected for the calculations.

- w_{OM}= Weighting of the operating margin emission factor (%).
- $EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh).
- w_{BM} = Weighting of the build margin emission factor (%).
- $EF_{grid,BM,y}$ =Build margin CO_2 emission factor in year y (tCO_2/MWh).

The following global emission factor is obtained with the combination of the aforesaid factors for 2007:

$$EF_{grid,CM,2007} = 0.3502 kgCO_2/kWh$$

- **Project Emissions**

In accordance with the consolidated ACM0002 methodology, version 13.0.0, for the most renewable power generation activities, PE_y=0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ **[Equation 8]**

Where:
- PE_y = Project emissions in year y (tCO_2e)
- $PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2)
- $PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e)
- $PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year y (tCO_2e)

In this case, only project emissions from reservoirs of hydro power plants are applied ($PE_{HP,y}$).

For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoirs, estimated as follows:

(a) If the power density of the single or multiple reservoirs (PD) is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000}$$ **[Equation 9]**

Where:
- $PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year y (tCO_2e)
- EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants ($kgCO_2e/MWh$)
- TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh)

(b) If the power density of the project activity (PD) is greater than 10 W/m^2:

$$PE_{HP,y} = 0$$ **[Equation 10]**

The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ **[Equation 11]**

Where:

- PD = Power density of the project activity (W/m^2)

- Cap_{PJ}= Installed capacity of the hydro power plant after the implementation of the project activity (W)
- Cap_{BL}= Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
- A_{PJ}= Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
- A_{BL}= Area of the single or multiple reservoirs measured in the surface of the water before the implementation of the project

Therefore, if we take into account the power density of the project activity, the second case should take into account, where the power density is greater than 10 W/m^2 . In this case, the methodology indicates that the project activity is zero, so:

$$PE_y = 0\ tCO_2/year$$

- **Leakage**

According to the methodology ACM0002 v.13.0.0 no leakage emissions are considered.

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data or parameter.)

Data/Parameter	$EF_{grid,BM,y}$
Data unit	t CO_2/MWh
Description	Building margin CO_2 emission factor of the grid in year y using the "Tool to calculate the emission factor for an electricity system"
Source of data	0.2345
Value(s) applied	As per the "Tool to calculate de emission factor for an electricity system"
Choice of data or measurement methods and procedures	As per the "Tool to calculate de emission factor for an electricity system"
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	EF_{Res}
Data unit	Kg CO_2e/MWh
Description	Default emission factor for the emissions of reservoirs of hydro power plants
Source of data	Decision by EB23
Value(s) applied	90 Kg CO_2e/MWh
Choice of data or measurement methods and procedures	-
Purpose of data	Calculation of project emissions
Additional comment	This value will be revised when a new value is determined and indicated

Data/Parameter	Cap_{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data	Project Site

Value(s) applied	0
Choice of data or measurement methods and procedures	Determine the installed capacity based on recognized standards
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	A_{BL}
Data unit	m^2
Description	Area of the single reservoir measured in the surface of the water, before the implementation of the project, when the reservoir is full. For new reservoirs, this value is zero
Source of data	Project site
Value(s) applied	0
Choice of data or measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of data	Calculation of project emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

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The ex-ante calculations for the reduction of emissions are the following:

$$ER_y = BE_y - PE_y$$ **[Equation 12]**

Where:

- ER_y = Emission reductions in year y (tCO_2e)
- BE_y = Baseline emissions in year y (tCO_2)
- PE_y = Project emissions in year y (tCO_2e)

Therefore, the calculation of the reduction of emissions only takes into account the baseline emissions. Its calculation will be carried out in accordance with the procedure stated in section B.6.1.

B.6.4. Summary of ex ante estimates of emission reductions

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During the first seven-year crediting period, the project has a reduction potential of 88,250 tCO_2/year, calculated according to the version 03.0.0 of the document “Tools to calculate the emission factor for an electric system” included in the ACM0002/ Version 13.0.0 methodology. Based on the data we already know, we estimate that the following reduction in emissions will be attained during the first crediting period of the project activity:

Year	**Baseline emissions (t CO_2e)**	**Project emissions (t CO_2e)**	**Leakage (t CO_2e)**	**Emission reductions (t CO_2e)**
2014	14,708	0	0	14,708
2015	88,250	0	0	88,250
2016	88,250	0	0	88,250

2017	88,250	0	0	88,250
2018	88,250	0	0	88,250
2019	88,250	0	0	88,250
2020	88,250	0	0	88,250
2021	73,542	0	0	73,542
Total	617,750	0	0	617,750
Total number of crediting years	7 (renewable twice until 21 years are completed)			
Annual average over the crediting period	88,250	0	0	88,250

B.7. Monitoring plan

The project uses the approved ACM0002 monitoring methodology "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", version ACM0002, Version 13.0.0. In the case of the Power Plant of Cucuana[13] , this document establishes that the following data must be monitored:

1. Electricity generated by the project's activity

2. data required to recalculate the operating margin emission factor

All data required for the verification and issue of CERs will be stored in electronic format during at least two years after the end of the crediting period or the last issue of CERs for the project.

EPSA has a Quality Improvement System that has been certified by the ISO 9001 standard and is applied to the Energy Generation, Transmission, Distribution and Retail Marketing processes, as well as Diverting Processes and Support Processes that could have an impact on the quality of the products or services supplied by EPSA. To ensure employee training the procedure PR.GRH.07.002, "Procedure for the Develop of Competencies" is available.

The general operation of the plant of Cucuana and the Monitoring Plan for the reduction of GHG emissions will be integrated within the System, being subject to an audit by a third part that will guarantee its correct implementation.

B.7.1. Data and parameters to be monitored

Data/Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Data unit	kg CO_2/TJ
Description	CO_2 emission factor of fuel type i used in power unit m in year y
Source of data	IPCC default values at the lower limit of the uncertainty at 95% confidence interval as provided in table 1.4 of Chapter1 of Vol.2 (Energy) of the 2009 IPCC Guidelines for National GHG Inventories
Value(s) applied	See appendix 4
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	These values will be revised when relevant bibliography is available

[13] This plant does not have a reservoir or water reserve to operate during at least 10 days.

Data/Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Project activity site
Value(s) applied	252,000
Measurement methods and procedures	The following parameters will be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid Within this parameter is contemplated measure both quantities of energy whether the plant is generating or not. So, the quantity of energy will be monitored by EPSA each hour. The data obtained will be recorded once a month on a spreadsheet. In addition, the data will also be provided by the NEON system, which will be downloaded annually and recorded on a different spreadsheet.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures	Cross check measurement results with records for sold electricity: the two measurement units (main and auxiliary) of the energy transferred from the plant to the network will be calibrated every 2 years. The measurement data registered by the personnel of EPSA will be compared with the data provided by the NEON system to detect possible error. There is the procedure PR.PRO.03.0001, "Procedure for control of the production equipment", to carry out the calibration and verification (internal and external) of measuring equipment.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EG_{m,y}$, EG_h and $EG_{k,y}$
Data unit	MWh
Description	Net electricity generated by power plant/unit m or k (or in the project electricity system in case of EG_h) in year y or hour h
Source of data	Neon System
Value(s) applied	The data obtained from the NEON system and corresponding to the year 2007 have been applied. It has conducted the annual amount of generation from all low-cost/must-run plants and the others plants, obtaining a value of: Low-cost/must run (kWh): 44,340,373,748.6 Thermal (kWh): 9,325,288,821.6 The data obtained from the NEON system and corresponding to each hour of the year y have been applied
Measurement methods and procedures	The quantity of energy generated by the power plants during the year is registered in the NEON System as "Real Generation". This system will be accessed once a year to download data, which will be stored in an electronic spreadsheet. It should take into account each year adding new power plants and their typology.
Monitoring frequency	Annually during the crediting period for the relevant year.
QA/QC procedures	The hourly data of the total generation of the system and the hourly data corresponding to each plant will be downloaded. The sum of all individual data will be checked, in order to ensure that it is similar to the total system generation data. In case there are differences between the two types of data, the reasons and sources will be analyzed and errors will be corrected
Purpose of data	Calculation of baseline emissions
Additional comment	The calculation of the operating margin emission factor will not use the "Real generation" data directly, but rather that of energy that can be shifted, ice,, that generated with a flexible approach and which can thus be shifted by the generation of the project activity. This piece of data is calculated automatically by the spreadsheets designed to monitor the project, based on the procedure stated in Appendix 4 of this document

Data/Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Data unit	-
Description	Average net energy conversion efficiency of power unit m or k in year y
Source of data	Associated Services Management, XM Compañía de Expertos en Mercados S.A. E.S.P. Heat Rate in MBTU/MWh of the different plants connected to the National Interconnected System of Colombia is provided by the “Dirección Servicios Asociados, XM Compañía de Expertos en Mercados S.A. E.S.P.”, but this information is not provided for cogeneration. So, for cogeneration using bagassefuel, fuel oil and coal + bagasse have been selected the heat rates “Promedios horarios de emisión para el cálculo de la metodología consolidada de línea base ACM0002 para proyectos de generación de escala completa” published by the Energy Mining Planning Unit of the Ministry of Mines and Energy of the Republic of Colombia. For cogeneration using coal as fuel and gas has been taken respectively the average value of all Colombian centrals that use such fuels.
Value(s) applied	See Appendix 4
Measurement methods and procedures	The unit of the data provided by the “Dirección Servicios Asociados, XM Compañía de Expertos en Mercados S.A. E.S.P.” concerning the heat rate of each power plants is MBTU / MWh. Through a change of units, according to the conversions indicated in the spreadsheet for calculating the operating margin emission factor (first sheet, FE power station), whose detailed explanation is found in Appendix 5 of this document, the average efficiency of each of central of the Colombian Interconnected System is obtained.
Monitoring frequency	Annually during the crediting period for the relevant year.
QA/QC procedures	If the data obtained from the utility or the dispatch center of official records is significantly lower than the default value provided in appendix 1 of “Tool to calculate the emission factor for an electricity system, version 03.0.0” for the applicable technology, Epsa will assess the reliability of the values, and will provide appropriate justification if deemed reliable. Otherwise, the default values provided in appendix 1 will be used
Purpose of data	Calculation of baseline emissions
Additional comment	The data will be updated in accordance with the latest information facilitated by the Colombian electricity authorities. In the case of cogeneration, their information will be request and a new update of the document that has been extracted will be sought.

Data/Parameter	$EF_{grid,CM,y}$
Data unit	t CO_2/MWh
Description	Combined margin CO_2 emission factor of the grid in year y using the “Tool to calculate the emission factor for an electricity system”
Source of data	As per the “Tool to calculate de emission factor for an electricity system”
Value(s) applied	0.3502
Measurement methods and procedures	As per the “Tool to calculate de emission factor for an electricity system”
Monitoring frequency	Annually during the crediting period for the relevant year.
QA/QC procedures	As per the “Tool to calculate de emission factor for an electricity system”
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	Cap_{PJ}
Data unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project Site

Value(s) applied	
Measurement methods and procedures	Determine the installed capacity based on recognized standards
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	A_{PJ}
Data unit	m^2
Description	Area of the single reservoir measured in the surface of the water, after the implementation of the project, when the reservoir is full
Source of data	EPSA E.S.P
Value(s) applied	
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comment	-

B.7.2. Sampling plan

There is not necessary a sampling plan for the monitoring plan of this project activity

B.7.3. Other elements of monitoring plan

This section describes the tasks that will be developed with the purpose of carrying out the regular monitoring of the project activity. In this sense, a monitoring plan has been designed with the purpose of guaranteeing that the project activity is correctly organised from the start, in terms of data gathering and maintenance, as required to obtain realistic GHG emission data.

Therefore, the Supervisor of the project activity maintenance tasks will be defined prior to the start of the crediting period, who shall assume the development and execution of the monitoring plan.

To obtain the measurements required, the project activity will be supervised throughout the crediting period with the measurement systems that will provide the official flow, energy and power measures.

The Hydroelectric Power Plant of Cucuana shall deliver its energy to the interconnected system in the sub-station of Mirolindo, which is where the commercial frontier registered with the Administrator of the electrical interconnected system - XM- will be established. The information will be recorded each day by two measurement units with a precision of 0.2 and the active energy dispatched the previous day must be reported at 8:00 in the morning.

The energy control department will be responsible for the maintenance and supervision of the measurement equipment, which will monitor the deviations presented with its verification and energy balancing systems.

The complete revision of the measurement equipment is carried out every two years and the industrial measurement area is in charge of coordinating these processes with the production management area.

To guarantee the ecologic flow in the section of the Cucuana and San Marcos rivers, two measurements will be taken respectively: one will measure the total flow before its collection and the other one will be taken in the bypass channel. The difference between these values will give the

natural river flow volume. To guarantee in both rivers that the ecologic flow is 20% of the total before its collection, the measurements taken on these two points will be recorded on a system that is in charge of processing the information and adjusting the gate automatically to guarantee the flows required.

The plant will have all equipment required for the instantaneous measurement of the active and apparent power, power levels, current per phase, power factor and energy delivered per turbine generator group. These measurements will be local and remote from the EPSA control centre.

Likewise, the Plant's Operation Reports will be used as a reference and be made available for any inspections carried out during the crediting period, including the following aspects:

- Annual electricity production, broken down by month, which will become part of the Plant Operation Log, with all real and reactive power production data.
- Annual and monthly plant factor.
- Maximum annual and monthly demand.
- Annual and monthly load factor.
- Annual and monthly consumption of turbines.
- Relevant events during the year.

The Project Manager will be responsible for the implementation and update of all data and parameters monitored, included in the previous section, ensuring that the emission reduction calculations obtained are realistic and based on evidence. Likewise, said Supervisor will be in periodical contact with the person responsible for the execution of the Environmental Handling Plant of the Hydroelectric Power Plant of Cucuana, with the purpose of guaranteeing the execution of the project and that it contributes to the social and environmental development of Tolima.

In addition, the following data which are necessary to calculate the baseline will be downloaded annually from the NEON system:

- Quantity of electricity generated by the Hydroelectric Power Plant of Cucuana each hour. The measurement data registered by the personnel of EPSA will be compared with the data provided by the NEON system to detect possible error.
- Annual electricity generated by each plant of the National Interconnected System of Colombia.
- Electricity generated by the National Interconnected System of Colombian hourly.
- New plants built and those commissioned in the National Interconnected System of Colombia, in order to update the list of the plants that can be included in the calculation of the build margin emission factor. This data will be downloaded from the NEON system if the Electricity Market Regulator does not provide such information.

Annually, it will also be updated the calculation of:

- Annual electricity generated by low-cost/must-run power plants and the rest of the power plants.
- Average net energy conversion efficiency each power unit. For this, it is necessary to update the information about the heat rate of each power plant connected to the SIC that is provided by the *"Dirección de Servicios Asociados, XM Compañía de Expertos en Mercados S.A. E.S.P."*, especially in the case of the cogeneration for which data is not provided and it has been found in different sources as detailed in section B.7.1.
- Emission factor of each plant.
- Operating margin emission factor.
- Build margin emission factor.
- Baseline emission factor.

A set of spreadsheets has been designed to automate the process for the calculation of the emission factors with the purpose of facilitating the calculations required in the follow-up and monitoring tasks, which will be analysed in Appendix 5 of this document. The successive calculation of the reduction

of emissions in these spreadsheets will be summarised in monitoring and follow-up reports that will be subject to thirdparty verification.

All data and parameters will be recorded in accordance with the quality systems of the companies participating in the project, with their corresponding quality control and assurance procedures, Likewise, there will be a record of the Power Plant Operation reports, in accordance with these procedures.

EPSA will study with the local communities the assignment of a percentage of the CERs incomes in: reforestation, improvement of biodiversity in the basin, in accordance with the projects of the POMCH, PBOT, Municipal Development Plan and approved by the competent authorities, in accordance with the validation of the communities of the area of influence of the project. The implementation will carry out in accordance with the commitments that EPSA will acquire with the community during the operation stage, once obtained the approval of the project as a CDM. Others voluntary investment projects different from those derived from the sale of certified emission reductions will agree with the commitments acquired by EPSA after socialization meetings. This information will be gathered once a year according with registries obtained from expenditure and will be noted and recorded the amount for each project.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

28/09/2010

C.2. Expected operational lifetime of project activity

50 years and 0 months

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable crediting period and first crediting period

C.3.2. Start date of crediting period

01/11/2014

C.3.3. Duration of crediting period

7 years and 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Empresa de Energía de Pacífico S.A. E.S.P. -EPSA E.S.P.- requested Ingetec S.A. the “Environmental Impact Assessment of the Hydroelectric Power Plant of Cucuana", which has been used to define the prevention and mitigation measures, as well as the projects required to control, compensate and prevent the negative impacts and effects that the project generates, in addition to maximising the positive impacts derived from the construction of the Hydraulic Power Plant. In addition, it is aimed at guaranteeing the correct use of resources and minimise (or avoid, when possible) their negative impact.

The Environmental Impact Assessment includes the Environmental Handing Plan, Monitoring Plan, Contingency Plan and Abandonment and Recovery Plan

The Environmental Handling Plan (EHP) is structured in a series of technical handling files, including the following: objective, aim, project's stage, environmental impact to control, measure, action plan, application's place, population that will benefit, monitoring supervisors, chronogram, quantification and costs. It is also detailed the Socio-Environmental Management Unit of the Project (Unidad de Gestión Socio-Ambiental del Proyecto, UGSA) who will guarantee that the proposed objectives of the different programs included in the EHP are carried out.

The environmental and social handling plans are formulated to establish the strategies and activities which allow to reduce, prevent and mitigate the impacts generated by the project. The Environmental Handling Plan includes 8 control programs concerning the physical component, 4 programs concerning the biotic component and 7 programs concerning the socioeconomic component, according to:

- Physical Component:
  - Liquid residues handling program
  - Handling of potentially unstable areas and land program
  - Handling of areas of excavation's excess deposit program
  - Areas of source of material handling program
  - Program for the operating handling of the collection and sediments
  - Conventional and dangerous solid waste handling program
  - Air and noise quality handling program
  - Restoration in areas of temporal use handling program
- Biotic Component:
  - Vegetable coverage and land habitats handling program
  - Land fauna handling program
    1. Conservation of the endemic and endangered fauna in the areas of interest
    2. Study of the biology of the *Eleutherodactylus sp*.(possible new species found in the collection area of San Marcos river)
  - Ichthyologic communities handling program
    1. Study of the biology of the *Cordylancistrus sp*.(possible new species found downstream of the discharge of the project into the Cucuana river)
    2. Tracking of the fish's population in the parts of the river where the flow is being reduced
  - A program to raise public awareness about the presence of the *Cordylancistrus sp*. and *Eleutherodactylus sp*., because they might be two new species for science.
- Socioeconomic Component:
  - Population's resettlement program
  - Information and participation program
  - Institutional and territorial strengthening program
  - Economic activities restitution and compensation payments
  - Support to the reestablishment of agricultural activities
  - Employment policy and labour's entailment
  - Preventive archaeology program
    1. Monitoring archaeology subprogram
    2. Archaeological spreading subprogram

In the vegetable coverage and land habitats handling program it is included a section for the Environmental Education, where it is indicated that labour should take part in workshops and educational activities about the importance of the local fauna and its relationship with the flora, as well as the importance of the fauna that controls plagues.

The monitoring plan allows the supervision and the feedback of the actions applied in the development of the environmental handling plan. As well as the programs of the EHP, these monitoring programs consider the physical, biotic and socioeconomic component and each of these components include a specific monitoring program focused in evaluating the efficiency of the

impact's handling. Each program is structured including: objective, handled impacts, affected systems and components, impact's handling measures and monitoring measures with its activities and indicators. There are a total of 11 programs:

- Physical component:
    - Disposal of excavation's excess and erosive process monitoring program
    - Emissions and air and noise quality program
    - Domestic and dangerous solid waste's disposal monitoring program
- Biotic component:
    - Vegetable coverage and land habitats monitoring program
    - Hydro-biologic communities and water quality monitoring program
- Socioeconomic component:
    - Monitoring of the programs for the population's resettlement and housing's replacement, economic activities restitution and compensation payments
    - Monitoring of the information and participation program
    - Monitoring of the institutional and territorial strengthening program
    - Monitoring of the support and reestablishment of agricultural activities program
    - Monitoring of the labour's entailment and employment policy program
    - Monitoring of the Preventive archaeology program

The eventuality plan presents the identification of the extern and intern dangers, the evaluation of these dangers, the vulnerability and the level of risk, and finally it formulates the contingency plan with its requirements, answers and it identifies the emergency scenes for the project. The plans are:

- Contingency plan for earthquakes
- Contingency plan for flooding
- Contingency plan for landslide and collapse
- Contingency plan for fires and explosions
- Contingency plan for spillage of fuel
- Contingency plan for terrorism and public order

Public health contingency plan Finally, the abandonment and recovery plan presents two programs, each of them with its: objectives, aims, stages, environmental impacts, measures, actions to develop, supervisor and chronograms. These programs are:

- Program of dismantling and use of the areas and installations of the project at the end of operation.
- Program of closing of the social management.

The Environmental Handling Plan for the Hydroelectric Power plant of Cucuana has been approved by Cortolima (competent environmental authority) and is integrated within the Environmental Impact Assessment which has also been approved.

The resolution number 2411 dated December 19, 2008 gives the Environmental License to Empresa de Energía del Pacífico S.A. E.S.P. – EPSA E.S.P. for the project of the "Hydroelectric Power Plant of Cucuana". The resolution clarifies aspects relating to "concession of water during the construction and operation stage", "permit for continued occupation of river beds", ,"dumping permit", " permit for the disposal of residues" and "forestall exploitation authorization".

D.2. Environmental impact assessment

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The impacts of the Hydroelectric Power Plant of Cucuana in the area of construction of the project have been assessed methodologically in four different scenarios or periods:

a) during the preliminary period

b) during the period when the works execution was projected, assessing the potential impacts associated to construction processes
c) during the operation period
d) during the closing dismantling of the project

The identification and assessment of each impact associated to each project stage is structured by the correlation between the project activities with the components and processes of the environment.

The potential impacts associated to the geological issues in the construction of the project are associated to: destabilisation of natural embankments, landfills, dump sites, mass clearing during excavations; and are associated to the following water issues: alteration of underground drainages, quality of water, use of this natural resource for leisure purposes; and they are also associated to the quality of air as regards: increase in particles, gases and noise. The terrestrial and aquatic niches of the biota can also be affected. The socio-economic component is especially affected by the displacement caused during the construction works, as in the case of a small increase in the demand for services of the labour population and the effects on the historic cultural resources of the subsoil.

The potential impacts that can affect the physical-biotic component are showed in the following table:

IMPACT	STAGE	IMPORTANCE
Loss of land due to construction	Construction	Medium
Generation of potentially unstable areas and affectation of talus	Construction and operation	Medium
Alteration of the flow's regime of the Cucuana and San Marcos Rivers	Operation	Very high
Morphological changes and river's beds degradation in the Cucuana and San Marcos Rivers	Operation	Medium
Alteration of the water quality	Preliminary, construction and operation	Medium
Alteration of air quality	Preliminary and construction	Medium
Generation of conventional and dangerous solid waste	Preliminary, construction and operation	Low
Generation of excavation's residues	Preliminary and construction	Medium
Vegetable coverage loss	Preliminary and construction	Medium
Affectation of land fauna	Preliminary, construction, operation and dismantling	Low
Alteration of hydro-biologic communities	Construction and operation	Medium

The majority of the analysed impacts have a medium importance, meanwhile that a) generation of potentially unstable areas and erosive process and b) alteration of the flow's regime of the Cucuana River have a high importance; the first one is centred mainly in the unstable areas due to rehabilitation and construction of paths.

It is important to highlight that inside the study, diagnostic and classification of the Natural National Reserves carried out by the competent authority and the Departmental System of Protected Species (Sistema Departamental de Áreas protegidas, SIDAP) and coordinated in the department of Cortolima, there is not identified any of these kind of natural resources inside the indirect area of influence of the hydroelectric project of Cucuana.

The potential impacts that can affect the socioeconomic component are:

IMPACT	STAGE	IMPORTANCE
Generation of expectations and conflicts	Preliminary, construction and decommissioning	Very High
Affectation of agricultural and economic activities in land greater than 20,1 ha	Preliminary and construction	Very Low
Restriction of land's use in small properties	Construction	Medium
Generation of employment	Preliminary, construction and decommissioning	High
Alteration and loss of the archaeological patrimony	Preliminary and construction	Very High

14 areas with an archaeological interest have been identified, mainly housing's places, a cave art station (district of San Miguel, Roncesvalles) and others that could have been necropolis. In general and from the social point of view, it is expected that the Cucuana river exploitation will be accepted by the village communities.

The existing and potential impacts can be analysed to structure and optimise the Handling Plan, with the purpose of giving coverage and even mitigating the potential negative impacts and turning them into socially and environmentally positive products. The Handling Plan has been drafted to guarantee the environmental sustainability of the project and the environment where it will be located and operated. In addition, the Handling Plan will be structured in a series of technical handling files and a six-monthly chronogram for the construction, operation and dismantling stages. EPSA will assign enough economic resources to attend the environmental handling plan during the construction and operation stages

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

Different socialisation meetings were held with the communities within the direct and indirect area of influence of the project during the drafting of the Environmental Impact Assessment of the Project of the Hydroelectric Power Plant of Cucuana to draw up the design, impact and environmental handling plan studies, the Kyoto Protocol and the projects under the CDM modality.

The notification process started contacting with the local leaders and the Community Action committee's representatives in the district being affected by the Project and fixing dates, hours and places for the meetings as well as the districts who should assist to each of them. Elements used to spread the information, which were given to the presidents of the Community Action Committees, were posters for the most visited places in each district (schools, community halls, stores and bus stop) and leaflets for the families and they. In addition, the broadcasting La Voz de La Tierra (Roncesvalles) was contracted and phones calls were made to the leaders two days before the date of the meeting, in order to confirm it as well as the necessary arrangements.

The socialisation and participation meetings, which were called by EPSA and INGETEC S.A., had the participation of the local authorities, local leaders, communities of the districts influenced by the project and social and community organization's representatives presents in the area.

The following was addressed during each meeting:

- The general technical characteristics and scope of the project, both in terms of the works and potential impacts
- The environmental impact studies required by the Colombian legislation, which were presented to the Competent Environmental Authority for their analysis and decision
- Results of the environmental impact studies and the Environmental Handling Plan (EHP)
- The potential compensatory, voluntary and legal projects
- The possible CDM project

A total of eighteen information and project validation meetings were held with the communities, as shown on the following table:

Item	Municipality	District	Meetin's place	Meeting's date (2008)	No. of assistants	Observations
01	Roncesvalles	San Marcos	Roncesvalles	November 15, 2007	9	Meeting with the Community
02	Roncesvalles	San Marcos	San Marcos School	November 29, 2007	41	Meeting with the Community
03	Roncesvalles	Ayacucho	Ayacucho School	November 30, 2007	25	Meeting with the Community
04	Roncesvalles	Guayabos, San Pablo, Ayacucho, Agua de Díos, San Jerónimo, San Francisco	San Francisco	October 21, 2008	42	Meeting with the Community
05	Roncesvalles	Roncesvalles	Roncesvalles	October22, 2008	28	Meeting with the Administration
06	Roncesvalles	San Marcos, El Tesoro, El Paraíso	San José School, San Marcos	October 22, 2008	89	Meeting with the Communities
07	Roncesvalles	San Marcos, El Tesoro, El Paraíso	San Marcos	January 23, 2009		
08	Roncesvalles	Ayacucho, San Pablo	Ayacucho	January 24, 2009		Meeting with the Communities
09	Roncesvalles	San Francisco, Agua de Dios	San Francisco	January 24, 2009		Meeting with the Communities
10	Roviras	Reforma, Corazón, Auras, Hervidero, Palo	Reforma	February 24, 2009		Meeting with the Communities
11	Roncesvalles	Cucuanita Yerbabuena El Coco San Miguel El Diamante	Roncesvalles toy library	January 27, 2009	37	Two factors that affected the assistance to the meeting were the tough winter and bad conditions of the paths
12	Roncesvalles	Roncesvalles	City Hall	January 27, 2009		Meeting with the Administration
13	San Antonio	San Antonio	City may	February 26, 2009		Meeting with the Administration

Participants of these meetings were local authorities, local leaders, communities of the districts influenced by the project and social and community organization's representatives presents in the area. These meetings showed how important the project was for them, as an opportunity for the development of the region and improvement in the standard of living of the population.

E.2. Summary of comments received

The communities have openly expressed their understanding of the project, having been informed about its dimensions, scope and opportunities. In addition, they consider that the Environmental

Handling Plan has included all aspects that are sensitive to the project receiving environment and have designed the adequate measures to mitigate, correct and/or avoid these potential impacts.

The list of the main issues about the project that were treated in the meetings held, as well as questions, concerns, explanations of the communities and contributions about the knowledge of the area and the hydroelectric project proposed, is shown next:

- Profit for the communities derived from the project
- Use of the water in the project- Ecologic flow
- Reforestation of the Cucuana river basin
- Access paths: rehabilitation, maintenance and new ones.
- Jobs and policy of the company
- Supply of resources that must been transferred by law in order to help the investment's projects that are defined in the development plans (aqueducts, water treatment plants, etc)
- Take care of impacts and effects that are derived from the build and operating activities
- Differences between the Social Management Plan in the EHP of the project and the voluntary investment programs of the company derived from its responsibility policy

E.3. Consideration of comments received

The law establishes a plan of a 1% investment in the unique paragraph of the Article 43, law 99 dated 1993 "… All project that will use water taken directly from natural sources for human consumption, entertainment, irrigation or any industrial or agricultural activity, must spend no less than 1% of the total investment for the restoration, preservation and control of the hydrographic basin which is the water source…".

As established, the works and activities that will be the basis for the calculation of the cost for the 1% investment are:

- Purchase of lands associated to main and secondary building works for the construction and operation of the project
- Purchase of lands for the construction and rehabilitation of paths
- Purchase and rent of machinery and equipment used in the works.

Taking into account that the total cost of the Cucuana Project is 77,901,368,000.00 pesos, the investment to accomplish the 1% law is 779,013,680.00 pesos and is distributed into two programs which have been defined by the EPSA company, based on the projects identified and prioritised in the meetings held with the communities and their representatives:

- Program 1: Support to the formulation of the marshalling plan of the Cucuana river basin.
    - Project 1.1: Support to restoration, preservation and protection of the vegetable coverage in river basin of tributaries of the Cucuana River (30%)
    - Project 1.2: Project to stabilise areas subject to erosion (30%)
    - Project 1.3: Environmental training (10%)
- Program 2: Institutional strengthening of the cleaning up policies of the municipal town halls for the basin's districts, related with residual water treatments (30%)

In addition, EPSA is committed to:

- Respect the priorities in the use of water, in accordance with the current regulations, whereby human consumption will be the main priority.
- In case the Project of the Hydroelectric Power Plant of Cucuana obtains the reduced emission certificates, EPSA is able to study with the local communities to assign a percentage of the profits in: reforestation, improvement of biodiversity in the basin, in accordance with the projects of the POMCH, PBOT, Municipal Development Plan and approved by the competent authorities, in accordance with the validation of the communities of the area of influence of the project. The potential benefits can be executed

while the plant is producing energy and for a limited period of time, as established in the protocol.

SECTION F. Approval and authorization

The letter of approval from Colombia for the project activity was issued.

Appendix 1. Contact information of project participants

Organization name	Empresa de Energía del Pacífico S.A. E.S.P
Country	Colombia
Address	Calle 15 #29B-30 Autopista Cali - Yumbo
Telephone	(57) 2 3210000
Fax	(57) 2 3210470
E-mail	fmartinez@epsa.com.co
Website	www.epsa.com.co/
Contact person	Fabián Martinez Gutierrez

Organization name	Empresa de Energía del Pacífico S.A. E.S.P
Country	Colombia
Address	Calle 15 #29B-30 Autopista Cali - Yumbo
Telephone	(57) 2 3210000
Fax	(57) 2 3210470
E-mail	aarias@epsa.com.co
Website	www.epsa.com.co/
Contact person	Albeiro Arias Gomez

Appendix 2. Affirmation regarding public funding

This project does not include Public finance sources.

Appendix 3. Applicability of methodologies and standardized baselines

See section B2: Applicability of methodology

Appendix 4. Further background information on ex ante calculation of emission reductions

BASELINE INFORMATION

Fuel emission factors

The emission factors (effective CO_2 emission factor) assumed in all calculations have been obtained from table 1.4, page 1.23 of Document "2006 IPPC Guidelines for National Greenhouse Gas Inventories", taking the lowest value for a confidence level of 95%

CO_2 Emission factors	
Type of fuel	**Effective emission factor (kg/TJ)**
Natural Gas	54,300
Other bituminous carbons	89,500
Sub-bituminous carbons	92,800

Heat rates and type of fuel used in each thermal power plant

Name of the plant	Heat Rate (MBTU/MWh)	Main fuel
Barranquilla 3	11.8104	Gas
Barranquilla 4	11.522	Gas
Cartagena 1	9.6359	Gas
Cartagena 3	13.4904	Gas
Flores 1	12.2191	Gas
Flores 2	12.2715	Gas
Flores 3	9.2513	Gas
Guajira 1	14.3162	Gas
Guajira 2	8.1684	Sub-bituminous carbon
Merieléctrica 1	8.1684	Gas
Paipa 1	6.3751	Sub-bituminous carbon
Paipa 2	9.4663	Sub-bituminous carbon
Paipa 3	7.8000	Sub-bituminous carbon
Paipa 4	10.0025	Sub-bituminous carbon
Palenque 3	9.6021	Gas
Proeléctrica 1	9.6961	Gas
Proeléctrica 3	9.6965	Gas
Tasajero 1	9.5477	Other bituminous carbons
Tebsab	9.6806	Gas
Termocandelaria 1	7.0872	Gas
Termocandelaria 2	9.7103	Gas
Termocentro 1 Ciclo	6.4732	Gas
Termodorada 1	7.3752	Gas
Termoemcali 1	9.8036	Gas
Termosierrab	13.7	Gas
Termovalle 1	6.579	Gas
Termoyopal 1	12.7056	Gas
Zipaemg 2	12.7586	Gas
Zipaemg 3	9.6027	Gas
Zipaemg 4	9.0118	Gas
Zipaemg 5	8.6793	Gas
Termoyopal 2	11.0451	Gas
Termopiedras 1 Gener	12.7057	Gas
Morro 1	12.4000	Other bituminous carbons
Morro 2	13.8400	Other bituminous carbons
Cimarrón	13.8400	Other bituminous carbons

Source: **Associated Services Management**, XM *Compañía de Expertos en Mercados S.A. E.S.P.* In the case of TermoPiedras 1 Generates has been used the average value of the gas-fired heat because its heat rate has not been provided**.**

Emission factors by plant

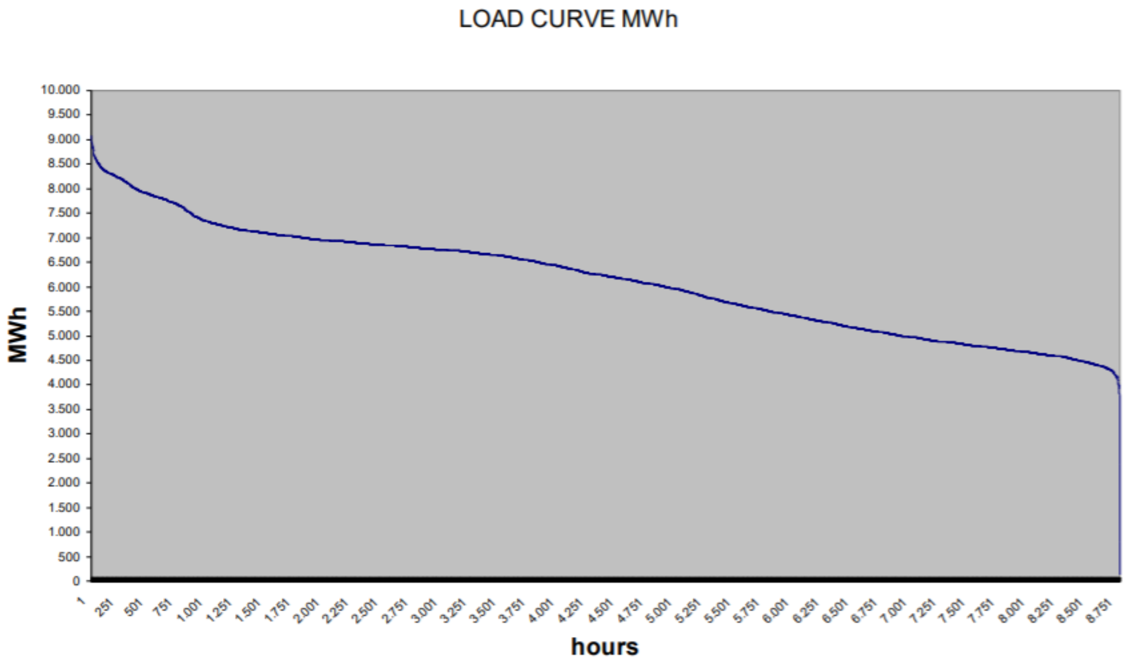
The combination of the data of the two tables shown above can be used to obtain the following factors of emission per kWh generated for the thermal power plants.

Name of the plant	Emission Factor (kg CO_2/kWh)
Barranquilla 3	0.556
Barranquilla 4	0.571
Cartagena 1	0.677
Cartagena 3	0.660
Flores 1	0.423
Flores 2	0.573
Flores 3	0.550
Guajira 1	0.562

Guajira 2	1.341
Merieléctrica 1	0.552
Paipa 1	1.321
Paipa 2	1.196
Paipa 3	1.202
Paipa 4	0.906
Palenque 3	0.820
Proeléctrica 1	0.468
Proeléctrica 3	0.468
Tasajero 1	0.927
Tebsab	0.447
Termocandelaria 1	0.547
Termocandelaria 2	0.555
Termocentro 1 Ciclo	0.406
Termodorada 1	0.556
Termoemcali 1	0.371
Termosierrab	0.365
Termovalle 1	0.377
Termoyopal 1	0.728
Zipaemg 2	1.205
Zipaemg 3	0.907
Zipaemg 4	0.851
Zipaemg 5	0.820
Termoyopal 2	0.728
Termopiedras 1 Gener	1.081
Morro 1	0.710
Morro 2	0.793
Cimarrón	0.793
Central Tumaco Cogenerador	0.699
Cogen. ingenio Providencia	0.000
Cogeneracion Coltejer	1.068
Cogenerador Bioaise	0.570
Cogenerador central Castilla	0.699
Cogenerador Incauca	0.550
Cogenerador ingenio Riopaila	0.699
Cogenerador ingenio Risalda	0.699
Cogenerador Proenca	0.000

Calculation of λ_y

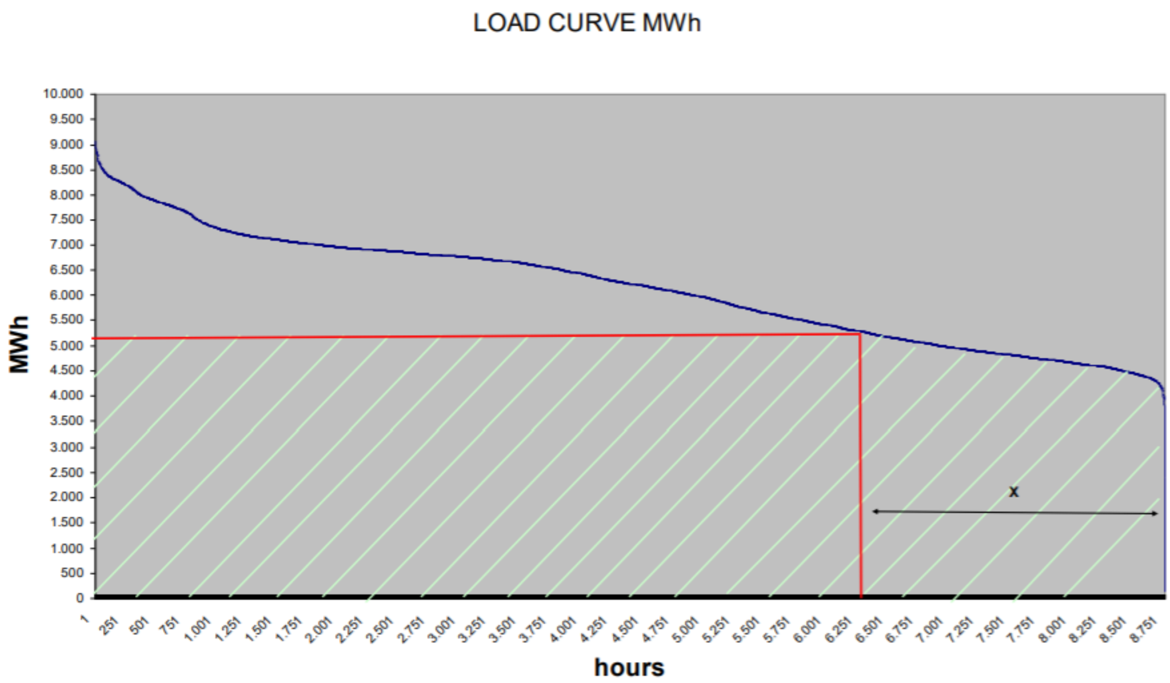
- Step i: The total hourly generation data of the year are presented, from high to low, in comparison to the total 8,760 hours of the year. Here is the graphs obtained for 2007 in which the operating margin emission factor has been calculated:



- Step ii: Calculate the total annual generation of low-cost/must-run plants ($\sum_k EG_{k,y}$). In accordance with the data for the total generations for the year 2007, the total quantity generated by low-cost/must-run plants (values for $\sum_k EG_{k,y}$) is shown below.

Year	Total Generation (MWh)	$\sum_k EG_{k,y}$ (MWh)
2007	53,665,662.6	44,340,373.75

- Step iii: Draw a horizontal line that crosses the line represented, so that the area under the curve represents the total generation of low-cost/must-run plants ($\sum_k EG_{k,y}$).



- Step iv: Determine value λ_y, taking into account that λ_y is calculated as X/8,760, where X represents the hours on the right of the point of intersection.

$$\lambda_{y,2007} = \frac{8{,}760 - 6{,}462}{8{,}760 hours..per..year} = 0.262$$

Operating margin emission factor

	2007		
POWER PLANT	**kWh**	**$kgCO_2/kWh$**	**$kgCO_2$**
MENOR LA CASCADA-ABEJORRAL	1,515,720.0	0.000	0.00
ALBAN	2,001,690,655.5	0.000	0.00
MENOR AMALFI	2,079,284.0	0.000	0.00
MENOR AMERICA	341,775.0	0.000	0.00
MENOR ASNAZU	3,840,029.0	0.000	0.00
MENOR AYURA	114,959,293.0	0.000	0.00
COGEN, BIOAISE	3,261,010.0	0.521	1,859,437.60
MENOR BELLO	1,901,014.0	0.000	0.00
MENOR BELMONTE	13,864,581.0	0.000	0.00
MENOR EL BOSQUE	7,290,651.0	0.000	0.00
MENOR BAYONA	3,343,468.3	0.000	0.00
COGEN, CENTRAL CASTILLA	4,518,150.3	0.699	3,156,379.78
MENOR COCONUCO	13,821,245.0	0.000	0.00
BETANIA	2,013,310,329.1	0.000	0.00
MENOR CALICHAL	423,168.0	0.000	0.00
CHIVOR	3,997,676,637.1	0.000	0.00
MENOR CIMARRON	31,525,154.12	0.793	24,996,935.02
MENOR CALDERAS	92,320,951.8	0.000	0.00
CALIMA	159,090,107.9	0.000	0.00
COGEN, COLTEJER	2,666.0	1.068	2,846.00
MENOR CEMENTOS DEL NARE	42,805,737.0	0.000	0.00
MENOR CAMPESTRE (EPM)	2,231,054.0	0.000	0.00
MENOR CAMPESTRE (CALARCA)	5,368,415.8	0.000	0.00
MENOR CHARQUITO	53,666,073.0	0.000	0.00
MENOR CARACOLI	19,545,116.0	0.000	0.00
COROZO - SAN MATEO 2 230 KV	0.0	0.000	0.00
MENOR CASCADA	20,853,585.2	0.000	0.00
TERMOCARTAGENA 1	18,205,720.9	0.677	12,318,730.12
TERMOCARTAGENA 2 (INACTIVA)	0.0	0.000	0.00
TERMOCARTAGENA 3	18,277,383.89	0.660	12,065,223.11
MENOR MORRO 1	107,611,427.98	0.710	76,449,303.35
MENOR MORRO 2	7,268,109.59	0.793	5,763,031.72
COGEN, TUMACO	30,824.20	0.699	21,533.79
MENOR DOLORES EPM	46,232,756.00	0.000	0.00
ECUADOR-TULCÁN (ENLACE)	152,960.40	0.000	0.00
ECUADOR-POMASQUI (ENLACE)	38,239,618.71	0.000	0.00
ESMERALDA	189,713,243.87	0.000	0.00
MENOR FLORIDA	88,638,500.00	0.000	0.00
MENOR GUACAICA	6,458,530.00	0.000	0.00
GUATAPE	3,570,426,745.0	0.000	0.00
GUATRON	2,822,997,571.4	0.000	0.00
GUAVIO	5,339,817,742.0	0.000	0.00
MIEL	1,461,814,352.0	0.000	0.00
COGEN, INCAUCA	42,832,681.2	0.550	23,557,974.66
COGEN, INGENIO PROVIDENCIA	1,510,684.0	0.000	0.00

MENOR INSULA	126,705,224.7	0.000	0.00
MENOR INTERMEDIA	6,761,792.5	0.000	0.00
MENOR IQUIRA 1	17,197,056.0	0.000	0.00
MENOR IQUIRA 2	8,763,120.0	0.000	0.00
COGEN, INGENIO RISARALDA	8,660,842.0	0.699	6,050,464.22
JAGUAS	848,160,082.0	0.000	0.00
MENOR JULIO BRAVO	6,451,860.4	0.000	0.00
MENOR LA JUNCA	126,056,329.0	0.000	0.00
MENOR LIBARE	23,830,146.0	0.000	0.00
MENOR EL LIMON	5,731,562.0	0.000	0.00
MENOR EL LIMONAR	87,554,765.0	0.000	0.00
MENOR EL PALO	8,332,084.0	0.000	0.00
LA TASAJERA	1,790,490,036.0	0.000	0.00
MENOR MIROLINDO	17,989,762.0	0.000	0.00
MENOR MUNICIPAL	8,620,980.0	0.000	0.00
MENOR MONDOMO	2,441,225.0	0.000	0.00
MENOR MANANTIALES	13,347,703.0	0.000	0.00
MERILECTRICA 1	55,704,240.0	0.552	30,752,044.20
MENOR NIMA	36,891,465.5	0.000	0.00
MENOR NIQUIA	98,819,667.0	0.000	0.00
MENOR NUTIBARA	2,725,851.0	0.000	0.00
MENOR OVEJAS	7,027,971.0	0.000	0.00
MENOR PIEDRAS BLANCAS	17,468,477.0	0.000	0.00
MENOR PIEDRAS	2,729,535.0	0.000	0.00
PARAISO GUACA	3,565,166,002.0	0.000	0.00
MENOR PAJARITO	29,462,529.0	0.000	0.00
MENOR PALMAS SAN GIL	73,435,302.6	0.000	0.00
PALENQUE 3	606,566.4	0.820	497,507.42
MENOR URRAO	2,531,697.0	0.000	0.00
PLAYAS	1,648,935,288.0	0.000	0.00
MENOR REMEDIOS	982,277.0	0.000	0.00
COGEN, PROENCA	7,334,980.0	0.000	0.00
PAIPA 1	62,726,332.0	1.321	82,854,541.55
PAIPA 2	301,820,617.5	1.196	361,101,856.81
PAIPA 3	295,752,774.5	1.202	355,359,621.37
PAIPA 4	1,003,019,661.0	0.906	908,560,412.07
PORCE II	2,037,516,524.0	0.000	0.00
MENOR PRADO 4	30,958,376.6	0.000	0.00
PRADO	156,885,019.2	0.000	0.00
PROELECTRICA 1	41,656,798.0	0.468	19,494,690.00
PROELECTRICA 2	44,767,748.0	0.468	20,950,562.96
MENOR PASTALES 1	2,669,003.0	0.000	0.00
MENOR LA PITA	10,576,737.0	0.000	0.00
MENOR PATICO - LA CABRERA	5,847,042.0	0.000	0.00
MENOR PUENTE GUILLERMO	5,672,807.0	0.000	0.00
MENOR PTAR	0.0	0.000	0.00
MENOR PROVIDENCIA	15,252,148.0	0.000	0.00
MENOR RIO BOBO	13,485,048.0	0.000	0.00
MENOR LA REBUSCA	3,084,660.0	0.000	0.00
MENOR RIO ABAJO	6,085,050.0	0.000	0.00
MENOR RIO RECIO	2,667,650.0	0.000	0.00
MENOR RIO CALI	13,421,690.9	0.000	0.00
MENOR RIO FRIO I	7,023,536.2	0.000	0.00
MENOR RIO FRIO II	59,812,567.0	0.000	0.00
MENOR RIO GRANDE	2,816,364.0	0.000	0.00
RIOGRANDE	70,661,304.0	0.000	0.00
MENOR RIO INGENIO	70,865.2	0.000	0.00
MENOR RUMOR	15,281,548.7	0.000	0.00
MENOR RIO MAYO	113,586,200.0	0.000	0.00
MENOR RIONEGRO	29,840,217.0	0.000	0.00

MENOR RIO PIEDRAS	152,130,992.8	0.000	0.00
COGEN, INGENIO RIOPAILA	4,450,078.0	0.699	3,108,824.49
MENOR SAN JOSE DE LA MONTAÑA	1,343,483.0	0.000	0.00
MENOR SAJANDI	16,578,359.0	0.000	0.00
MENOR SAN JOSE	2,283,875.8	0.000	0.00
MENOR SILVIA	2,458,524.0	0.000	0.00
SALVAJINA	1,176,788,523.0	0.000	0.00
MENOR SAN CANCIO	12,948,218.1	0.000	0.00
SAN CARLOS	7,216,389,988.0	0.000	0.00
SAN FRANCISCO	261,650,556.4	0.000	0.00
MENOR SONSON	93,095,024.0	0.000	0.00
MENOR RIO SAPUYES	9,764,535.0	0.000	0.00
MENOR SERVITA	3,035,321.4	0.000	0.00
MENOR SUEVA 2	30,919,274.0	0.000	0.00
TERMOBARRANQUILLA 3	25,585,070.2	0.556	14,212,718.39
TERMOBARRANQUILLA 4	23,993,984.8	0.571	13,704,689.79
TEBSA TOTAL	3,894,720,467.8	0.447	1,740,461,208.80
TERMOCANDELARIA 1	156,139,000.0	0.547	85,408,994.83
TERMOCANDELARIA 2	8,756,000.0	0.555	4,856,254.98
TERMODORADA 1	14,402,790.1	0.556	8,012,586.49
TERMOEMCALI 1	11,059,819.4	0.371	4,101,668.08
TERMOFLORES 1	531,514,216.5	0.423	224,585,720.54
TERMOFLORES 2	49,855,176.6	0.573	28,570,133.62
TERMOFLORES 3	58,295,424.0	0.550	32,069,644.27
GUAJIRA 1	121,183,830.0	0.562	68,064,978.23
GUAJIRA 2	89,582,280.0	1.341	120,166,739.65
MENOR LA TINTA	114,867,113.0	0.000	0.00
MENOR TAMESIS	8,939,529.0	0.000	0.00
MENOR TERMOPIEDRAS	11,702.7	1.081	12,656.04
MENOR TEQUENDAMA	113,864,225.0	0.000	0.00
TERMOCENTRO 1	408,882,041.0	0.406	166,022,204.82
TASAJERO 1	762,308,010.0	0.927	706,565,366.86
TERMO SIERRA 1	386,747,280.0	0.365	141,256,266.10
TERMOVALLE 1	19,840,340.6	0.377	7,478,292.73
TERMOYOPAL 1	73,588,081.2	0.728	53,567,271.82
TERMOYOPAL 2	158,042,650.3	0.728	115,043,724.96
MENOR UNION	3,281,538.6	0.000	0.00
URRA	1,466,593,500.0	0.000	0.00
MENOR VENTANA 2	11,711,549.0	0.000	0.00
MENOR VENTANA 1	16,233,462.0	0.000	0.00
CUESTECITAS - CUATRICENTENARIO 1 230 KV	1,146,936.0	0.000	0.00
ZIPAEMG 2	111,361,027.0	1.205	134,169,223.93
ZIPAEMG 3	96,505.0	0.907	87,510.43
ZIPAEMG 4	77,607,046.0	0.851	66,043,389.80
ZIPAEMG 5	289,017,293.0	0.820	236,878,250.80
MENOR ZARAGOZA	7,650,194.6	0.000	0.00
MENOR LA HERRADURA	124,066,333.0	0.000	0.00
PARQUE EOLICO JEPIRACHI	49,890,974.9	0.000	0.00
MENOR LA CASCADA	7,833,587.5	0.000	0.00
MENOR SANTA ANA	49,920,512.0	0.000	0.00
MENOR LA VUELTA	50,497,538.0	0.000	0.00
MENOR GRANADA	1,389,360.00	0.000	0.00
	53,665,662,570.2	-	5,920,261,416.2

Marginal build factor

The calculation of the marginal build factor involved the calculation of 20% of the total energy generated during the year 2007, obtaining a value of 10,733GWh, The plants were classified, in accordance with the most recently built plants, adding the energy generated per plant during 2007, so that the total would provide a value equal to or above 10,733GWh and which would include a complete plant, for calculation purposes, as stated in the methodology.

PLANTS BUILT THAT REPRESENT 20% OF THE TOTAL MWh DURING 2007 (SET>=20%)					
COMMERCIAL COMMISSIONING DATE	GENERATING PLANT	NOMINAL CAPACITY (MW)	MWh	t CO_2	t CO_2/MWh
19/09/2007	REMEDIOS	1.00	982.28	0.00	0.000
19/08/2007	MORRO 2	17.00	7,268.11	5,763.03	0.793
18/08/2007	CIMARRON	17.00	31,525.15	24,996.94	0.793
5/08/2007	AMALFI	1.00	2,079.28	0.00	0.000
30/07/2007	URRAO	1.00	2,531.70	0.00	0.000
24/07/2007	CASCADA GENERADOR	3.00	20,853.59	0.00	0.000
23/05/2007	MORRO 1	20.00	107,611.43	76,449.30	0.710
25/03/2007	COGENERADOR CENTRAL TUMACO 1	0.00	30.82	21.53	0.699
30/01/2007	SAN JOSE LA MONTAÑA	1.00	1,343.48	0.00	0.000
1/01/2007	CALDERAS	20.00	92,320.95	0.00	0.000
1/09/2006	COGENERADOR COLTEJER 1	5.00	2.67	2.85	1.068
11/03/2005	TERMOYOPAL 1	19.00	73,588.08	53,567.27	0.728
1/01/2005	LA JUNCA 1	19.00	126,056.33	0.00	0.000
1/09/2004	CEMENTOS DEL NARE 1	5.00	42,805.74	0.00	0.000
16/08/2004	MERILECTRICA 1	169.00	55,704.24	30,752.04	0.552
15/08/2004	COGENERADOR CENTRAL CASTILLA 1	1.00	4,518.15	3,156.38	0.699
8/08/2004	COGENERADOR INGENIO RIOPAILA 1	2.00	4,450.08	3,108.82	0.699
29/07/2004	TERMOYOPAL 2	30.00	158,042.65	115,043.72	0.728
10/04/2004	TEQUENDAMA 1	19.00	113,864.23	0.00	0.000
10/04/2004	TEQUENDAMA 2				
6/12/2003	EL LIMONAR 1	18.00	87,554.77	0.00	0.000
6/12/2003	LA TINTA 1	19.00	114,867.11	0.00	0.000
16/11/2003	SAN JOSE 1	0.00	2,283.88	0.00	0.000
16/11/2003	SAN JOSE 2				
22/08/2003	CHARQUITO 1	19.00	53,666.07	0.00	0.000
15/08/2003	COGENERADOR INGENIO RISARALDA 1	6.00	8,660.84	6,050.46	0.699
1/12/2002	MIEL I 1	396.00	1,461,814.35	0.00	0.000
1/12/2002	MIEL I 2				
1/12/2002	MIEL I 3				
1/06/2002	SONSON 21	19.00	93,095.02	0.00	0.000
3/05/2002	CHIVOR 1	1,000.00	999,419.16	0.00	0.000
3/05/2002	CHIVOR 2				
1/09/2001	PUENTE GUILLERMO 1	1.00	5,672.81	0.00	0.000
29/06/2001	PORCE II 3	405.00	2,037,516.52	0.00	0.000
6/05/2001	PORCE II 2				
8/04/2001	PORCE II 1				

27/01/2001	TERMOSIERRAB	405.00	386,747.28	141,256.27	0.365
5/01/2001	CHIVOR 8	1,000.00	999,419.16	0.00	0.000
4/01/2001	CHIVOR 7	0.00	0.00	0.00	0.000
30/11/2000	TERMOCENTRO 1 CICLO COMBINADO	280.00	408,882.04	166,022.20	0.406
13/07/2000	TERMOCANDELA RIA 2	157.00	8,756.00	4,856.25	0.555
16/06/2000	URRA 4	338.00	366,648.38	0.00	0.000
3/06/2000	TERMOCANDELA RIA 1	157.00	156,139.00	85,408.99	0.547
13/05/2000	URRA 3	338.00	366,648.38	0.00	0.000
1/04/2000	URRA 2	338.00	366,648.38	0.00	0.000
31/03/2000	RIO PIEDRAS 1	20.00	152,130.99	0.00	0.000
14/02/2000	URRA 1	338.00	366,648.38	0.00	0.000
1/01/2000	TPIEDRAS 1	4.00	11.70	0.00	0.000
16/07/1999	TERMOEMCALI 1	229.00	11,059.82	4,101.67	0.371
1/07/1999	COGENERADOR INGENIO PROVIDENCIA 1	1.00	1,510.68	0.00	
8/01/1999	PAIPA 4	150.00	1,003,019.66	908,560.41	0.906
1/01/1999	RIOFRIO II GENERADOR	10.00	59,812.57	0.00	0.000
1/01/1999	COGENERADOR BIOAISE 1	0.00	3,261.01	1,859.44	0.570
1/01/1999	COGENERADOR PROENCA 1	4.00	7,334.98	0.00	0.000
1/01/1999	COGENERADOR INCAUCA 1	10.00	42,832.68	23,557.97	0.550
1/01/1999	RIOFRIO I GENERADOR	0.00	7,023.54	0.00	0.000
1/01/1999	RUMOR GENERADOR	1.00	15,281.55	0.00	0.000
17/12/1998	TERMOVALLE 1	3.00	19,840.34	7,478.29	0.377
20/10/1998	TEBSAB	791.00	3,894,720.47	1,740,461.21	0.447
			14,354,506	3,402,475.074	0.237

If we analyse the energy generated by the last five plants installed, we can see that the energy generated is lower than that generated by the plants that make up 20% of the total energy in 2007, so that, in accordance with the methodology, the plants that make up 20% of the total are selected. The table shown next includes the energy generated by the last five plants, to justify the selection.

LAST 5 PLANTS BUILT DURING 2007					
COMMERCIAL COMMISSIONING DATE	GENERATING PLANT	NOMINAL CAPACITY (MW)	MWh	t CO_2	t CO_2/MWh
19/09/2007	REMEDIOS	1.00	982.28	0.00	0.000
19/08/2007	MORRO 2	17.00	7,268.11	5,763.03	0.793
18/08/2007	CIMARRON	17.00	31,525.15	24,996.94	0.793
5/08/2007	AMALFI	1.00	2,079.28	0.00	0.000
30/07/2007	URRAO	1.00	2,531.70	0.00	0.000
			44,386.52	30,759.97	0.693

Consideration of exports and imports

The methodology ACM 0002/Version 13.0.0establishes that the electricity imported from other connected systems must be considered as another plant when calculating the operating margin factor. Colombia establishes an account with electrical connections with Venezuela, Ecuador and, in the near future, also with Panama. However, as a consequence of its high hydroelectric component, Colombia has a clear electric energy exporting character and only 0.074% of the almost 52,787 GWh of demand addressed by the NIS during the year 2007 came from other countries.

2007 General NIS Data	
Data	**GWh**
Generation	53,624.1
Imports	39.5
Exports	846.5
National demand addressed	52,787.0
National demand not addressed	64.3
NIS Demand	52,851.3

Source: XM

Taking into account this situation, we can determine how imports can complicate the calculation of the baseline and monitoring operations, greatly modifying the values of the factors obtained with negative results, increasing the degree of uncertainty in the calculations while not providing a greater precision. Therefore, the import data has not been included in the calculation of GHG emissions. If we establish that imports can have an impact on the operating margin emission factor in the future, the monitoring plan will be modified to include hourly values (in kWh), its price of participation in the system (in $/kWh) and its emission factor (in kgCO_2/ kWh) in the baseline calculations. In the tool, for the imports from another country, an emission factor of 0 kgCO_2/kWh is applied, so its inclusion only affect the total amount of electricity, which due to its low value , it is assumed negligible compared to the total amount of energy generated in the system.

Appendix 5. Further background information on monitoring plan

The Monitoring Plan established can be used to calculate the reduction of GHG emissions generated by the project's activity with a simple process. The calculations will be mainly based on the gathering of data on the electricity generated by all plants connected to the National Interconnected System, including that corresponding to the Hydroelectric Power Plant of Cucuana. The data will be gathered throughout the duration of the project activity and the crediting period, which is composed by a period of 7 years and which can be extended for another two 7-year periods.

The plant's emissions will be zero so that the project's activity emissions will not have to be monitored. Likewise, the leakages associated to the project will be practically zero. Therefore, only the baseline emissions must be calculated.

These are mainly composed by the CO_2 emissions of the thermal power plants that use carbon and natural gas and which are shifted by the generation of the Power Plant of Cucuana. To assess their performance, the operating and build margin factors will be calculated, as explained next:

The calculation of the **operating margin emission factor** will use one spreadsheets with four sheets to guarantee the dynamic and automatic monitoring of the reduction of GHG emissions attained after the implementation of the project:

- The emission factors of each plant are calculated in kg CO_2/kWh in the first sheet, with the heat rate values of the power plant, provided by the Associated Services Management, XM Compañía de Expertos en Mercados S.A. E.S.P. with the emission factors obtained from table 1.4 of page 1.23 of the document "2006 IPPC Guidelines for National Greenhouse Gas Inventories", taking into account the lowest value with the 95% interval confidence.

- The second spreadsheet must include the hourly data of total system generation provided by the NEON system.
- The next sheet is sorted generation hourly total system from top to bottom and are represented in terms of the 8,760 hours a year. In addition it is estimated the area under the curve for different times of year, to calculate the value of λ.
- The last sheet, the operating emission factor is calculated taking into account the value of λ, the generation of each power plant and their emission factors.

In the case of the **build margin emission factor**, there is a spreadsheet used to enter the new plants commissioned, which takes into account those that complete 20% of the year's generation, updating the said factor.

Appendix 6. Summary report of comments received from local stakeholders

See section E.

Appendix 7. Summary of post-registration changes

At section B.6.1 in step 4, **option A1** of the "tool to calculate the emission factor of an electrical system" was added as an approach to calculate the emission factor of each plant m based on fuel consumption and electricity generation, as this information is available to the public in the database of the national interconnected system: http://informacioninteligente10.xm.com.co/oferta/Paginas/HistoricoOferta.aspx

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Document information

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.

Version	*Date*	*Description*
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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