Project design document form
(Version 11.0)

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

BASIC INFORMATION	
Title of the project activity	Bajo Tuluá Minor Hydroelectric Power Plant - 3599
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	5.1
Completion date of the PDD	20/12/2019
Project participants	EPSA S.A. E.S.P.
Host Party	Colombia
Applied methodologies and standardized baselines	ACM0002 - Large-scale Consolidated Methodology - Grid-connected electricity generation from renewable sources (version 19.0)
Sectoral scopes	Sector scope (1): Energy industries
Estimated amount of annual average GHG emission reductions	28,786 tCO_2

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 total installed capacity of 23,5 MW, with the aim of making use of the capacity of the Tuluá 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 the Cauca Valley, while contributing to the sustainable development of the region with the reduction of CO_2 emissions.

The Bajo Tuluá Hydroelectric Power Plant project in the Tuluá River, is located in the middle section of the river's basin, between points 1,477 and 1,247 metres above sea level, in the department of the Cauca Valley. The power plant obtains water at 1,474.7 metres above sea level with a mean flow of 12 m^3/s. At this point, the water flow will be driven with pressure systems to the engine house, where two Francis turbines with a design power of 12,04MW each 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 117.4 GWh annually. It will help to reduce thermal power generation in the SIN by providing renewable energy to the grid. Thus, it will contribute to sustainability by increasing the share of renewable energy and reducing GHG emissions. The expected average annual emission reductions are 28,786 tCO_2 during a renewable 7-years crediting period.

The spatial extension of the project boundary includes the physical location of the project (Bajo Tuluá 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.

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 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 each distribution point (m^3/s):	12
Turbine design flow (m^3/s)	6
Elevation of the distribution point (metres above sea level):	1,474.7
Length of the conduction tunnel (m):	5,657
Final diameter of the tunnel (m):	3.00
Maximum gross drop (m):	225
Installed capacity (MW):	23.5
Number and type of turbines:	2 turbines, Francis

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 (SIN) by the power plant of Bajo Tuluá 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 minor hydroelectric power plant of Bajo Tuluá contributes to the fulfilment of the following national sustainable development priorities:

- Reduction in the atmospheric contamination (NO_X, SO_X, COVs 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 minor Hydroelectric Power Plant of Bajo Tuluá shall add 23.5 MW of installed power 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 the Cauca Valley 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 the Cauca Valley 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.

A.2. Location of project activity

The project of the Minor Hydroelectric Power Plant of Bajo Tuluá is located on the middle section of the basin of the Tuluá River. The water flows through the river points 1,477 and 1,247 metres above sea level, in the department of the Cauca Valley, municipalities of Tuluá, Buga and San Pedro, Colombia. The water intake point is located on the left margin in the Crucero Nogales borough, Crucero Nogales district at the height of the Cristalina ravine, municipality of Buga. The engine house is located in the height 1,247, and the discharge is above the mouth of La Esmeralda ravine into the Tuluá River, in the Esmeralda district, in the municipality of San Pedro. The electrical distribution line starts in the engine house and finish in the Tuluá sub-station and it pass through the municipalities of Buga, San Pedro and Tuluá.

In particular, the water intake and powerhouse points are located on the following coordinates (in DMS - degrees/minutes/seconds format):

	Latitude	Longitude
BAJO TULUÁ RIVER WATER INTAKE POINT	03 ° 55' 30.98 "N	76 ° 05' 16.62" W
BAJO TULUÁ RIVER WATER POWERHOUSE	03 ° 58' 00" N	76 ° 07' 14" W

Details of physical location

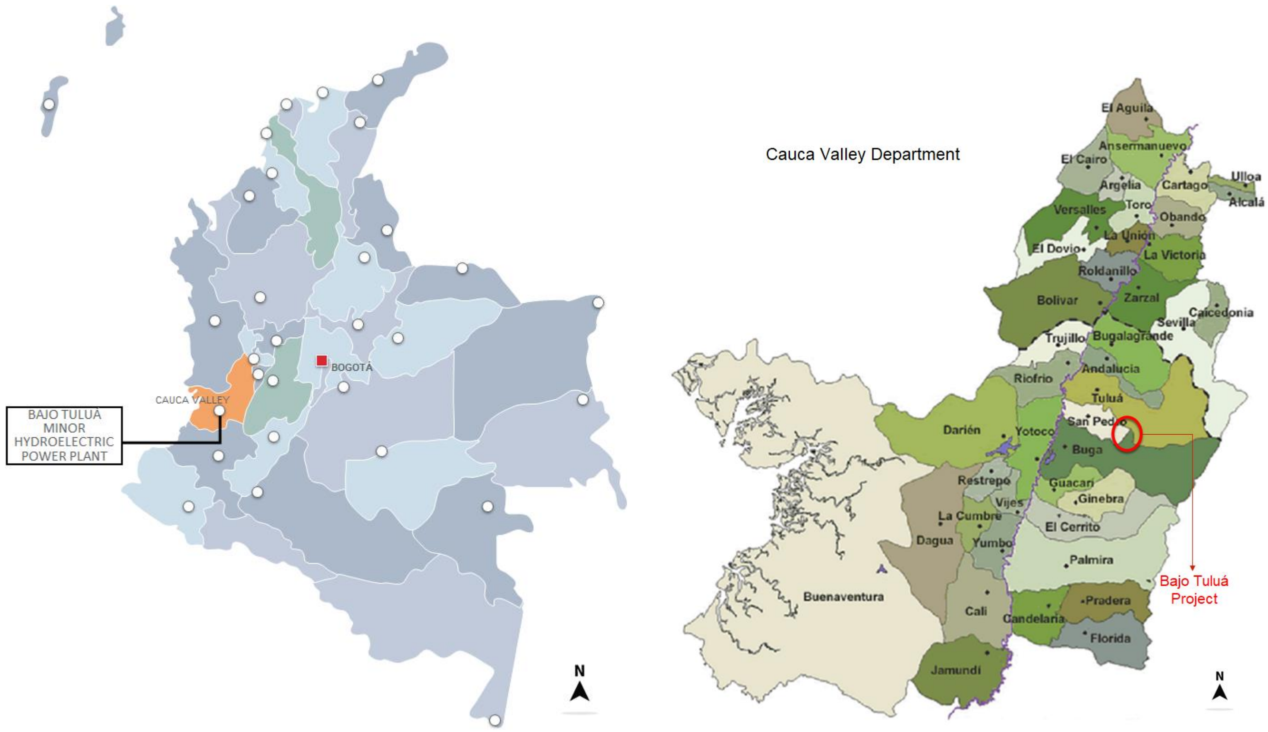

Figure 1. Project Location

A.3. Technologies/measures

This project collects the waters of the Tuluá River in the point 1,477.7 metres above sea level in the municipality of Buga. With the construction of a small dam that is 50 metres wide in the Tuluá River at this point (1,477.7 metres above sea level), a damming will be created, and it will allow water collection through a lateral collection point. The lateral collection point has a reception tank that drives water flow to a 110 metres long adduction channel which connects with a triple sedimentation basin. This one has an exit and a delivery channel which gives flow to the conduction tunnel which connects with the load tank. The pipe who feeds the power plant stars in the load tank and it split into two flows to distribute to two Francis turbines. 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 34.5 KV and it is connected to the sub-station of Tuluá. The distribution line shares 16 km with the line designed for the Bajo Tuluá project, until it arrives to the sub-station of Tuluá. The line walkway usually has parallel paths and therefore it is guaranteed ease of access, construction material's displacements and transport and worker's maintenance and entry. Moreover, the line walkway passes through lands with moderated slopes that make accessibility easier.

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

- **Dam**: it is located in the point 1,477.7 metres above sea level and its function is to generate a small damming that will allow the water collection from the river above an established sill (its function is not to store water but to make easier the collection of water).
- **Water collection**: the water intake points, or bypass point is a lateral collection point at 1,474.7 metres above sea level. The collection is formed by a grating port that avoids the pass of thick materials that are being transported by the river. Downstream of the grating port there is a reception tank that calms water flow.

- **Desilting canal**: it functions is to establish a fast flow in front of the lateral collection point that will allow sweeping all the sediments aggraded in front of it.
- **Ecological flow channel**: it is a structure with a fixed port controlled by a sliding gate that allows guaranteeing the ecological flow. This flow has priority to the flow collected through the water intake point.
- **Calming tank**: it connects through an orifice with the adduction channel.
- **Adduction channel**: it starts in the calming tank and it is 110 metres long until it connects with the sedimentation basin.
- **Sedimentation basin**: it is a triple sand trap. The water generated is collected in a small calming tank from where it starts the conduction tunnel.
- **Conduction tunnel**: horseshoe section with a partially lined tunnel and 5,657 metres in length from the start of the conduction to the load tank or holder.
- **Load tank**: from here starts the pipe which feeds the power plant and it is 560 metres long and has a diameter of 1.80 metres.
- **Engine house**: house of the superficial type that integrates the spaces required to host the two sets of generators with Francis turbines and the connection's yard. The engine house is composed by the following equipment: inlet valve, two Francis turbines with horizontal axis and a throttle, generators, insulated phase bars, generator's switches, potential transformers, auxiliary mechanical equipment, auxiliary electrical equipment and bridge crane. Finally, water is driven into the Tuluá River through a discharge tunnel. The water capacity of each turbine is the same and is thus equivalent to 50% of the total capacity of 23.5 MW (generators capacity).

Table 1. Technology characteristics - Turbines

MAIN CHARACTERISTICS OF THE TURBINES	
Number of units	2
Type	Francis, horizontal
Level of water in the load tunnel	1,475.3 metres above sea level
Level of water discharged by the turbine	1,244 metres above sea level
Level of the injectors	1,243 metres above sea level
Gross drop	225 m
Maximum net drop	194.39 m
Design flow per turbine	6 m^3/s
Design power per unit	12.04 MW
Expected efficiency at 100% opening	93 %
Nominal speed	720 m^{-1}
Submergence	+1 m

Table 2. Technology characteristics - Generators

MAIN CHARACTERISTICS OF THE GENERATORS	
Brand	Indar
Type	PSA-1250-Z/10
Number of units	2
Rated output	13,080 KVA
Rated voltage	13,800 V
Rated power factor	0.90
Rated frequency	60Hz

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

Table 3. Technology characteristics – Distribution line

Nominal voltage	34.5 KV
Number of circuits:	Simple three-phase circuit,
Conductor:	ACSR 556,5 MCM DOVE DOVE
Cable guard	Type: Optical Ground Wire(OPGW)
Structures:	In the concrete post, with a height of 14 meters and metallic small towers, with a configuration for the one three-phase circuit, with steel cable holding lines, where necessary.
Insulating elements:	Polymer based, of the post or suspension type.
Length of the line:	16 km
Number of structures:	66

The distribution line will be shared with the one from the hydroelectric power plant of Alto Tuluá. This one starts at the point 1,500 metres above sea level and arrives to the Bajo Tuluá's engine house. From here, both projects share 16 km of distribution line. The line walkway is close to paths which will be built inside the project's area of influence and therefore it is guaranteed ease of access, construction material's displacements and transport and worker's maintenance and entry. Moreover, the line walkway passes through lands with moderated slopes that make accessibility easier.

- **Monitoring equipment**: Main and back up meters are located at Tuluá sub-station. In general monitoring equipment characteristics will follow the specifications required by the CREG (Regulatory Commission for Energy and Gas), measurement code.

- **Complementary civil works**: access path to the collection, load tank-Holder, engine house, adaptation of landfills, construction of two bridges (one located in La Esmeralda ravine and one shared with Alto Tuluá project in San Marcos river), rehabilitation of current routes, expansion of energy networks for the construction 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)	EPSA S.A. E.S.P. (Private entity)	No

A.5. Public funding of project activity

There is no public funding for the proposed project.

A.6. History of project activity

In the past, there have been many attempts to use the tributaries of the Cauca River for the generation of hydroelectric energy, some of which have materialised since the past century in the form of projects, such as the Cali River project (1925) and other projects throughout the basin of the Cauca River, such as the minor power plants of Ovejas, Palos, etc

Forty-three projects can be identified in the general electrification plan of the OLAP, but minor projects became outdated as a result of the construction of larger projects. In 1989, the studies to encourage the implementation of this type of power plant projects were started again. In 1996, after the increase in the demand for energy in the Cauca Valley, EPSA defined the Minor

Hydroelectric Power Plant Study Plan for plants with a capacity under 100 MW, although these could not be executed due to budget problems.

During 2003, the portfolio of existing projects was revised and hydroelectric power plant projects with the following characteristics were identified: derivation to run-of-river plants, installed capacity below 50 MW, cost that does not exceed 50 million US $, quick execution (less than 3 years), minimal environmental problems and economic viability, considering the new finance framework resulting from the trade of certified emission reductions (CERs). Within this portfolio, the viability study of the Alto Tuluá (1,800 metres above sea level) and Bajo Tuluá (1,440 metres above sea level) projects was carried out.

1. PP hereby confirms that: The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA); The proposed CDM project activity is not a project activity that has been deregistered.

2. PP further declares that: The proposed CDM project activity was not a CPA that has been excluded from a registered CDM PoA; No registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not applicable

SECTION B. Application of methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

The project activity is developed under the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated Large-scale Methodology for grid-connected electricity generation from renewable sources" (version 19.0)[1].

Also, following the ACM0002, version 19.0 guidelines, it is applied for the renewable of the crediting period:

a. TOOL07 "Tool to calculate the emission factor for an electricity system" (version 07.0)[2]
b. TOOL11 "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1)[3] is also applied.

B.2. Applicability of methodologies and standardized baselines

The Consolidated Large-scale Methodology ACM0002 (version 19.0), is applicable to grid-connected renewable energy power generation project activities that:

(a) Install a Greenfield power plant;
(b) Involve a capacity addition to (an) existing plant(s);
(c) Involve a retrofit of (an) existing operating plants/units;
(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or
(e) Involve a replacement of (an) existing plant(s)/unit(s).

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[1]See document: https://cdm.unfccc.int/filestorage/5/8/I/58IAGB7SZUDEO2VN6LYM30K41HFPRQ/EB100_repan06_ACM0002.pdf?t=Z2V8cG9obHc4fDAw7Kw1X4DOOrkYg2mGbnft
[2] See document: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf
[3] See document: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

In this case, the proposed project activity involves grid-connected renewable energy power generation through the installation of a run-of-river Hydroelectric Plant (a Greenfield power plant).

The applicability conditions of the methodology ACM0002 are presented below together with an explanation on why each condition is met by the project activity.

Table 4. Methodology Applicability

Applicability Conditions	Project Activity
1. The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The proposed project activity involves renewable energy power generation through the installation of a hydro power plant without reservoir. Thus, this condition is met.
2. In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit 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 expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The proposed project activity involves the installation of a Greenfield power plant. Thus, this condition is not applicable.
3. In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased, and the power density is greater than 4 W/m^2; or (c) The project activity results in new single or multiple reservoirs and the power density is greater than 4 W/m^2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs is lower than or equal to 4 W/m^2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs (a).

Applicability Conditions	Project Activity
4. In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	The proposed project activity does not involve integrated hydro power projects. Thus, this condition is not applicable.
5. The methodology is not applicable to: (a) 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; (b) Biomass fired power plants/units.	The proposed project activity does not involve switching from fossil fuels to renewable energy sources at the project site or the installation of biomass fired power plants. Thus, this condition is met.
6. In the case of retrofits, rehabilitations, 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, that is 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”.	The proposed project activity involves the installation of a Greenfield power plant. Thus, this condition is not applicable.
7. The applicability conditions included in the tools apply.	The conditions of the “Tool to calculate the emission factor for an electricity system” and Tool for the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” are analyzed below.
7.1. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	The proposed project activity supplies electricity to the local grid, avoiding part of the electricity generated by the grid-connected power plants. Thus, this condition is met.

Applicability Conditions	Project Activity
7.2. Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	In this case, the emission factor for the project electricity system is calculated for grid power plants only. Thus, this condition is met.
7.3. The tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	In this case, the project electricity system is located totally in Colombia. Thus, this condition is met.

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

According to the guidance specified in the Methodology ACM0002 (version 19.0), the spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to (see Figure 2). The main measuring equipment is located at the substation Tuluá.

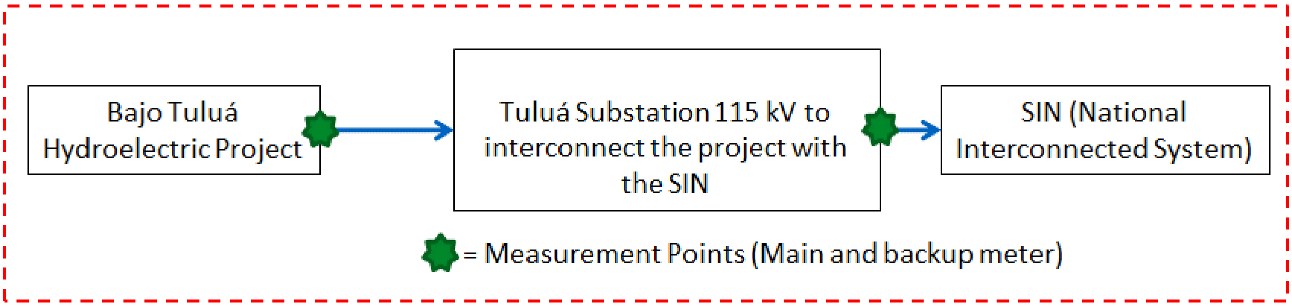


Figure 2. Project Boundary and measurement point

The spatial extension of the limits of the project includes the physical location of the project (Power Plant of Bajo Tuluá) and all plants connected to the electricity system, which will be connected to the Hydroelectric Power Plant of Bajo Tuluá (National Interconnected System of Colombia -SIN[4]). The power plants of this grid are all connected and can be dispatched without significant transmission constraints.

[4] In Spanish: *Sistema Interconectado Nacional - SIN*

Source		GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		---	No	No other emission sources
Project activity	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	The project has no reservoir
		CH_4	No	The project has no reservoir
		N_2O	No	The project has no reservoir
		---	No	The project has no reservoir

B.4. Establishment and description of baseline scenario

The hydroelectric power plant project of Bajo Tuluá 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.

As stated in the approved methodology ACM0002 “Grid-connected electricity generation from renewable sources”, version 19.0: If the project activity is the installation of a Greenfield power plant, the baseline scenario is the following:

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 (CM) calculations described in the “Tool to calculate the emission factor for an electricity system – version 7.0”.

Therefore, the baseline scenario consists of the electricity that would have been generated and delivered to the grid in the absence of the proposed project activity by:

- Other plants currently connected to the SIN; and
- New capacity additions to the SIN.

Hence, the baseline scenario is identified as the continuation of the common practice of power generation, i.e. mainly large hydro power plants with reservoirs and thermal power stations (Fuel oil, natural gas and coal), that emit large quantities of carbon dioxide (CO_2) to the atmosphere.

For the second crediting period, the continued validity of the original baseline has been assessed, following the stepwise procedure, according to the TOOL11 “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (version 03.0.1),

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

For the renewal of the crediting period, no new national and/or sectoral policies are affecting the baseline scenario. In the absence of the project activity, electricity would still have been partly generated by fossil fuel power plants or by the addition of new fossil fuel power plants connected to the grid. Also, considering that renewable energy projects have lower costs in the margin, they are always dispatched, as reported for the first crediting period.

It can be said that the project complies with the current regulations dealing with renewable sources of power generation. Specifically, the project activity is not affected by the body of actual main regulations (see Table 5).

The structure of the Colombian energy market is based on Laws 142 (Public Services Law) and 143 (Electricity Law) of 1994[5], which represent the last major reform of the power sector and establish the current regulatory framework. Since their enactment, Colombia has had a liberalized energy market, which is characterized by an unbundled generation, transmission, distribution, and commercialization scheme in order to separate the power activities and the markets. An electricity spot market and the development of a long-term contract market for electricity sales are the core of new structure to introduce a more effective framework for competition and an independent regulatory system supervised by the CREG (Regulatory Commission for Energy and Gas), created by the Law 143. This Electricity Law specifically introduced rules regarding: (i) Power sector planning; (ii) power generation; (iii) transmission and distribution; (iv) grid operation; (v) grid access fees; (vi) regime for electricity sales; (vii) concessions and contracts; and (viii) environmental issues, among others.

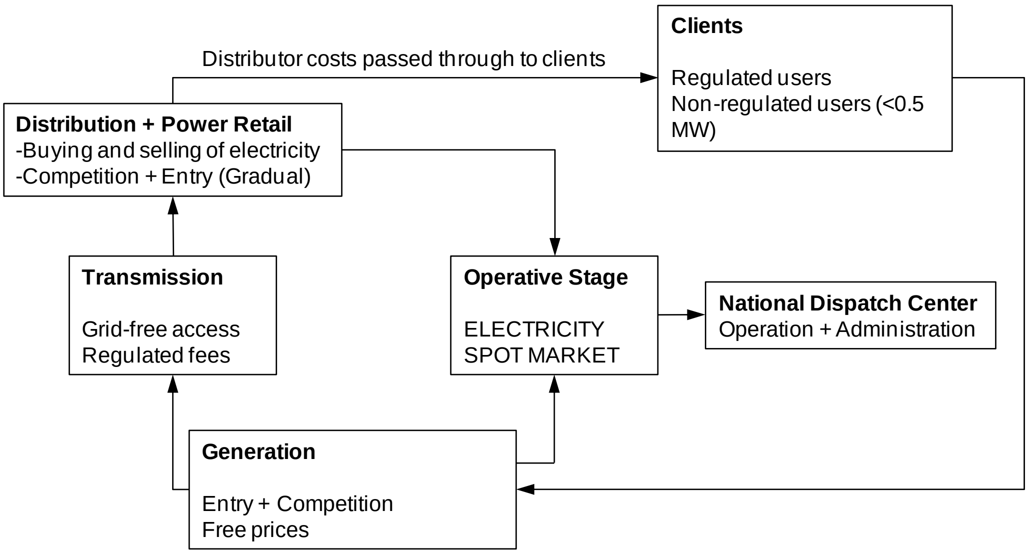


Figure 3. Simplified Scheme of the Colombian Power Market based on Electricity Law from 1994 (Law 143).

In order to construct and operate the hydroelectric plant and deliver electricity to the red, there are several instances that are directly involved to control that the project is implemented in accordance with the regulation and legal requirements as briefly explained in the following summaries:

1. **CORPORACIÓN AUTONOMA DEL VALLE DEL CAUCA (CVC)**: Based on Article 49 of the law 99 of 1993 and article 3 of the decree 1220 of 2005 the project requires an environmental license to construct and operate the project.
   Since the project has less than 100 MW, based on Article 52 of law 99 and article 8 of decree 1220, the corresponding Regional Autonomous Corporation (in this case **CORPORACIÓN AUTONOMA DEL VALLE DEL CAUCA -CVC**) is responsible to control and supervise compliance of the project with the requirements established in the Environmental Impact Assessment – EIA, and the environmental license.

[5] Laws can be accessed on the website: http://www.creg.gov.co/cxc/secciones/documentos/leyes.htm (accessed: 12/03/2019)

Therefore, the construction of the Project was authorized by CVC by means of the following resolutions and procedures:

- The Environmental Handling Plan for the Minor Hydroelectric Power plant of Bajo Tuluá has been approved by the CVC (competent environmental authority) and is integrated within the Environmental Impact Study which has also been approved.

- The resolution 0100 No. 0730-0606 dated November 14, 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 "Minor Hydroelectric Power Plant Bajo Tuluá 1440". The resolution clarifies aspects relating to "license of surface water", "permit for continued occupation of channels", "dumping permit", "atmospheric emissions by fixed sources permit", "forestall exploitation authorization", "access paths" and "Clean Development Mechanisms".

- The hydroelectric was licensed including its corresponding transmission lines; under the Resolution 0100 No. 0730-606 de 2008.

2. **UPME:** It acts as a supervisory entity. Any project to be implemented and interconnected with the electricity grid needs to be registered at the UPME. There are several phases, although the only mandatory registration step is called "Phase IV", which is emitted upon final project design and the emission of the environmental license.
3. **XM Compañía de Expertos en Mercados S.A. E.S.P.:** this is the grid administrator and operator. The entity that will buy the energy has also to be subscribed to XM and meet all applicable laws.
4. **CREG**: As the regulating entity, the CREG assures that all regulatory requirements are met. It also measures annually the capacity of the power plants.

Table 5. Policy compliance (yes √ – not X)

Policy	Impact on baseline	Validity during first crediting period	Outstanding changes since issuance
Laws 142/143 of 1994 Set the norms and procedures for the generation, interconnection, transmission, distribution, and electricity commercialization	X	√	X
Resolution 055 of 1994 - Electricity market conditions	X	√	X
Resolution 086 of 1996 - Power generation activities regulation	X	√	X
Resolution 039 of 2001 - Establish complementary conditions	X	√	X
Law 697 of 2001 - Promotes the development and use of rational and efficient sources of energy	X	√	X

Policy	Impact on baseline	Validity during first crediting period	Outstanding changes since issuance
Law 1715 of 2014 Controls the integration of non-conventional renewable energies into the National Energy System.	X	X	X

Since the project is being constructed and operated in a highly regulated market that is controlled by a series of public and private actors, compliance with all applicable laws and regulatory requirements is supervised and can be guaranteed.

Therefore, it can be concluded that the fundamental elements of the baseline have not changed since the project was first registered, and the market structure, regulatory framework, and functioning remains the same.

Step 1.2: Assess the impact of circumstances

At the time of requesting renewal of the crediting period on the current baseline emissions, no impact of circumstances prevail. It can be concluded that the conditions used to determine the baseline emissions in the previous crediting period are still valid.
Law 1715 which promotes renewable energy has not modified prices or electricity availability. The enactment of that law has not enhanced the continuation of the baseline scenario at the time of validation.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

Since the baseline scenario identified at the validation is the continuation of the current practice, i.e. the electricity would be supplied by the power grid in the absence of the project activity, and the baseline did not consider the use of any existing equipment by the project, because in the absence of the project activity the energy generated would have been generated by the operation of grid-connected power plants and by the addition of new generation sources to the grid.

Step 1.4: Assessment of the validity of the data and parameters

Relevant data and parameters, as the build and operating margin emission factors for the combined margin emission factor, were updated for the second crediting period according to the TOOL07 - Tool to calculate the emission factor for an electricity system - version 7.0. This update includes Grid Emission Factor and all values used in its calculation (fossil fuel emission factors etc). Application of Steps 1.1, 1.2, 1.3 and 1.4 above confirmed that the current baseline remains valid for the second crediting period; even though, some data and fixed parameters needed to be updated due to changes presented above. In this context step 2 is assessed below.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

Baseline emissions for the second crediting period have been updated in accordance with the stated above in step 1.4., without reassessing the current baseline, based on the latest approved version of the methodology ACM0002 (version 19.0). This update was applied in the context of the

sectoral policies and circumstances that are applicable at the time of requesting for renewal of the crediting period, which have not changed as to affect the project dispatch.

Step 2.2: Update the data and parameters

As said in step 1.4, the parameters regarding the grid emission factor calculation have been updated for this second crediting period using TOOL07 - Tool to calculate the emission factor for an electricity system - version 7.0. The build margin emission factor was updated for the second crediting period applying the ex-ante option, and the same way, the operating margin emission factor was reevaluated applying the ex-ante option. More details can be seen in section B.6 and B.7 (updated monitoring parameters).

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:

Table 6. Project Timeline

Date	Key Event	Evidence
09/2005	Early consideration of implementing the project as a CDM project	No Objection Letter by Colombian DNA
28/05/2007	First Local Stakeholders Consultation Meeting	PDD, Section E.
November 2007	Union Fenosa Strategic Plan (BIGGER). Approval of Investment: decision date	BIGGER approval
18/04/2008	Environmental Impact Assessment	Ingetec S.A.
13/06/2008	Agreement with CDM consultant	Socoin S.A.
18/06/2008	Agreement with DOE for validation services	AENOR
21/07/2008	Initial adoption of PDD submitted to DOE for Validation	Gas Natural SDG
02/08/2008	Public Consultation	UNFCCC website
15/01/2009	Starting Date of project activity	Date of purchase of equipment by EPSA
10/02/2009	Beginning of access works	Chronogram

As stated above, the additionality of the project activity has been analysed with the use of the latest version of the “Tool for the demonstration and assessment of additionality”, version 05.2. These are the steps followed:

Step 1. Identification of the alternatives of the project’s activity in compliance with the current legislation and regulations

Sub-step 1a. Define the alternatives to the project’s 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 25 MW fuel-fired power plant in order to supply this electricity to the Interconnected System.

Initially, a coal plant of 350 MW was selected as an alternative project, according to the usual parameters of profitability that requires Unión Fenosa (now known as Naturgy Generación S.L.U.) projects, but it was finally removed from the PDD because it would not be comparable with the project activity due to a much higher installed capacity. Smaller coal power plants, close to 60-80 MW, tend to respond to residual applications or complementary businesses (such plants use residual miners) that would not be objectively comparable with the project activity, as the scheme of cost-benefit not only responds to the business of power generation such as the CH of Bajo Tuluá.

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. Compliance with the current legislation 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.

Table 7. Projects included in the Colombian Generation Expansion Plan in the short and medium-term

Projects included in the Colombian Generation Expansion Plan in the short and medium-term			
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/vapor	Dec.-09
Termocol	210	Fuel-oil	Dec.-09
Guarinó transfer	---	Hydro. (Bypass of the water from the Guarinó	Jun.-10
Amoya	78	Hydro.	Jul.-10
Porce III	660	Hidro. (Reservoir)	Sep.-10/Ene.-11/Apr.-11/Jul.-11

[6] See Document number 7 from the references list that is included in “Additional Documentation”

Projects included in the Colombian Generation Expansion Plan in the short and medium-term			
PROJECT	**CAPACITY (MW)**	**TYPE**	**FORECASTED DATE OF COMMISSIONING**
Manso transfer	---	Hydro. (Bypass of the water to Miel I reservoir)	May.-11
El Manso	27	Hydro.	May.-11
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. Analysis of the investment

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 05.2. In addition, it has been considered the "barrier analysis" as an argument to strengthen the additionality assessment according to the criteria of the tool.

Sub-step 2a. Determination of the 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. As reinforcement of the investment analysis "barrier analysis" will also be evaluated.

Sub-step 2b. Option III

The financial indicator used has been the 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 Bajo Tuluá, the investment profitability analyses carried out by Unión Fenosa (now known as Naturgy Generación S.L.U.), 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.

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 Center, financial transactions costs associated with Act 99, Ac 56 and Fazni.
- Other costs associated with municipal funds and the special commission structure.
- Revenue obtained from the sale of electricity. The calculations took into account its change over time depending on the CPI[7]

[7] Source: Bancolombia, November 2008

- In the second case, revenues associated to the sale of CERs

Bajo Tuluá power station has an effective capacity of 23.5 MW under regular operation. Therefore, production is 117.4GWh, which can be obtained based on 67% of the power station load factor. These operation hours result from the studies derived from the EIA and the subsequent estimates made when the design of the basic components of the power station was revised. The 121 COP/MWh sell price is that 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.

The tax deductions considered include the deduction of 40% of the value of investments in fixed assets productive (Law 1111 of December 27, 2006). In the case of the analysis with revenue of CERs, the investment is lower due to saving from VAT on equipment imported under the tax law in Article 424-5.

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.

Bajo Tuluá Hydroelectric Power Plant has neither income nor expenditure because its capacity is lower than 23.5 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 and a sensitivity analysis of the price considered in the PDD has been included.

The Operation and Maintenance costs are 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:

- Centro Nacional de Despacho SIC (National Distribution Centre, Trading System, CREG 110), published on January 2007 and indexed on a monthly basis to the PPI (224 COP/kW-month, year 2007)
- Property (premises associated to the project), 6‰ over 150% of property's commercial value · 4‰ (4 per thousand tax) on financial transactions
- Ley 99 (Act 99), to be applied on 6% of total energy sales (CREG 135), valued at 52.7 COP/kWh- month (2007) and indexed to the CPI
- Ley 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), valued at 1 COP/kWh (2007) and indexed yearly to the CPI.

The line indicated as other costs are special municipal funds plus the structure commission; if income 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 amortizations period 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.

The tax imposed is 33% on investment and, during the first years, it provides a tax benefit accumulated and consumed as profits are generated. 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 (%)	11.67	13.10 / 13.59

Table 8. Project Parameters

Parameter	Unit	Value
Installed Capacity	MW	23.5[8]
Annual Generation	GWh/year	117.4
Average Sale Price	$COP/kWh	121
Investment	COP M	112,227
Annual O&M + Regulatory costs	COP M	1,705
Project Life	Yes	50
Amortization Period: Plant & Equipment	Yes	20
Amortization Period: Other Investment concepts	Yes	5
CPI	%	3.18
Income Tax Rate	%	33
Project IRR	%	11.67

Source: Project Developer

Discount rate required

Basically, the model says that the return to be expected on an asset (or investment) must equal the return on an asset (or investment) with no risk plus the average market risk multiplied by the specific risk factor of said investment. The Barrier-IRR is derived from Colombian sovereign bonds as they are debt instruments and therefore safer than investment-type assets. For the determination of the IRR barrier, in addition to include the sovereign risk (which includes premium for credit risk and country risk), a premium for the market risk (that is given by the greatest risk facing the bong you have to invest in an asset generation) has also been included; said risk comes from the higher risk against the bond that has to invest in a generation asset.

The following bonds have been used for the calculation of the IRR barrier, with these instructions:

- American bond to 30 years, is the bond that represents the best long-term assets without risk, is clearly the case of this plant and a project of similar characteristics.
- 2020 Colombian Bond (emission date: July 2005), is the bond that represents the best long-term assets.

The financial indicator more suitable for the decision context is the IRR post-tax, since in Colombia, in the case of the analysis with revenues from CERs, the investment is lower due to the savings from VAT on equipment imported and therefore the final profitability comes not only because of the CERs issued but also from the taxes avoided.

[8] This value is not directly used in the IRR calculation, but the annual generation which is based on long term hydrological studies and is not influenced by the said installed capacity.

In order to have a valid comparison, the Barrier-IRR post-tax has been also calculated (weighted average cost of capital, WACC) by means of using a cost of capital after taxes when determining the market risk premium.

Taking into consideration that Colombia's government bonds have a yield of approx. 10.05%[9] (active without risk) and that the premium market to face the investment risks, have been estimated in 2.54%, IRR barrier to carry out this type of investment from Union Fenosa (now known as Naturgy Generación S.L.U.) is 12.59%. The best investment profitability, in terms of Project IRR, is obtained from the project scenarios considering the monetization of CERs generated by project activity (13.11% - 13.60% depending on CER price levels), with respect to the other project scenario in which the monetization of CERs generated by project activity was not considered (11.67%). (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 Union Fenosa (now known as Naturgy Generación S.L.U.). 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.

Therefore, it is necessary to consider the fact that the Bajo Tuluá Minor Hydroelectric Power Plant is less attractive, in financial terms, than the options of building a fuel-fired power plant, and 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 Union Fenosa (now known as Naturgy Generación S.L.U.) on climate change and the CDM objectives of the company.

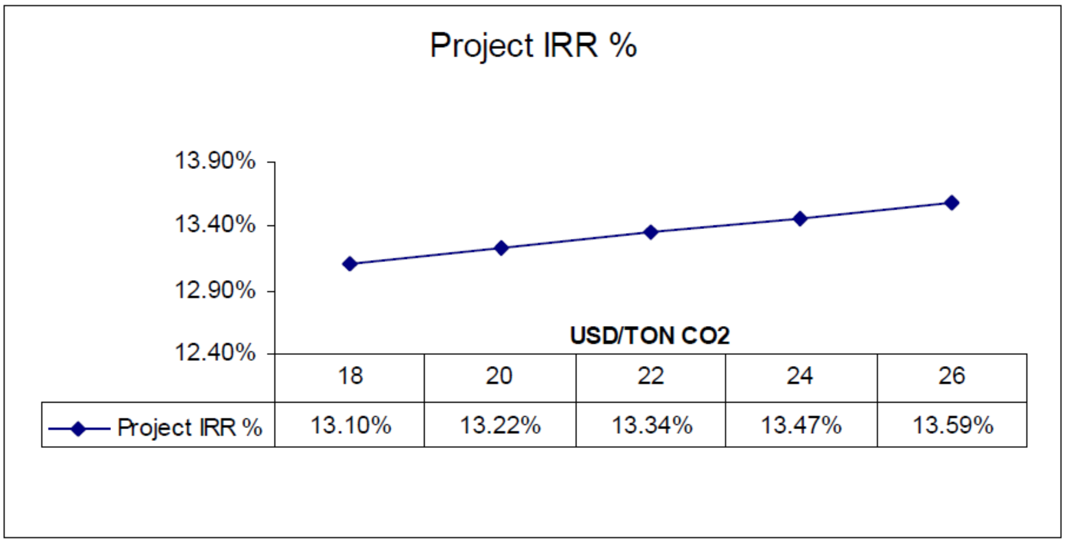
Sub-step 2d. Sensitivity analysis

Indicators used for the sensitivity analysis have been the price of tCO_2 in organised markets and annual electricity generation (GWh per year).

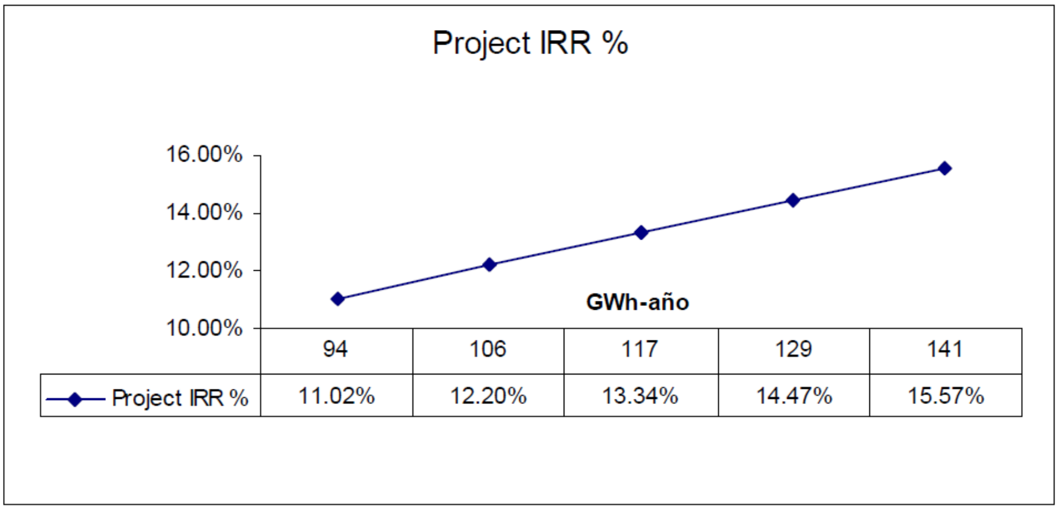
The increases in the Project IRR for the different scenarios are shown on the graphs and corresponding tables.

- Sensitivity analysis of the Project IRR in the stage with carbon credits depending on the Price of CERs

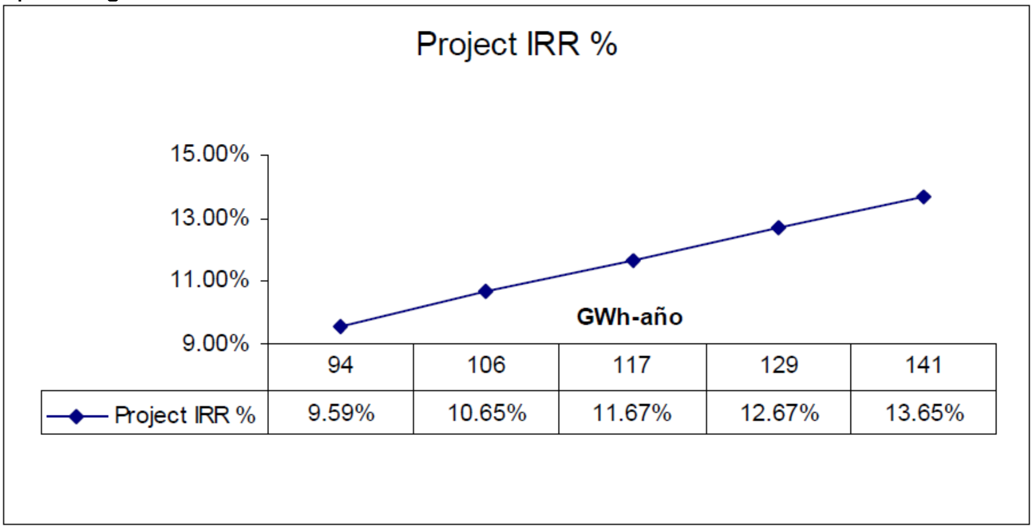
[9] Source: Bancolombia, November 2007



- Sensitivity analysis of the Project IRR in the stage with carbon credits depending on power generation



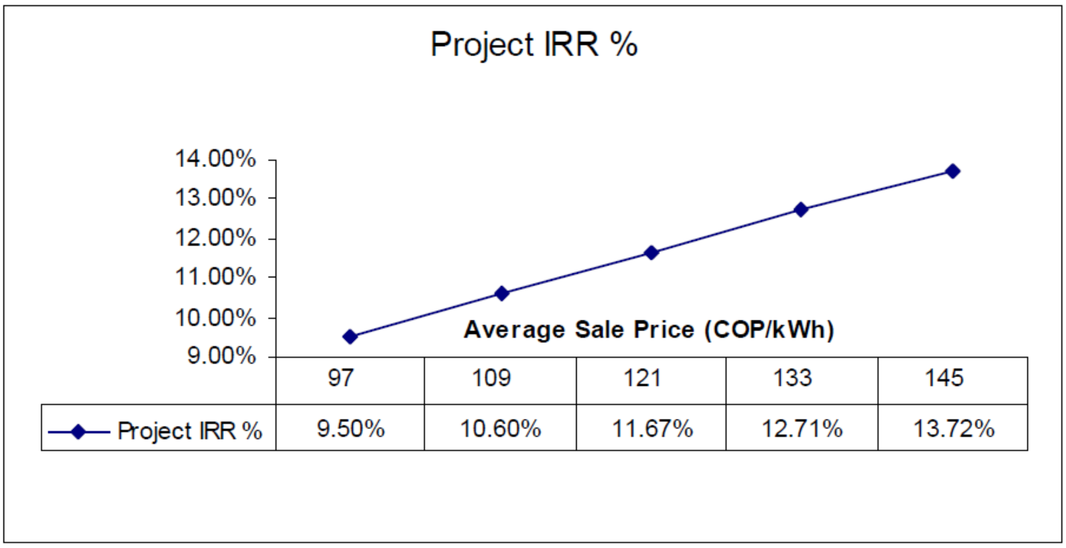
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on power generation



This sensitivity analysis is focused on the value of 117.4 GWh according to the water series developed to obtain the environmental license. Considering these head and flow rates of the river during the same period as well as the turbine-generator parameters it was carried out a hydroelectric simulation, obtaining as a result an average annual production of 117.4 GWh.

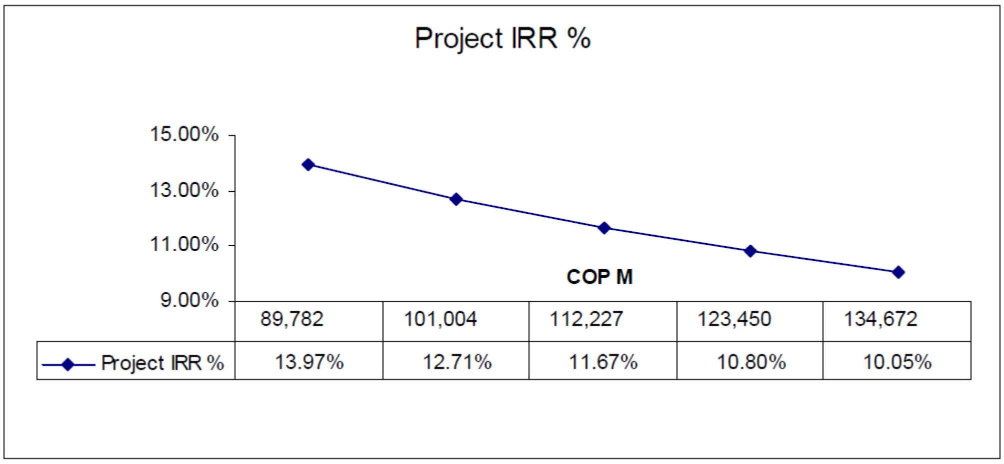
As shown in the Annex 5-Additional documentation, Reference 18 – Energy production, the probability of exceeding in a 10% the estimated energy production during the first five years of commercial operation is 0.7%. The sensibility analysis included was considering the overproduction during the whole operating period, not only the first five years. Hence, the conclusion is that is almost impossible to reach that level of production for the project.

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



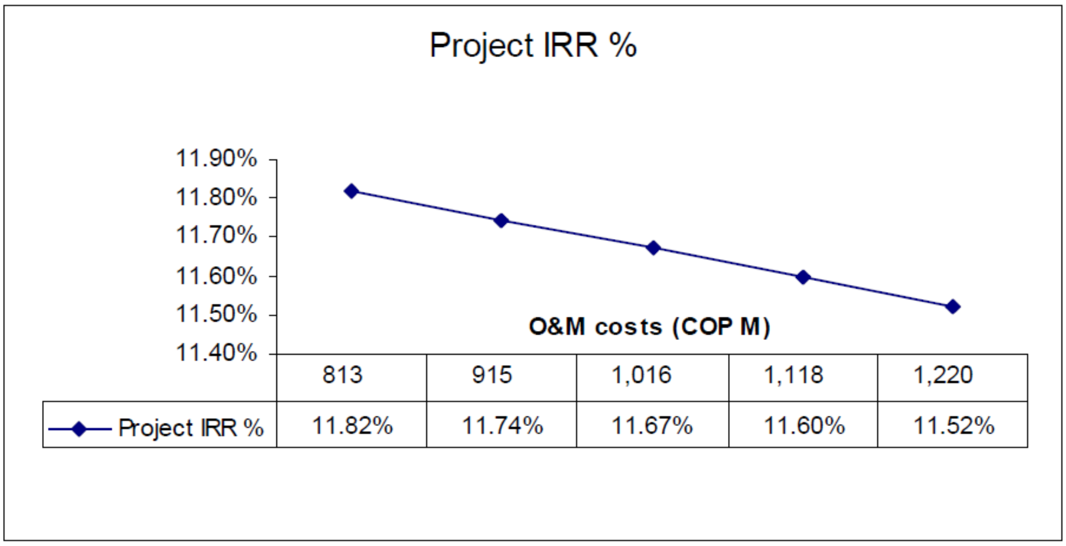
As it can be seen with an increase of a 10% in the Average Sale Price of energy, the project IRR without CERs is higher than the Barrier IRR. In any case, this should be considered only as a theoretical exercise because the values of energy prices hardly vary from the expected as it can be checked in all the scenarios outlined by the UPME in the Expansion Plan Generation-Transmission 2008-2022. Unless specific values (spikes of a month or two on a horizon of 24 years) never exceeds the price indicated for Bajo Tuluá.

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

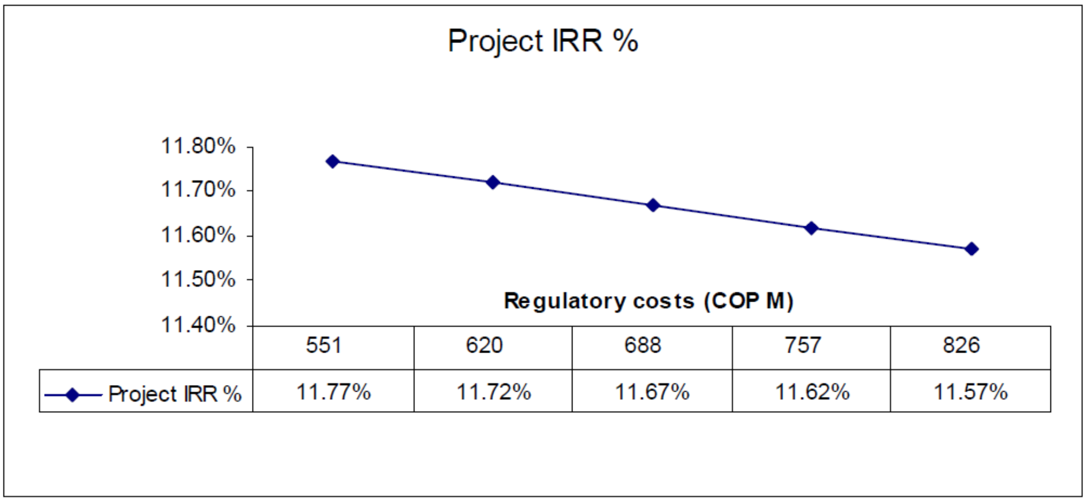


This graphic shows the sensitivity analysis of the Project IRR in the stage without carbon credits depending on the investment in accordance with the Tool for the demonstration and assessment of additionality, version 05.2, that is to say, with a symmetric interval of ±10%[10]. However, reality shows that the most probable stage concerning the investment cost will be close to the medium point or above it, conclusion that can be obtained from several contracts, such as the main equipment contract[11].

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



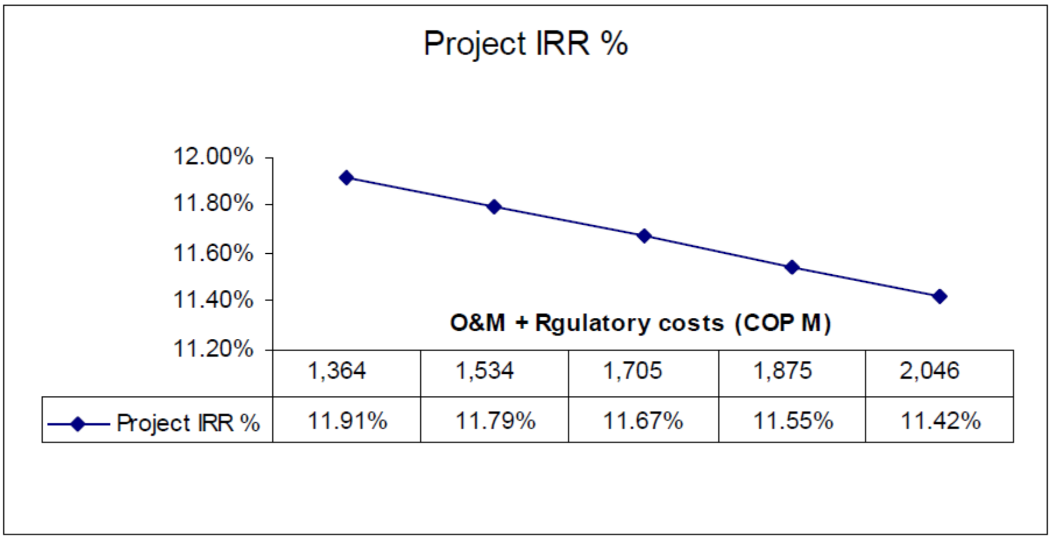
- Sensitivity analysis of the Project IRR in the stage without carbon credits depending on Regulatory costs



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

[10] In the Tool for the demonstration and assessment of additionality, version 05.2, page 15, it is said that "… as a general point of departure, variations in the sensitivity analysis should at least cover a range of +10% and -10%...".

[11] The main equipment contract is included in Annex 5 – Additional Documentation, Reference 13.



Step 3. Analysis of barriers

This section analyses how the project activity has a set of barriers that hinder its execution and make the baseline scenario more attractive, so that the project must be considered as an additional project.

Sub-step 3a. Identification of the barriers that could prevent the implementation of the project activity proposed

The barriers identified are the following:

- *Sector barriers*: There are a series of uncertainties surrounding the value of sale of electricity generated[12] and the values charged by capacity, which are also related to the availability and price of fuels and the reliability of the Interconnected System (which cannot be mainly based on hydroelectric energy because of hydro-geologic uncertainties). Extreme weather events caused by climate change, such as "El Niño" or increasing periods of drought affecting the availability of hydropower plants.

Sub-step 3b. Justification of the fact that the barriers identified cannot prevent the implementation of at least one of the alternatives (except the project activity proposed)

The current trend to add plants to the system is characterised by the construction of thermal power plants and large hydraulic power plants associated to accumulation reservoirs. These alternatives offer true advantages as regards run-of-river power plants, since they do not have to face the following barriers when they are added to the system:

Sector barriers: Historically, critical drought conditions are linked to El Niño events, such as those of 1991–1992 and 2002–2003 when severe energy rationing occurred when pool prices reached very high spot prices, forcing regulatory changes in the market. The Colombian electricity market includes a reliability payment for each resource based on its ability to generate energy during unusually dry periods, which is called firm energy. This firm energy is expected to meet user demand under 50 critical conditions (when the wholesale market price is larger than the scarcity price). This is found in CREG Resolution 071 2006. In 2008, Colombia introduced an innovative and effective market in which auctions are held to commit enough firm energy to cover its needs

[12] During the 1996-2006 period, the stock exchange price has varied between less than 40 $/kWh and more than 275 $/kWh.

(Cramton and Stoft 2007, 2008). The firm energy market coordinates investment in new resources to assure that sufficient firm energy is available in dry periods. Currently the economic signal favours conventional thermal power plants. Thermal power plants powered with fossil fuels do not depend on the hydrologic conditions. Under any circumstance, these installations can participate in the dispatch system, provided that they have enough fuel for their operation and depending on their efficiency and price. Therefore, if the system has a price that is sufficiently high, the thermal power plant will be in operation selling the electricity generated. Hydraulic power plants with accumulation reservoirs can manage water resources, so that they are more reliable source of energy than run-of-river power plants, which have a high dependence on the current hydrologic conditions. The hydraulic power plants with accumulation reservoirs do not have such a high degree of uncertainty in the operation of the energy distribution system and they are a more attractive and safe investment than run-of-river plants. In addition, the influence of climate change on extreme weather events ("El Niño") and increasing periods of drought are barriers that prevent the implementation of the project activity and do not prevent the implementation of conventional thermal power plants. Since cash flow predictability is critical for investment planning and decision making, variable resources such as minor run-off-river hydro power plants, which are not eligible to receive the same reliability payment than conventional hydro and thermal power plants, are facing sectoral barriers that could affect its development. For instance, if Bajo Tulua Minor Hydroelectric Power Plant were eligible to receive a reliability payment associated with a default yearly firm energy rating of 35% of total generation (Art. 37, Resolution CREG-071, 2006), the project developers could receive an additional, transparent and stable annual compensation of 575,178 USD (on average), according to the Firm Energy price of USD 13.998 per MWh currently in force. (http://www.superservicios.gov.co/MEM/archivos/informesexpert/informe29.pdf). Income from CERs would alleviate the identified barrier that prevents the proposed project activity from occurring.

Therefore, the analysis of barriers shows how the alternative to continue with the current trend of adding capacity to the system (conventional hydroelectric power plants and thermal plants) is the option with the lowest number of barriers, but it is not the best option to contribute to sustainable development and mitigate the climate change. Despite this situation, EPSA has opted to build a run-of-river plant that must face a series of more complex and important barriers. The main objective of the project activity proposed is to provide a clean energy, thus contributing to the improvement in the electricity service and regional development, aspects which are integrated in the environmental and social policy of this company with a public origin, committed with society and the environment of the Department of the Cauca Valley. Therefore, the project activity can be considered as an additional activity, especially when the registration of the project as CDM contributes to reduce some of the barriers faced by the project.

Step 4. Analysis of common practices

Sub-step 4a. Analysis of other activities similar to those of the project

As stated above, the Colombian electricity sector is dominated by thermal and hydroelectric power plants. Within the latter, we can distinguish between power plants with accumulation reservoirs and run- of-river plants, which have a greater risk to generate energy, despite the lower environmental impact, since they cannot regulate the availability of water resources to guarantee the level of production.

During the year 2007, the run-of-river hydroelectric plants generated 5.16% of the total energy generated by the system and they represented 4.41% of the total installed capacity for the whole Interconnected System of Colombia.

Table 9. Common practice analysis -2007

ANALYSIS OF THE IMPORTANCE OF RUN-OF-RIVER HYDRAULIC POWER PLANTS DURING 2007

Total capacity of the SIC	13,415,430	kW
Capacity of run-of-river hydroelectric power plants	591,430	kW
% Capacity of run-of-river hydroelectric power plants	4.41	%
Total generation of the SIC	53,665,662,570	kWh
Generation of run-of-river hydroelectric power plants	2,769,175,603	kWh
% Generation of run-of-river hydroelectric power plants	5.16	%

Source: Calculations based on data dispatch from NEON database

Sub-step 4b. Discussion about other similar options used

In addition to the trend described, analysis of similar activities to the project activity has been conducted, considering minor run-of-river plants in Colombia with similar capacities, between 10-20 MW.

Until 2003 there were only 9 plants of these characteristics in Colombia: Niquia (19 MW), Ayura (18 MW), Palmas San Gil (15 MW), Insula (19 MW Year 1951), Charquito (19.4 MW), La Tinta (19.4 MW), El Limonar (18 MW), Río Frío II (10 MW), and Tequendama (19.4 MW).

Since 2004, in addition have been build 3 plants of this kind (La Vuelta, La Herradura and Santa Ana) that have been considered as CDM. Plants closed or modified have not been considered in the analysis because would not be similar to the project activity or would not be included in project boundary. Closed plants do not supply energy to the Colombian National Interconnected System meanwhile modified plants have different building risk, investment and recovery than a new construction plant and therefore they would not be comparable.

Table 10. Plants of its kind

Name of the plant	Installed capacity (MW)	Date of commissioning	Comments
La Vuelta	12.00	18-12-2004	CDM
La Herradura	20.00	01-04-2004	CDM
Santa Ana	13.43	11-05-2006	CDM

Analysing the generation and power of these three plants regarding the total power and generation of the system, the following percentage values are obtained:

Table 11. Common practice analysis since 2004 and registered as CDM

ANALYSIS OF RUN-OF-RIVER HYDRAULIC POWER PLANTS WITH 10-20MW CAPACITY BUILT SINCE 2004 AND REGISTERED AS CDM		
Total capacity of the SIC	13,415,430	kW
Capacity of run-of-river hydroelectric power plants with 10-20 MW since 2004 and registered as CDM	45,430	kW
% Capacity of run-of-river hydroelectric power plants with 10-20 MW since 2004 and registered as CDM	0.34	%
Total generation of the SIC	53,665,662,570	kWh
Generation of run-of-river hydroelectric power plants with 10-20 MW since 2004 and registered as CDM	224,484,383	kWh
% run-of-river hydroelectric power plants with 10-20 MW since 2004 and registered as CDM	0.42	%

Source: Calculations based on data dispatch from NEON database

Therefore, considering recent projects of a similar nature, virtually all of them have been claimed as CDM, whatever its capacity, so that we can guarantee that the development of such project's activity, without consideration as CDM, is not a common practice in Colombia.

According to the information contained in the Plan Expansion reference Generation - Transmission 2008- 2020, the Ministry of Environment, Housing and Territorial Development of Colombia has a portfolio of 113 potential projects eligible under the CDM mechanism. Of these projects, 31 relate to the energy sector at different stages of development, having a total of 11 projects for minor hydropower plants (minor than 20 MW) (see table below).

Table 12. Common practice analysis – minor hydropower plants

Project	Number of projects
Hydroelectric under 20 MW	11
Hydroelectric over 20 MW	10
Eolic plants	2
Biomass plants	3
Increased capacity and efficiency in thermal power generation	2
Bypass of water	1
Reduction of losses in transmission lines	2
Total	31

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

Therefore, the application of the additionality tool shows that proposed project activity is additional because:

1. The project activity cannot be compared to the baseline scenario, characterised by the construction of hydroelectric power plants with accumulation reservoirs and thermal power plants

2. Other similar activities cannot be observed in Colombia

3. The project activity has important barriers that are not present in the baseline scenario or which are not as important

4. These barriers can be partially overcome with the registration of the project as a CDM

5. The monetarisation of the sale of CERs is required to make the investment attractive

6. As a consequence of the greater contribution to local sustainability and the mitigation of the climatic change, EPSA has opted for the development of the project activity in lieu of other options that were more attractive in economic terms

Due of the strategic character of CDM projects in order to achieve specific objectives of the company, the importance of CDM incentive in the decision-making about development of the project has been taken into account from project design stage. The reports of committee meetings reflect the decisions regarding the different stages of CDM projects life cycle.

In addition, we must highlight that the project for the Minor Hydraulic Power Plant of Bajo Tuluá is in procedure to receive the no objection letter issued by the Ministry of Environment, Housing and Territorial Development.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

The ACM0002 methodology - Version 19 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. Therefore, the calculation for the reduction of emissions associated to the operation of the project activity only considers the baseline emissions. Their calculation is carried out with a combined margin factor, resulting from the weighting of the two factors calculated before:

- 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.

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:

Table 13. Basic information for baseline calculation[13]

BASIC INFORMATION FOR THE CALCULATION OF THE BASELINE	
Data	**Source**
Fuel emission factor	Source: Fuel Emissions Factor database of Colombia published by UPME (FECOCupme.xls)
Heat Rate	Associated Services Management, XM *Compañía de Expertos en Mercados S.A. E.S.P. Source: http://paratec.xm.com.co/paratec/SitePages/generacion.aspx?q=capacidad*
Total electricity generated by all power plants connected to the National Interconnected System of Colombia	XM
Total hourly generation of the System	XM
Type of fuel used in each plant	UPME / XM

The baseline scenario and the emission rate calculation are based on the electricity that otherwise would have been generated by the plants connected to the grid and by addition of future plants. According to the methodology, no leakage emissions are considered.

Baseline emissions are calculated by multiplying the combined margin emission factor ($EF_{grid,y}$, in tCO_2e/MWh) by the electricity generated by the proposed project activity during the year *y* (EG_y, in MWh).

[13] Detailed calculations and data of the baseline emissions are presented in the Excel file "EF Colombia 2018-2016_Bajo Tuluá v2F".

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation by the project activity would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

The detailed calculations and data of the baseline emissions are presented in the Excel file "EF Colombia 2016-2018_Bajo Tuluá v2F". In the following, the relevant methodological approaches and formulas are presented.

$$BE_y = EG_{PJ,y}\ x\ EF_{grid,CM,y} \quad \textbf{(1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Since it is a green-field project, according to Eq. (12) of ACM0002 (version 19.0),

$$EG_{PJ,y} = EG_{facility,y} \quad \textbf{(2)}$$

For emission factor calculation

The combined margin emission factor ($EF_{grid,CM,y}$) is calculated following the methodological tool "Tool to calculate the emission factor for an electricity system" (version 07.0) by applying the following steps:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emissions factor.

In the following it is explained how each step is applied.

<u>STEP 1. Identify the relevant electricity systems.</u>

For determining the electricity emission factors, the project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity Bajo Tuluá Minor Hydroelectric Power Plant and that can be dispatched without significant transmission constraints. In this case, the project electricity system is given as the National Interconnected System (SIN).

For the purpose of determining the operating margin emission factor, the CO_2 emission factor(s) for net electricity imports is chosen as 0 t CO_2/MWh.

<u>STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).</u>

In accordance with the tool, this step is optional. For the proposed project activity, off-grid power plants are not included in the project electricity system (Option 1).

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

In accordance with the tool, the calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

For the project activity, the simple adjusted OM is applied, using the *ex-ante* option:

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 PDD 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 PDD for validation.

Therefore, the years 2016-2017-2018 have been chosen based on the most recent data available at the time of submission of the PDD for validation.[14]

All power plants connected to the SIN are included. Power plants registered as CDM project activities are also included as suggested by the tool. The data of the most recent year is available from XM (grid operator and administrator[15]).

STEP 4. Calculate the operating margin emission factor according to the selected method.

The simple adjusted operating margin emission factor $EF_{grid,OM-adj,y}$ (tCO_2e/MWh) is a variation of the simple operating margin emission factor , where the power sources (including imports) are separated in low-cost/must-run power sources (k) and other power sources (j), as follows:

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

Where:

λ_y	=	Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{EL,k,y}$	=	CO_2 emission factor of power unit k in year y (tCO_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

[14] The term “CDM-PDD” Project Design Document.

[15] www.xm.com.co

The lambda factor (λ) is determined as:

$$\lambda = \frac{\text{number of hours per year low - cost / must - run sources are on the margin}}{\text{8760 hours per year}} \quad \textbf{(4)}$$

According to the methodology, the number of hours low-cost/must-run sources are on the margin is obtained through the following procedure (see Figure 4 below):

Step i) Plot a Load Duration Curve

Collect chronological load data (typically in MW) 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.

Step ii) Organize Data by Generating Sources

Collect electricity generation data from each power plant/unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants/units.

Step iii) Fill Load Duration Curve

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 times hours) equals the total generation (in MWh) from low-cost/must-run power plants/units

Step iv) Determine the "Number of hours per year low-cost/must-run sources are on the margin"

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 lambda is equal to zero.

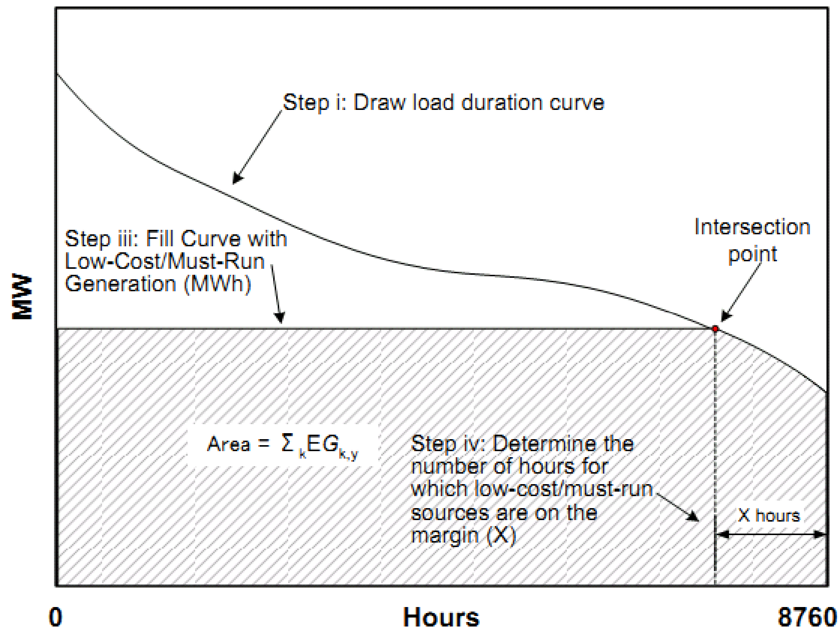


Figure 4. Illustration of Lambda calculation for simple adjusted OM method.
(Note: Step (ii) is not shown in the figure; it deals with organizing data by source.)

The detailed calculations of lambda are provided in the Excel file “EF Colombia 2016-2018_Bajo Tuluá v2F”. The following figures show the load duration curves and the area given by low cost/must run units, and the resulting lambda.

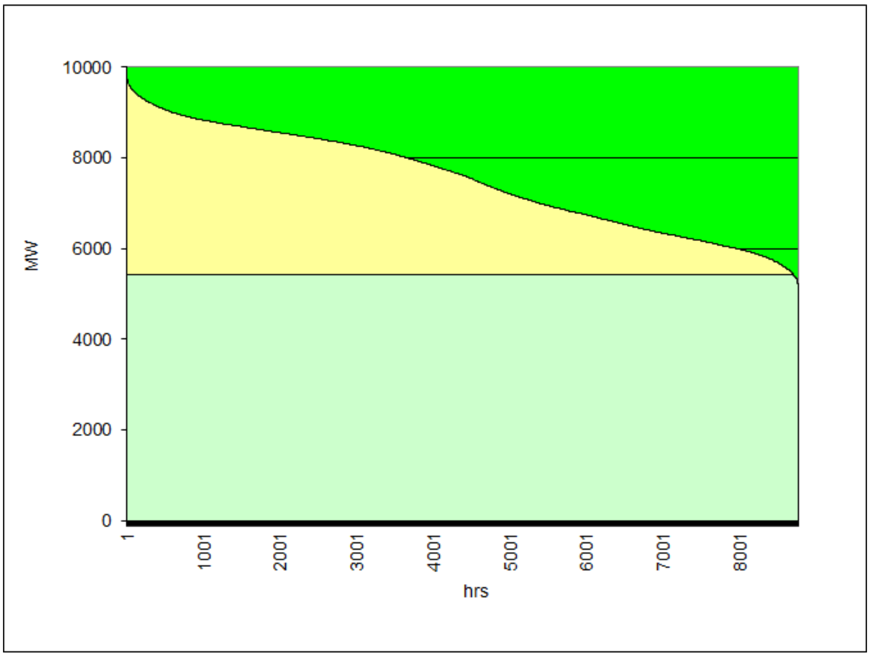


Figure 5. Load duration curve and area given by low-cost/must-run units, and the resulting lambda in year 2016.

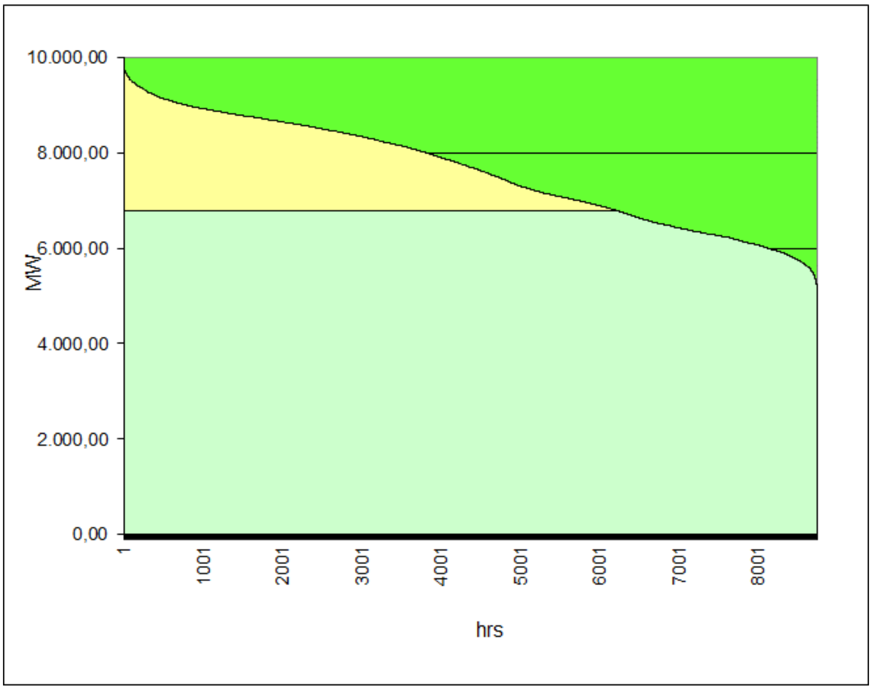


Figure 6. Load duration curve and area given by low-cost/must-run units, and the resulting lambda in year 2017.

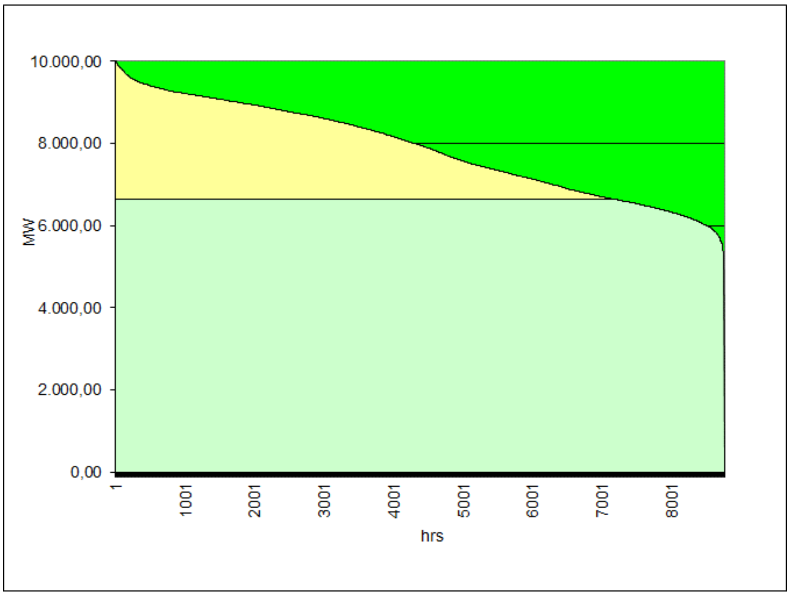


Figure 7. Load duration curve and area given by low-cost/must-run units, and the resulting lambda in year 2018.

Determination of $EF_{EL,m,y}$

The emission factor of each power unit *m* is determined as follows (power units *k* are not included, since the low-cost/must-run units have zero emissions and thus do not require calculating the emission factor):

For the simple adjusted OM "Option A: Calculation based on average efficiency and electricity generation of each plant" of the tool is chosen as the most appropriate approach. Option A2 is the appropriate method due to the availability of heat rates (efficiencies) of each plant:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \qquad \textbf{(5)}$$

Where:

$EF_{EL.m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission 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)

By applying formulae (4) to determine the emission factor of each power plant, the results from the lambda calculation and the main equation (5) for the OM emission factor, and the corresponding generation weight for each year, the simple OM emission factor is determined as shown in Table 14.

Table 14. Simple adjusted operating margin emission factor for the years 2016-2017-2018

Parameter	2016	2017	2018
EF No LC/MR	0.6615	0.6482	0.6595

Parameter	2016	2017	2018
EF LC/MR	0.000	0.000	0.000
Lambda	0.0089	0.2906	0.1769
EF OM [tCO_2/MWh]	**0.6556**	**0.4598**	**0.5428**
Generation [MWh]	**65,942,173**	**66,667,097**	**68,948,232**
$EF_{OM\ Simple\ adjusted\ 2016\text{-}2017\text{-}2018}$($tCO_2$/MWh)		**0.5522**	

STEP 5. Calculate the build margin (BM) emission factor

In terms of vintage of data and the fact that for the first crediting period option 2 was selected as described below, option 1 of the tool is chosen for the second crediting period:

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Since this calculation corresponds to second crediting period, the build margin is calculated used option 1 (ex-ante), it means that the build margin emission factor is updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE.

Capacity additions from retrofits of power plants are not included in the calculation of the build margin emission factor.

The sample group 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); 17,804 MWh

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh) 63,284,104 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 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≥20%) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh); 12,682,682 MWh.

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}) 12,682,682 MWh;

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. Ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from 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 activity, 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 ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh); If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times EG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago 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);

(f) The sample group of power units *m* used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{->}10yrs}$).

As can be seen in the excel sheet of the emission factor (“EF Colombia 2016-2018_Bajo Tuluá v2F”), in this case steps (a) to (c) were needed to be applied and the resulting sample group of power units *m* is the SET_{sample}.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, i.e. in this case the year 2018. The calculation is made as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(6)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	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 power generation data is available

The emission factor of each power unit *m* in the build margin is determined analogous as for the operating margin: For all power units *m* the data on fuel consumption and electricity generation is available, therefore option A2 of the tool is chosen as the most appropriate approach (see formulae in OM).

The total generation in 2018 excluding CDM plants was 63,284,104 MWh, which means that 20% of the total generation is 12,656,821 MWh. The total generation included in the BM is 12,682,682 MWh with corresponding CO_2 emissions of 1,813,252 tCO_2.

The detailed calculations are provided in the worksheet “BM” of the Excel file “EF Colombia 2016-2018_Bajo Tuluá v2F”.

The resulting BM emission factor is **0.1429 tCO_2/MWh**. (rounded down).

<u>Step 6: Calculate the combined margin (CM) emissions factor</u>

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM}\ x\ EF_{grid,OM,y} + w_{BM}\ x\ EF_{grid,BM,y} \quad \textbf{(7)}$$

Where:

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

The weighting of operating and build margin is done as indicated in the tool for the second crediting period, i.e. w_{OM} = 0.25 and w_{BM} = 0.75.

The combined margin emission factor is calculated as $\mathbf{EF_{grid,CM,y}}$ **= 0.2452** tCO_2/MWh (rounded down).

B.6.2. Data and parameters fixed ex ante

Data/Parameter	**Installed capacity of the Hydroelectric Power Plant of Bajo Tuluá**
Data unit	MW
Description	Total installed capacity
Source of data	EPSA S.A. E.S.P.
Value(s) applied	23.5
Choice of data or measurement methods and procedures	-
Purpose of data	Project emissions
Additional comment	-

Data/Parameter	$\mathbf{EF_{grid,OM,y}}$
Data unit	tCO_2/MWh
Description	Operating margin emission factor
Source of data	Associated Services Management, XM Compañía de Expertos en Mercados S.A. E.S.P (XM System), and Fuel Emissions Factor database of Colombia published by UPME (FECOCupme.xls).
Value(s) applied	0.5522
Choice of data or measurement methods and procedures	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07.0” applying option ex-ante meaning that 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. Therefore, it is calculated using the 3-year generation weighted average based on the most recent data 2016-2017-2018. The data is obtained from “XM System” Colombian grid operator. Please check section B.6.1 of the document. See Excel file “EF Colombia 2016-2018_Bajo Tuluá v2F”
Purpose of data	Baseline emissions
Additional comment	-

Data/Parameter	$\mathbf{EF_{grid,BM,y}}$
Data unit	tCO_2/MWh

Description	Building Margin CO_2 emission factor in year y
Source of data	Associated Services Management, XM *Compañía de Expertos en Mercados S.A. E.S.P (XM).*
Value(s) applied	0.1429
Choice of data or measurement methods and procedures	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07.0” applying option ex-ante using the most recent information available on units already built which means 2018-year generation. The data is obtained from “XM” Colombian grid operator. Please check section B.6.1 of the document. See Excel file “EF Colombia 2016-2018_Bajo Tuluá v2F” worksheet BM
Purpose of data	Baseline emissions
Additional comment	-

Data/Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Associated Services Management, XM *Compañía de Expertos en Mercados S.A. E.S.P (XM System). and* Fuel Emissions Factor database of Colombia published by UPME (FECOCupme.xls)
Value(s) applied	0.2452
Choice of data or measurement methods and procedures	Calculated as per “Tool to calculate the emission factor for an electricity system, version 07.0” applying option ex-ante using the generation-weighted average of years 2016-2017-2018, based on the most recent data. The data is obtained from “XM System” Colombian grid operator. Please check section B.6.1 of the document See Excel file “EF Colombia 2016-2018_Bajo Tuluá v2F” worksheet CM
Purpose of data	Baseline emissions
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

As explained above in Section B.6.1, emission reductions are calculated as follows:

$$ER_y = EG_{facility,y} \times EG_{grid,CM,y}$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh)
$EF_{grid,CM,y}$	=	CM CO_2 emission factor in year *y* (tCO_2/MWh)

For the ex-ante calculation of emission reductions, the quantity of net electricity supplied to the grid is estimated based on Bajo Tuluá Hydropower monitoring. The proposed project activity is expected to supply an average of 117,400 MWh per year to the grid.

As shown above in Section B.6.1, the CM emission factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \ x \ EF_{grid,OM,y} + w_{BM} \ x \ EF_{grid,BM,y}$$

According to the Tool, for wind power generation projects, the weights to be applied are: w_{OM} = 0.25 and w_{BM} = 0.75.

The OM emission factor is determined as a 3-year generation-weighted average, based on the most recent data available at the time of submission of the project documentation to the DOE for validation. Specifically, data for years 2016-2017-2018 is used, and the resulting OM emission factor is 0.5522 tCO_2/MWh.

The BM emission factor is determined based on the most recent information available on units already built at the time of submission of the project documentation to the DOE for validation. Specifically, data from year 2018 are used, and the resulting BM emission factor is 0.1429 tCO_2/MWh.

Thus, the resulting CM emission factor is the following:

$EF_{grid,CM,y}$= 0.5522 tCO_2/MWh × 0.25 + 0.1429 tCO_2/MWh × 0.75 = **0.2452 tCO_2/MWh**

As a consequence, the annual value of emission reductions estimated for the project activity is the following:

ER_y = 117,400 MWh × 0.2452 tCO_2/MWh = **28,786 tCO_2**

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

$$ER_y = BE_y - PE_y - L_y = BE_y \quad \textbf{(8)}$$

Where:
- ERy is the reduction of emissions (tCO2e) during year y
- BEy are the baseline emissions during year y
- PEy are the project emissions during year y
- Ly represents the emissions due to leakages during year y

Thus: ER_y = 28,786 tCO_2/yr

In accordance with the ACM0002 / version 19 methodology, there are no forecasted project emissions related to the generation of energy based on renewable sources (PE=0). Likewise, the emissions caused by leakages are very low (Ly =0), since the plant will not have an accumulation reservoir, so that they should not be calculated.
Therefore, the calculation of the emission reductions 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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2018	2,603	0	0	2,603
2019	28,786	0	0	28,786
2020	28,786	0	0	28,786
2021	28,786	0	0	28,786
2022	28,786	0	0	28,786
2023	28,786	0	0	28,786
2024	28,786	0	0	28,786
2025	26,183	0	0	26,183

Year	Baseline emissions ($t CO_2e$)	Project emissions ($t CO_2e$)	Leakage ($t CO_2e$)	Emission reductions ($t CO_2e$)
Total	201,502	0	0	201,502
Total number of crediting years	7			
Annual average over the crediting period	28,786	0	0	28,786

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{facility, y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant to the grid in the year y.
Source of data	Electricity meter(s) / Invoicing
Value(s) applied	117,400 MWh/ year.
Measurement methods and procedures	The quantity of energy generated will be monitored by EPSA. The data obtained will be recorded once a month on a spreadsheet. In addition, the data will also be provided by the XM, which will be downloaded and recorded annually.
Monitoring frequency	The quantity of energy generated will be monitored by EPSA each hour. Continuous monitoring and monthly recording and invoicing. EPSA is responsible for downloading the information 4 times a day. Every day, EPSA prepare a generation report, which must coincide with that reported in the XM portal (grid operator and administrator).
QA/QC procedures	Cross check measurement results with records for sold electricity: the measurement units of the energy transferred from the plant to the network will be calibrated periodically in accordance with the standards established by the national authorities or at least every 4 years according to Resolution CREG 038-2014. (see tables below) The measurement data registered by the personnel of EPSA will be compared with the data provided by the XM to detect possible error. The meters have an accuracy class of 0.2S or higher.
Purpose of data	Baseline emissions
Additional comment	-

Measurement point type	Consumption or energy transfer (MWh-month)	Installed capacity (MW)
1	C ≥ 15.000	CI ≥ 30
2	15.000 > C ≥ 500	30 > CI ≥ 1
3	500 > C ≥ 50	1 > CI ≥ 0,1
4	50 > C ≥ 5	0,1 > CI ≥ 0,01
5	C < 5	CI < 0,01

Measurement point type	Calibration frequency (years)
1	2
2 y 3	4
4 y 5	10

Project activity	Installed capacity (MW)	Calibration frequency (years)
Bajo Tuluá	20	4

B.7.2. Sampling plan

Not Applicable

B.7.3. Other elements of monitoring plan

Monitoring procedures of the Minor Hydroelectric Power Plant of Bajo Tuluá are implemented onsite or remote, using Advance Metering Reading - AMR technology. The EPSA-CELSIA measurement operational team is in charge of taking the measurements and reporting to XM. A main and backup meters are installed at the interconnection point of the project with the SIN (which is where the commercial frontier registered with the Administrator of the electrical interconnected system - XM- will be established). The energy meters in the Tuluá substation are read via dedicated software every 6 hours. A daily automatic generation report is sent to XM from the substation by the Measurement Management Center – CGM operated by EPSA-CELSIA (see Figure 8).

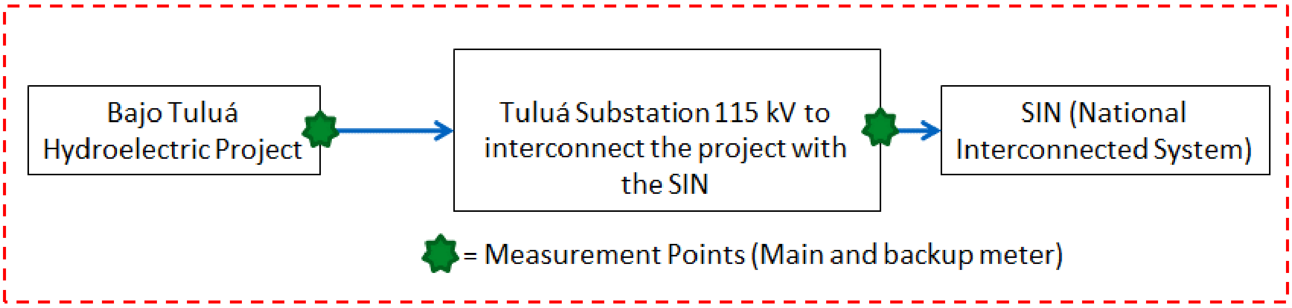


Figure 8. Project Boundary – Monitoring Plan

The counter of Tuluá Substation is the one that marks the energy that enters the SIN[16], which is remunerated and on which the charges of the Wholesale Energy Market (MEM) are charged. The way to transmit the information between the CGM[17] (Measurement Management Center - operated by EPSA-CELSIA) and the hydroelectric power station is via AMR (data system), then the CGM transmits the information to XM (Experts in Markets – Expertos en Mercados S.A. E.S.P.) in real time through the web-service. This process includes the interaction with ASIC, the Administrator of the Trade Exchanges System-XM in charge of the registration of contracts, liquidation and the billing of all the transactions carried out in this market. With the web-service the report is made to ASIC.

Generation data by regulation is stored for two years (According to resolution CREG 038), and for EPSA-CELSIA internal policies they are stored for 3 years. The data acquisition software is called PRIME READ and the management software is MDM Energy IP, likewise, the report software is MITHRA (through this software the data is sent to XM).

As indicated, at every measurement point there is a main electricity meter and a backup meter, which assures correct measurement in case of failures of the main electricity meters (See Table 15). If any other emergency would not allow measuring correctly the power generation of the plant or if data would be missing as a result of a failure in the monitoring process, no emission reductions shall be claimed during that period until guaranteeing again correct function of the meters and having reliable data.

[16] In the Colombian regulation, this is called "commercial boundary" or in Spanish: "frontera comercial". The substation is Tuluá 115 kV.

[17] In Spanish - Centro de Gestión de Medida - CGM

Table 15. Monitoring Equipment and calibration frequency

Project	Meters ID	Description	Meters Type	Localization	Calibration Frequency
BAJO TULUA	SMC 01: MAIN	Commercial Measurement System (SMC) 01: Main Meter	Class: 0.2S or higher	Substation Tuluá 115 kV	Every four (4) years according to CREG Measurement Code - 038 of 2014
	SMC 02: BACKUP	Commercial Measurement System (SMC) 02: Backup Meter	Class: 0.2S or higher	Substation Tuluá 115 kV	

QA/QC measures

All meters must comply with the standards established by the CREG, in terms of its specifications and calibrations. According to Resolution CREG 038 of 2014[18], article 11 and 28, it is established that by the installed capacity of the power plant Hydroelectric Bajo Tuluá (30>CI>1 MW) the measurement point is recognised as type 2 of the commercial boundary. According to this, the calibration of the equipment should be done at least every four years and must be certified by a body endorsed by XM.

The same resolution indicates that the system measurement elements must have a valid calibration certificate, issued by a certifying body approved by ONAC[19] (National Accreditation Body of Colombia).

Calibration tasks also follow national standards and are in accordance with the calibration instructive specified in Colombian standard NTC 4856 for electricity metering devices. In case both meters fail, no emission reductions will be claimed during that period until having again data from the main or backup meter.

The accuracy of the measuring equipment depends on the classification of the type of measurement according to Table 1, article 6 Res CREG 038-2014. The required precision is found in Table 2, Article 9, Resolution CREG 038-2014.

Supervision and accountability policies monitoring activities

The processes of supervision and accountability are made according to the existing regulation. EPSA-CELSIA as the CGM operator must submit annually a report with the operation of the measurement management system, according to the guidelines of resolution 038-2014, annex 3 and Circular 049 of 2015.

Data readings of the generated energy are made every 15 minutes. The CGM is responsible for downloading the information 4 times a day. Every day, the CGM make reports with the information from the previous day's generation, which must coincide with that reported in the XM portal.

The CGM data verification is performed checking data that comes from the main meter, matches those of the backup meter. Also, that the 96 data collected in the day (data corresponding to the readings that are made every 15 minutes), is within the normal ranges (not exceeding the capacity of the plant, not negative data, etc.).

Personnel responsible for monitoring

[18] See document 9 - *Resolucion-CREG-038-de-2014-codigo-de-medida.pdf*
[19] In Spanish – Organismo Nacional de Acreditación - ONAC

Figure 7 shows the organizational chart of the monitoring.

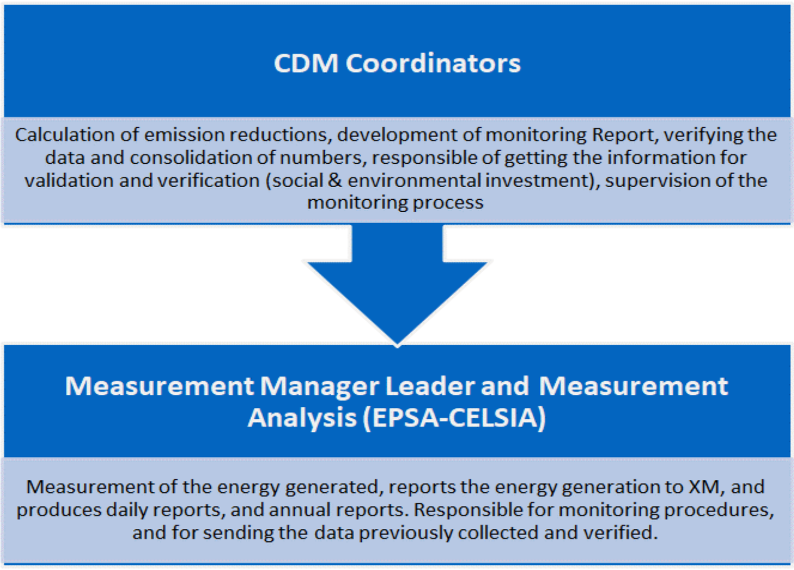


Figure 9. Operational structure of the monitoring plan

Responsible personnel:

- The CDM Coordinators supervise the monitoring process and are in charge of compiling the monitoring data in an excel spreadsheet and calculating the emission reductions of the monitoring period. They also watch over the Monitoring Report, usually developed by an external consultant in accordance with the CDM rules.

- The Operational Team at EPSA-CELSIA, which includes Measurement Manager Leader and Measurement Analysis is responsible for electricity generation reading and for processing the energy produced by the project from the meters installed at the substation. Records of the meter are downloaded in a spreadsheet for measurement control and the data discharged from the meter is stored electronically.

Personnel who carry out monitoring tasks are familiar with the basic monitoring requirements and structures. Since the main monitoring tasks, i.e. the measurement of the energy production, the calibration of energy meters, and the reporting of the energy generation, are carried out independently from the CDM project as part of the daily operation, no specific training is required. The CDM project Coordinators are supported by an external consultant if necessary, in order to assure correct application of the monitoring procedures. They also carry out corrective actions if any inconsistency is identified and train the internal personnel if necessary.

Other monitoring information

Likewise, the Plant's Operation Reports will be used as a reference and be made available for any inspections carried out during the second 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 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.

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

- Quantity of electricity generated by the Minor Hydroelectric Power Plant of Bajo Tuluá 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.

All data and parameters will be recorded in accordance with the quality systems on place, 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.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

15/01/2009

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

C.3.2. Start date of crediting period

29/11/2018 (Second crediting period)

C.3.3. Duration of crediting period

7 years and 0 months (renewable)
29/11/2018 – 28/11/2025

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Empresa de Energía del Pacífico S.A. E.S.P. – EPSA E.S.P., requested Ingetec S.A. the “Environmental Impact Assessment of the Minor Hydroelectric Power Plant of Bajo Tuluá", 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 Minor 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 Handling Plan, Monitoring Plan, Contingency Plan and Abandonment and Recovery Plan.

The 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 7 control programs concerning the physical component, 2 programs concerning the biotic component and 5 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
- Operating handling of the captation program
- 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
- Hydro-biologic communities handling program

Socioeconomic Component:
- Help and reestablishment of agricultural activities program
- Employment policy program
- Information and participation program
- Institutional and territorial strengthening program
- Preventive archaeology program
    i. Basic archaeology subprogram
    ii. Archaeological spreading subprogram

The monitoring plan allows the supervision and the feedback of the actions applied in the development of the environmental handling plan. These monitoring programs consider the physical, biotic and socioeconomic component and each program is structured including objective, handled impacts, affected systems and components, impact's handling measures and monitoring measures with its activities and indicators. The following actions are included:

Physical Component:

- Disposal of excavation's excess and erosive process: residues disposal in the riverbed is not allowed, not only in compliance with the restricted use of the area, but also to avoid their destabilization or dragging by a torrential rising tide of the river[20].
- Air and noise quality
- Level of currents that are affected by the construction of the tunnel

[20] See Environmental License (Annex 5, reference 4, pg 42) or Memorandum No. 0660-09-52936-2008-01, October 31, 2008

Biotic Component:

- Vegetable coverage and land habitats: in the EIA it has been identified that the ecosystem in the project's area is composed by a tropical dry forest or *subserofítico and subandino*. Vegetation is open with pasture, shrub and dispersed small trees with small and *coraceas* leafs, usually thorny. This ecosystem is identified in a national level as a priority one in which it is necessary to develop conservation actions (*Plan de Acción Nacional de Lucha contra la Desertifiación y la Sequía en Colombia*). In the project's area there are no protected areas of a National order. However, there are local and municipals process such as the Jicaramata enclave, which is identified in the Tuluá's POT and in the process of prioritizing local process for the north centre table of the Protected Areas Departmental System (*Sistema Departamental de Áreas Protegidas, SIDAP*). In addition, the National Forest Reserve of Tuluá is in the project's influenced areas. Therefore, if this area is affected it is necessary to go to the Ministry, who has the duty of verificating, assessing and approving any process that modifies these National Reserves.
- Hydro-biologic communities and water quality: after studying the ichthyology of the river, it was concluded that the only specie with an ecologic significance was the *Sabatela*, which is migratory specie able to overcome 1.50 metres high obstacles and which swims upriver to reproduce during the rainy season. Other identified species are *Tarpon, Leporinus, Brycon and Astvanax*. The dam is not designed to allow the Sabatela's jumps but to allow and make easier its upriver's going during its normal migration. Once the construction of the structure that allows the fish's pass starts, it will be directly observed to assess the effectiveness of said structure and the possible improvements that could be carried out in case there is any difficulty during the operation. In addition, the environmental license establishes it is necessary to restock the middle and low part of the Tuluá River with 10,000 specimens of young Sabaleta (Brycon henni).[21]

Socioeconomic component:

- Monitoring of the information and participation program
- Monitoring of the institutional and territorial strengthening program
- Monitoring of the help and reestablishment of agricultural activities program
- Monitoring of the labour's entailment and employment policy program
- Monitoring of the Preventive archaeology program

The total cost associated with the monitoring program of the environmental management plan for the project of Bajo Tuluá is 556,834,150 pesos.

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. Threats that can affect the projects have a natural or an anthropic cause. Natural threats are seismic threat (earth tremor and earthquakes), geotechnical threat (landslide and collapse) and the hydrologic threat (excessive rains, flooding); anthropic threats are for instance inappropriate constructive procedures, bad relationships with community and workers and unfavourable political situations in both fields regional and national. There are 8 contingency plans in total:

- Contingency plan for earthquakes
- Contingency plan for landslide and collapse
- Contingency plan for flooding

[21] See Environmental License (Annex 5, reference 4, pg 40) or Memorandum No. 0660-09-52936-2008-01, October 31, 2008

- Contingency plan for fires and explosions
- Contingency plan for spillage of fuel
- Contingency plan for failure in the diesel storage tanks
- Contingency plan for terrorism and public order
- Public health contingency plan

The direct cost associated with the purchase of necessary equipment to implement the contingency plans is 286.9 million of pesos.

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 Minor Hydroelectric Power plant of Bajo Tuluá has been approved by the CVC (competent environmental authority) and is integrated within the Environmental Impact Study which has also been approved.

The resolution 0100 No. 0730-0606 dated November 14, 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 "Minor Hydroelectric Power Plant Bajo Tuluá 1440". The resolution clarifies aspects relating to "license of surface water", "permit for continued occupation of channels", "dumping permit", "atmospheric emissions by fixed sources permit", "forestall exploitation authorization", "access paths" and "Clean Development Mechanisms".

D.2. Environmental impact assessment

The impacts of the Minor Hydroelectric Power Plant of Bajo Tuluá in the area of construction of the project have been assessed methodologically in three different scenarios or periods:

a) during the current period, when the cumulative existing impacts were identified
b) during the period when the works execution was projected, assessing the potential impacts associated to construction processes
c) during the operation and 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.

During the previous period to the construction, identified impacts are the affectation of economic activities, generation of employment, restriction of use in small rural properties, generation of expectation and conflicts caused by disinformation.

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 impacts associated to the operation are thus associated to the bypassing of the flow and some unexpected implications of the hydroelectric generation activity,

A table where the main identified impacts are detailed as well as the associated control program proposed in the environmental handling plan is showed next:

Table 16. Environmental Impacts

IDENTIFIED ENVIRONMENTAL IMPACTS		HANDLING - PROGRAMS
PHYSICAL	Loss of land due to construction	Land handling program
	Alteration of the flow's regime of the Tuluá River	Operating handling program
	Alteration of the ground-water level due to the tunnel construction	
	Morphological changes and river's bed degradation in the Tuluá River	
	Alteration of the water quality of the Tuluá River	Water quality handling program Handling of areas of excavation's excess deposit program Solid waste handling program Restoration in areas of temporal use handling program
	Generation of potentially unstable areas	Handling of potentially unstable areas and grounds program
	Alteration of air and noise quality	Air and noise quality handling program
	Generation of excavation's residues	Handling of areas of excavation's excess deposit program
	Generation of domestic and industrial solid waste	Solid waste handling program
BIOTIC	Vegetable coverage loss	Vegetable coverage handling program Handling of grounds program Handling of areas of excavation's excess deposit program Material's sources handling program
	Affectation of land fauna	Land habitats handling program Vegetable coverage handling program
	Alteration of hydro-biologic communities	Water quality handling program Handling of areas of excavation's excess deposit program Solid waste handling program Hydro-biologic communities handling program
SOCIAL	Affectation of agricultural and economic activities	Help and reestablishment of agricultural activities program Institutional and territorial strengthening program
	Affectation of land's use in small properties	Help and reestablishment of agricultural activities program

IDENTIFIED ENVIRONMENTAL IMPACTS		HANDLING - PROGRAMS
	Temporal generation of employment	Employment policy program
	Generation of expectations and conflicts	Information and participation program Institutional and territorial strengthening program
	Alteration and loss of the archaeological patrimony	Preventive archaeology program

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. The total cost of the environmental handling plan during the construction and operation stages, projected in 5 years, will be 2,518,320,127 pesos.

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 Minor Hydroelectric Power Plant of Bajo Tuluá to draw up the design, impact and environmental handling plan studies, the Kyoto Protocol and the projects under the CDM modality.

During the fieldwork and within the consultation with the authorities, neither ethnic communities nor collective territories were found.

This approchement to the local authorities materialised in informative meetings of the project called by EPSA and INGETEC S.A., with the participation of the chairmen of the community action committees of each borough, the mayors and some secretaries of the municipalities of Tuluá, Buga and San Pedro, councillors and the CVC.

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 projects

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

Table 17. Stakeholder consultations

Meeting No,	Place	Participating community	Issues/ Meeting Activity	Date
1	EPSA Auditory-Tuluá	San Marcos Community, La	Information and participation about the	May 28, 2007

Meeting No,	Place	Participating community	Issues/ Meeting Activity	Date
		Esmeralda	project	
2	Office of the City Hall of San Pedro	City Hall of San Pedro	Information and participation about the project	June 25, 2007
3	Community House	La Siria School and Communities of Crucero Nogales, La Esmeralda and La Siria	Information and participation about the project	July 1, 2007
4	Monteloro Community House	Communities of Monterolo, Piedritas, La Diadema, San Marcos and La Mansión	Information and participation about the project	July 2, 2007
5	EPSA Auditory-Tuluá	Community of La Esmeralda	Information and participation about the project	July 5, 2007
6	EPSA Auditory- Tuluá	Community of La Esmeralda	Delivery of La Esmeralda community notification	July 12, 2007
7	Río Frío plant and EPSA Auditory-Tuluá	Community of Monteloro	Visit to the Río Frío plant and information and participation about the project	July 16, 2007
8	Río Frío plant and EPSA Auditory-Tuluá	Communities of Monteloro, San Marcos and Crucero Nogales	Visit to the Río Frío plant and information and participation about the project	July 21, 2007
9	La Siria school	La Sirira, Esmeralda, Crucero Nogales, La Florida	Socialization of the project and visit to Río Frío II plant	September 5, 2007
10	El Placer school	Communities of El Placer, Crucero Nogales, Los Bancos, Florida, Rosario and Beachs of San Agustín	Presentation and analysis of the advances of EIA	January 12, 2008
11	Los Bancos School	Communities of Florida, La Mesa, Los Bancos, Rosario and San Agustín	Presentation and analysis of the advances of EIA	January 27, 2008
12	Río Frío plant and EPSA Auditory-Tuluá	Town Hall and Municipal Council of Tuluá	Visit and presentation of initial results of EIA	April 1, 2008
13	Río Frío plant and EPSA Auditory-Tuluá	Town Hall and Municipal Council of San Pedro	Visit and presentation of initial results of EIA	April 2, 2008
14	Community Hall of Monteloro	Communities of Monteloro, Piedritas and San Marcos	Presentation and analysis of the initial results of EIA	April 5, 2008
15	El Picacho School	Communities of El Brasil, El Picacho, La Ribera, La Coca, El Vergel and Marabeles	Presentation and analysis of the initial results of EIA	April 6, 2008
16	Río Frío plant and EPSA auditory- Tuluá	Town Hall and Municipal Council of Buga	Visit and presentation of initial results of EIA	April 9, 2008
17	El Placer School	Communities of Crucero Nogales, Los Bancos, Jicaramata, El Placer, Florida and	Presentation and analysis of initial results of EIA	April 12, 2008

Meeting No,	Place	Participating community	Issues/ Meeting Activity	Date
		Rosario		
18	La Esmeralda School	Communities of La Altania, La Esmeralda and La Siria	Presentation and analysis of initial results of EIA	April 13, 2008

Participants of these meetings were representatives of the different institutions such as the CVC, the Municipal Town Council, Municipal council, Leaders, Community action committees and associations of the communities that belong to the area of influence of the project. 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:

- Places for materials from the excavation
- Profit for the communities derived from the project
- Use of the water in the project- Ecologic flow
- Reforestation of the Tuluá river basin
- Access paths: rehabilitation, maintenance and new ones.
- Jobs and policy of the company
- Energy for the paths
- 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

EPSA company, based on the projects identified and prioritised in the meetings held with the communities and their representatives, is committed to the following:

- Provide economic support to the program that supports the formulation of the handling plan of the Tuluá river basin, including:
    - Support to restoration, conservation and protection programs of the territorial flora in the tributary's basins.
    - Project for the stabilization of sectors subject to erosion.
    - Environmental training by strengthening of the ecologic groups, PRAES's advise and formation of teaching staff.
    - Institutional strengthening of the cleaning up policies of the municipal town halls.

- Respect the priorities in the use of water, in accordance with the current regulations, whereby human consumption will be the main priority.

SECTION F. Approval and authorization

The Letter of Approval was issued in 15/07/2009 by the Colombian DNA.

Appendix 1. Contact information of project participants

Organization name	EPSA S.A. E.P.S.
Country	Colombia
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Appendix 2. Affirmation regarding public funding

Not applicable

Appendix 3. Applicability of methodologies and standardized baselines

Not applicable

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

Not applicable

Appendix 5. Further background information on monitoring plan

Not applicable

Appendix 6. Summary report of comments received from local stakeholders

Not applicable

Appendix 7. Summary of post-registration changes

Not applicable

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Document information

Version	Date	Description
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
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.
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.

Version	*Date*	*Description*
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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Document Type: Form
Business Function: Registration
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