Project design document form
(Version 10.1)

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

BASIC INFORMATION	
Title of the project activity	La Vuelta and La Herradura Hydroelectric Project
Scale of the project activity	X Large-scale ☐ Small-scale
Version number of the PDD	20
Completion date of the PDD	11/04/2019
Project participants	Empresas Públicas de Medellín E.S.P. MGM Carbon Portfolio, S.a.r.l.
Host Party	Colombia
Applied methodologies and standardized baselines	ACM0002: Grid-connected electricity generation from renewable sources - (version 19.0)
Sectoral scopes linked to the applied methodologies	(1): Energy industries (renewable sources)
Estimated amount of annual average GHG emission reductions	84,221 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project consists of two hydroelectric power plants that take advantage of the capacity of La Herradura river, by means of two subprojects in a chain (La Vuelta and La Herradura). This improves electricity service in the west of Antioquia Department, contributing to regional development. Simultaneously, the project provides clean energy and reduce CO_2 emissions.

The use of La Herradura river begins in the upper part of the basin at the La Vuelta Sub-Project. The mean flow is 12 m^3/s with net head of 112.9 m for an installed nameplate turbine capacity of 12.4 MW. La Herradura Sub-Project is located 5 km downstream (on the same river). The mean flow is 10.0 m^3/s with a net head of 230.6 m for an installed nameplate turbine capacity of 21.08 MW.

The project was built in the Republic of Colombia. It is located in the northwestern part of Antioquia Department. It takes place in Cañasgordas, Frontino and Abriaquí Municipalities.

The estimated amount of annual average GHG emission reduction to achieve by the implementation of the project activity is 84,221 tCO_2. The total emission reductions for the third crediting period (2019 – 2025) is 589,547 tCO_2.

Brief history of the project:
Several studies for the utilization of La Herradura river basin were conducted between 1965 and 1997. The first study, commissioned by the Cooperative of Municipalities of Antioquia for a mini-hydro plant at La Vuelta, was executed by Gutiérrez and Montoya Civil Engineers. In 1994, the Medellín Integral S.A. firm carried out technical and economic feasibility studies of La Herradura for the former Electrificadora de Antioquia, today Antioquia Energy Company (EADE S.A.E.S.P.). Between 1995 and 1997 various environmental and design studies for both projects were also undertaken. These studies defined the basic outline of effective use for these subprojects.

Finally, during 2001, Empresas Públicas de Medellín E.S.P. (EPM) conducted an internal review of the technical and environmental documentation of the subprojects, with the purpose of project optimization, as well as analyzing the economic and financial viability for their construction, and considering the possibilities of reducing financial risks through project formulation as CDM.

Table 1 shows the construction and operation starting dates of the hydroelectric power plants La Vuelta and La Herradura.

Table 1: Starting dates of construction and operation of La Vuelta and La Herradura

	La Vuelta	La Herradura
Construction start date	15 April 2002	22 April 2002
Operation start date	18 December 2004	8 October 2004

The first CDM crediting period started on 01/01/2005 and ended on 31/12/2011. The second CDM crediting period started on 01/01/2012 and will end on 31/12/2018. Throughout these periods, the project has delivered renewable energy to the interconnected national grid and reduced GHG emissions that would otherwise have been generated in grid-connected fossil fuelled power plants. The emission reductions have successfully been verified and certified under the CDM scheme.

Sustainable development considerations:

a. Economic

The project generates revenues for the municipalities from economic transfer within the framework of Law 99/93. These resources are available to the municipalities for the implementation of Municipal Development Plans, especially in basic sanitation and environmental protection programs.

The Urabá region, influenced directly by the development of the project, is the only area of the Department that is connected to the Caribbean Sea. This region includes export-oriented activities. In this region, the exploitation of banana plantations (one of the main export items) is developed at industrial and commercial levels. Additionally, there is a potential development for meat industry which could be favored with a better quality of power supply. The project improves electricity service in the region.

Electricity service for the northwest of Antioquia Department is provided by a two-link transmission system (Figure 1):

- Transmission line of 115 kV with a total length of 230 km, reinforced with a series compensation system in Apartadó substation, making it possible to increase its transportation and stability capacity.
- Transmission line of 230 kV with 49 km between Urrá and Urabá substations, connecting to Antioquia Department through Caucasia substation.

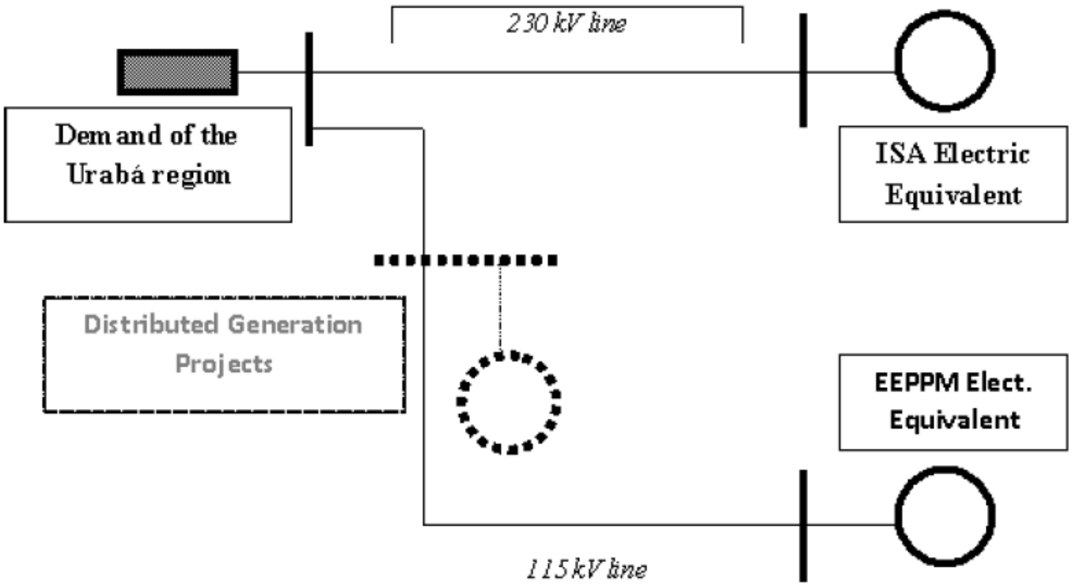


Figure 1: Electricity transmission system in the Antioquia Department.

The current average demand of Urabá region is of about 50 MW, which is covered through Urrá-Urabá lines of 230 kV and West-Apartadó of 115 kV. But if frequent guerrilla attacks in the region, which keep the 230 kV line out of order, are taken into account, the demand in the Urabá region should be limited, because through the 115 kV line it is not possible to transport 50 MW since the quality of the service cannot be secured due to the reduction in more than 10% of the nominal tension allowed in Apartadó substation. The length of the West-Apartadó line and the size of the demand covered bring about these problems of low voltage, which in spite of the installed series

compensation, does not guarantee the transportation capacity required by the line in Frontino-Apartadó section.

As another additional benefit, the subprojects are bent towards distributed generation, key issue in the electric energy business all over the world, especially because they favour the development of small scale projects, near consumption centers, producing low environmental impact and minimizing the risk of technological change expected for the mid-term.

b. Environmental

The project provides clean energy and reduce CO_2 emissions in Colombia.

The direct on-site emissions from the project are the emissions related to the production of electricity. Hydropower is a clean energy source that is emissions free, and there will be no GHG emissions that are directly related to the use of hydropower for electricity production. Subsequently, the direct emissions for the project are considered zero.

Moreover, the run-of-river plants have no regulating reservoirs so that environmental impacts are minimal and under control through a periodic monitoring plan.

c. Social

The project contributed to job creation during the construction period and also during operation (about 1,000 direct and indirect employments). Also, the project contributes to regional development through institutional strengthening, with the goal that municipalities manage their own development projects, as well as providing new access roads for villages in the region. Likewise, through the construction of roads providing better connection among the municipalities of Abriaquí, Frontino and Cañasgordas, people living in the project area would gain access to basic health services, education and trading of local agricultural produce. Potential expansion and replicability are also possible.

d. National Sustainable Development Criteria

The Colombian government, through the Colombian Office for Climate Change Mitigation (OCMCC), has elaborated sustainable development criteria for CDM projects.

In that sense, it can be stated that the project complies with the applicable sectoral legal framework and has completed the environmental impact assessment and received the environmental licenses, it has the corresponding authorization to be developed, and it respects community interests and rights. The project is in line with national policies and programs by promoting the use of renewable energy sources (Law 697/2001). It also contributes to improving long-term social and economic conditions of the local community, as stated above. Additionally, the project implements clean technology contributing to the cleaner production criterion.

Specifically, the main concerns are summarized as follows:

Review of sustainable development criteria of OCMCC

1. Commitment with sectoral regulation (property rights, rights over natural resources, certificates, licenses, environmental impact studies, rights of local communities according to Art. 330 of National Constitution, Law 21/1991, Law 99/1993, and Decree 1320/1998).

A copy of property rights, environmental licenses, and rights over natural resources, environmental impact studies, and documentation related to local community opinion assessment were available for validation of the project. Section D also includes a summary of the main aspects and conclusions of the environmental impact studies.

2. Contribution and compatibility with government policy (local, regional, and national planning, programs, and projects).

   The projects are in line with criteria for the generation capacity expansion plan of the whole national electricity system and general environmental and energy policies of the country. A summary of the related legislation was included.

3. Contribution to improvements in social and economic conditions of local community (institutional agreements, employment generation, capacity building, local market development, impact on the trade balance, consideration of social needs).

4. Actions to deal with local communities' needs have been considered as part of the Environmental Management Plan.

   Cleaner production implementation (minimization of environmental impact, technology transfer).

Hydroelectricity is a clean technology which helps to avoid air pollutant emissions coming from fossil fuel-fired power plants.

A more detailed description is presented about environmental, social and economic contributions of the project in Section D.

A.2. Location of project activity

Republic of Colombia. Antioquia Department. Cañasgordas, Frontino and Abriaquí Municipalities.

The project is located in the northwestern part of Antioquia Department, using the water of La Herradura river, under municipalities of Cañasgordas, Frontino and Abriaquí jurisdiction, although it can be considered as regional area of influence, the whole of Urabá Antioqueño, which goes from Santa Fe de Antioquia to Arboletes. In this zone of approximately 230 km^2, important municipalities, such as Dabeiba, Mutatá, Chigorodó, Apartadó and Turbo are found (see Figure 2).

- **La Herradura Sub-Project**
  La Herradura subproject takes place on La Herradura river, starting from an existing topographic fall between this river and the Cañasgordas river; the two rivers later join to form the Sucio river basin, a tributary of the Atrato river. The hydrographic basin of La Herradura river used for this project covers an area of about 320 km^2, which contributes to a mean flow of 14 m^3/s at the catchment point. The construction will be located under Frontino and Cañasgordas jurisdictions.

- **La Vuelta Sub-Project**
  The subproject takes place in the upper and middle La Herradura river basin, up to the fork at the Nancuí gulch, at 1595 m elevation, covering the whole of Abriaquí municipality and the limits coincide with the dividing basin and to a lesser extent with Frontino municipality. The hydrographic basin (catchment area) of La Herradura river used by the project covers an area of about 286 km^2, which contributes to a mean flow of 12.3 m^3/s at the catchment point.

The physical coordinates of the project activity are:

La Herradura powerhouse: + 6.8028 / - 76.0814
La Vuelta powerhouse: + 6.7304 / - 76.0883
Substation Chorodó: + 6.8483 / - 76.1379

Figure 2: Location of Project Activity.

A.3. Technologies/measures

The project activity consists of two hydroelectric power plants, with a total installed turbine capacity of 33.48 MW, in order to take advantage of the capacity of La Herradura River, by means of two subprojects in a chain (La Vuelta and La Herradura).

La Vuelta Sub-Project – Technical Details

Hydraulic Turbine	
Type	Francis, horizontal axis
Number of units	1
Nameplate capacity (without losses)	12,400 kW
Rotation speed	870 min-1
Design net head	112.9 m

Lifetime of hydraulic turbine[1]	40 years[2]
Years of operation	14 years 4 months. From December 2004 to nowadays
Generator	
Type	Synchronic, horizontal axis
Number of units	1
Nominal power output (nameplate)	14,000 kVA
Nominal tension	13,800 V
Nominal frequency	60 Hz
Power factor (cosine ø)	0.85
Synchronic speed	514.3 rpm
Lifetime of generator[3]	30 years[4]
Years of operation	14 years 4 months. From December 2004 to nowadays

La Herradura Sub-Project – Technical Details

Hydraulic Turbine	
Type	Francis, horizontal axis
Number of units	2
Nameplate capacity (without losses)	10,540 kW
Rotation speed	900 min-1
Design net head	230.6 m
Lifetime of hydraulic turbine[1]	40 years[2]
Years of operation	14 years 6 months. From October 2004 to nowadays
Generator	
Type	Synchronic, horizontal axis
Number of units	2
Nominal power output (nameplate)	12,000 kVA

[1] BONILLA, Carolina and GONZÁLEZ, Lizeth. “Estructuración, financiación y valoración de pequeñas centrales eléctricas en Colombia a través de opciones reales. Bogotá, 2017”. Available in: https://repository.cesa.edu.co/bitstream/handle/10726/1855/MFC_814.pdf?sequence=1&isAllowed=y This document indicates that technologies used in small hydroelectric power plant have a life time longer than 50 years.

[2] “EPM Assets lifetime ranges”. EPM has a more conservative estimation about lifetime of hydraulic turbine.

[3] BONILLA, Carolina and GONZÁLEZ, Lizeth. Estructuración, financiación y valoración de pequeñas centrales eléctricas en Colombia a través de opciones reales. Bogotá, 2017. Available in: https://repository.cesa.edu.co/bitstream/handle/10726/1855/MFC_814.pdf?sequence=1&isAllowed=y This document indicates that technologies used in small hydroelectric power plant have a life time longer than 50 years.

[4] “EPM Assets lifetime ranges”. EPM has a more conservative estimation about lifetime of hydraulic generator.

Nominal tension	13,800 V
Nominal frequency	60 Hz
Power factor (cosine ø)	0.85
Synchronic speed	900 rpm
Lifetime of generator[3]	30 years[4]
Years of operation	14 years 6 months. From October 2004 to nowadays

Turbine Regulator: programmable digital type with electronic head operated from central or by remote control from another control centre. It also has an electro-hydraulic system for normal operations of synchronization, charge and discharge.

Transformers: It has been decided the use of an outdoors transformer for the two generators, with a capacity of 24 MVA: three-phase, with primary nominal voltage of 13.8 kV and secondary of 44 kV and 60 Hz, oil-cooled under normal conditions and by forced air under operating conditions at continual maximum capacity.

Mechanical auxiliary equipments: Oil in bolsters is cooled in a dry type tower, the oil circuit is closed and the pumps are directly propelled by the unit axis. For the drainage of the spiral chamber, the relief valve discharge pit, the draft duct and infiltrated water and power house floors drainage, there is a system with submergible vertical pumps installed in the drainage pit to conduct water to the discharge channel.

Electric auxiliary equipments: A 480 kV-13.8 kV transformer is used as normal feed, fed from any of the two generators as main source. It has a diesel electric generator of 480 V and 60 Hz emergency system.

Each generation unit has a control centre and a 480 V distribution board so that maintenance and selection processes in auxiliary services operations are independent. There is a surveillance system and water level control in the load tank. Therefore, the central is interconnected, so as to secure accurate load tank operation hydraulic conditions.

Turbine specifications: The turbines are Francis reaction turbines, with a martensitic stainless steel welded impeller, with spiral chamber and welded draft pipe from soothed carbon steel sheets, of thin austenitic grain size.

A Francis turbine is a type of hydraulic reactor turbine where the flow exits the turbine blades in radial direction. Francis turbine is common in power generation facilities and is used in applications where high flow rates are available at medium hydraulic head (e.g. Niagara Falls). Water enters the turbine through a casing and is directed to the blades by wicket gates. The low momentum water then exits the turbine through a draft tube.

Francis turbines can be assembled both vertically and horizontally. Figure 3 bellow shows a Francis turbine where water can enter freely through the whole circumference and through the outer ring of the guide vanes. These guide vanes can be adjusted so the amount of incoming water may be controlled. Francis turbines are highly efficient and versatile turbines (inflow-impulse type in the first stage and outflow-axial reaction type in the second stage).

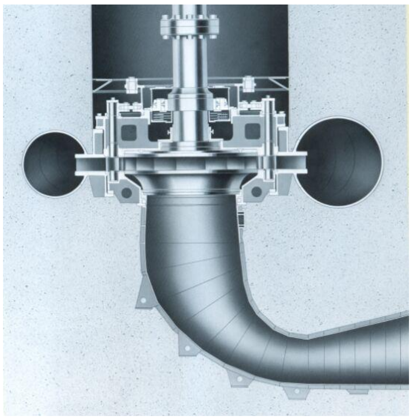


Figure 3: Francis Turbine Spiral Cased Horizontal Shaft – typical arrangement.

Net electricity generation is continuously measured, hourly registered and monthly recorded by electronic electricity meters. The values are cross-checked with the generation measured in terminals and vs SCADA (Supervisory Control And Data Acquisition) system. The four electricity meters are located in Chorodó substation: one main electricity meter for La Vuelta, one backup electricity meter for La Vuelta, one main electricity meter for La Herradura and one backup electricity meter for La Herradura,

The meters are bi-directional and therefore measure the net balance of the quantity of electricity supplied by the project plant to the grid and the quantity of electricity delivered to the project plant from the grid.

Calibration of meters follow national standards and are in accordance with the calibration instructive specified in Colombian standard NTC 4856 for electricity metering devices.

In the baseline situation, 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. For further information, see section B.4.

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 Party)	Empresas Públicas de Medellín E.S.P. (public entity)	No
Switzerland	MGM Carbon Portfolio, S.a.r.l. (private entity)	No

A.5. Public funding of project activity

No public funding, including official development assistance, is involved in financing this project activity.

A.6. History of project activity

Background:
"La Vuelta and La Herradura Hydroelectric Project" is a run-of-river hydropower project operated by Empresas Públicas de Medellín E.S.P. The project was registered as a CDM project activity on 15/01/2007. The first 7-year renewable crediting period started on 01/01/2005 and ended on

31/12/2011. The second 7-year renewable crediting period started on 01/01/2012 and will end on 31/12/2018. The project proponent is applying for the renewal of a third and last crediting period from 01/01/2019 to 31/12/2025. This PDD contains the necessary adjustments for the third crediting period.

Project activity is not a project activity that has been deregistered, nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA).

A.7. Debundling

Not applicable.

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

The project activity applies ACM0002 “Grid-connected electricity generation from renewable sources” (Version 19.0).

The grid emission factor is calculated according to the TOOL07 “Tool to calculate the emission factor for an electricity system” (Version 7.0).

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) is also applied.

Since this PDD version is for the third crediting period, the “Tool for the demonstration and assessment of additionality” that is referenced to in the baseline methodology does not need to be applied.

The “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” is not used either as there are no project or leakage emissions related to the project activity.

B.2. Applicability of methodologies and standardized baselines

ACM0002 states several conditions under which the methodology is available. The conditions and how they apply to the project activity follow.

> *3. This methodology 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).*

The project activity is an installation of a Greenfield power plant since the project consist in the installation of a run-of-river hydro power plant.

> *4.a. 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 project activity is the installation of a run-of-river hydro power plant.

4.b. 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.

Since the project activity is the installation of a new power plant, this criterion does not apply.

5. 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, calculated using equation (3), is greater than 4 W/m^2; or

c. The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), 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, calculated using equation (3), 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, as per equation (4), 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 results in new single reservoir, because the water river flow is conducted to an intake of the following dimensions:

61 m (length) and 61 m (width) for La Vuelta small hydroelectric plant.
45 m (length) and 45 m (width) for La Herradura small hydroelectric plant.

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

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

A_{BL}: Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

$$PD_{La\ Vuelta} = \frac{12,400,000\ W - 0}{(61\ m \times 61\ m) - 0}$$

$$PD_{La\ Vuelta} = 3,332.44\ W/m^2$$

$$PD_{La\ Herradura} = \frac{(10,540,000 \times 2)\ W - 0}{(45\ m \times 45\ m) - 0}$$

$$PD_{La\ Herradura} = 10,409.88\ W/m^2$$

Both of the water intake infrastructures are located on La Herradura river.

The project activity results in a new single reservoir and the power density is greater than 4 W/m^2.

6. 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.

This criterion is not relevant.

7. 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.

This criterion is not relevant for hydroelectric projects.

8. 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 project does not consist in a retrofit, replacement, or capacity addition; thus. this criterion is not relevant.

9. In addition, the applicability conditions included in the tools referred to below apply.

Thus, the methodology is applicable to the proposed project activity.

The TOOL07 "Tool to calculate the emission factor for an electricity system" (Version 7.0) is applied to calculate baseline emissions for a project activity that substitutes grid electricity. 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, there are specific conditions that should be met. Since the electricity system affected by the proposed project activity includes only grid connected power plants, no specific conditions should be assessed. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country, which for the proposed project activity is not the case.

Since the project is renewing the crediting period, 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) is also applied. It has no other specific application criteria that shall be met.

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

ACM0002 specifies that *"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"*.

The project activity is connected to the interconnected national system, i.e. the Colombian power grid.

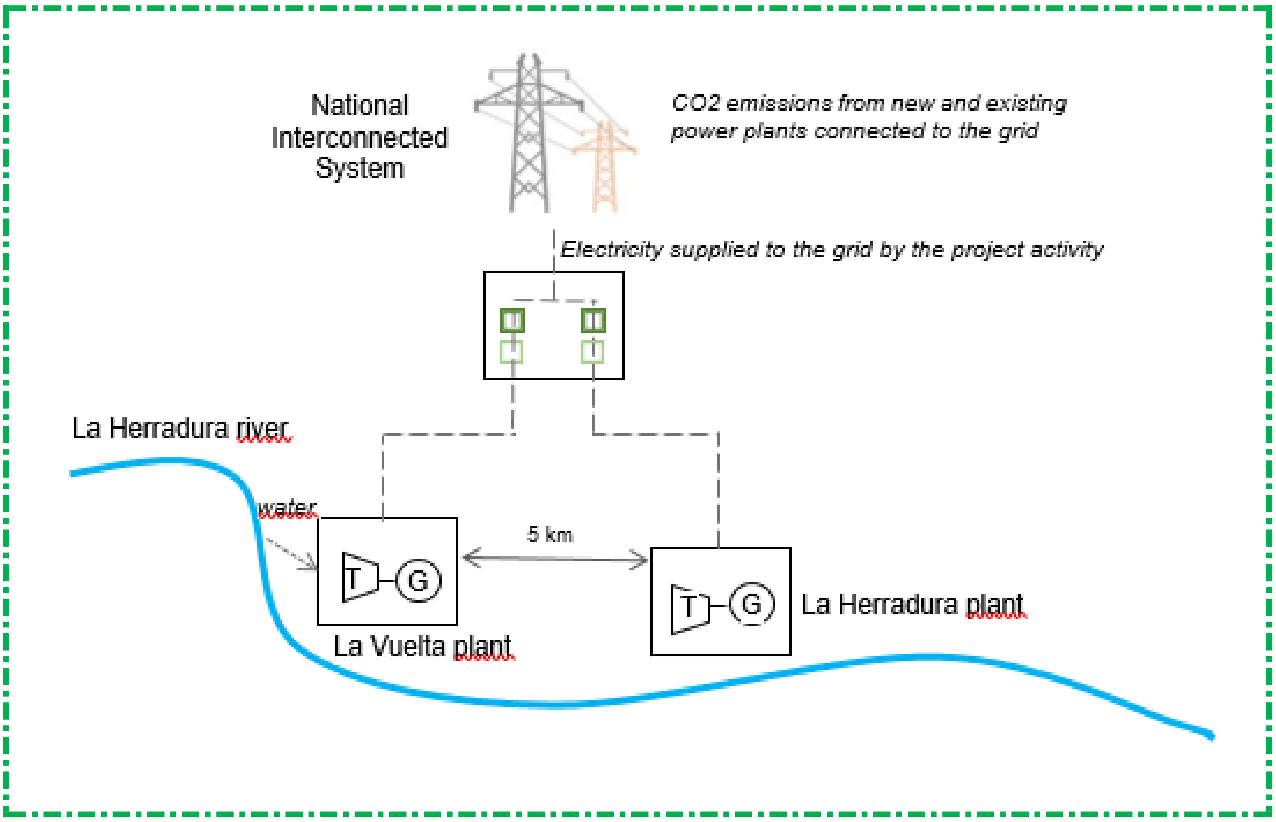
ACM0002 states that "*The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table 2 (in ACM0002)".* The relevant parts of that table and information on emission sources applicable to the project are shown in Table 2.

Only carbon dioxide emissions from electricity generated by fossil fuel fired power plants displaced by the project activity is taken into account in the baseline scenario. The project activity, itself, does not produce significant emissions of greenhouse gases.

Table 2: Emission sources applicable to the project.

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.
Project activity	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	These emissions do not apply, because there is no reservoir in the project activity.
		CH_4	No	
		N_2O	No	

As stated in the methodology ACM0002 version 19.0, "*for all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected";* thus, potential emissions from the emergency diesel generator at the project site are neglected.



Project boundary

B.4. Establishment and description of baseline scenario

The baseline scenario in the case of La Vuelta and La Herradura Hydroelectric Project is defined by the electricity delivered to the grid by the project 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. The establishment and description of baseline scenario for this hydroelectric project comes from the applied methodology ACM0002 “Grid-connected electricity generation from renewable sources” (version 19.0).

The baseline scenario consists of the current power plants in the relevant system grid for the project boundary (which is the Colombian National Interconnected System) and the projected capacity expansion as it occurs in the absence of the generation of this CDM project. Specifically, in the absence of La Vuelta and La Herradura Hydroelectric Project, the same level of demand for electricity would be met by the combined production of plants in the Colombian National Interconnected System and by the addition of new generation sources. Therefore, the estimations of the baseline emissions are based on the combined margin (CM) calculations as described in section B.6.

The baseline scenario for the project is the continuing operation of the existing and future power plants, necessary to meet the actual electricity demand, without La Vuelta and La Herradura Hydroelectric Project electricity generation. In the project scenario, the same electricity demand is met with the power dispatched in the base load by the project, displacing the generation from existing power plants and future power developments. Because the project uses renewable sources to produce electricity, there are no additional emissions from the project activity and the emissions reductions are generated by the displaced generation.

In accordance with 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), the stepwise procedure is carried out in the following.

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

There are no new national and/or sectoral policies that could affect the baseline scenario during the renewal of the crediting period. Renewable energy projects are always dispatched as they have lower costs in the margin, as it was the case for the first and second crediting period. 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, as shown in the Combined Margin calculations for the grid emission factor.

The project complies with the current regulations dealing with renewable sources of power generation. Particularly, the project activity is not affected by the main regulations current at the moment.

The structure of the Colombian energy market is based on Law 143 (Electricity Law) of 1994. Since their enactment, Colombia basically has had a liberalized energy market, which is characterized by an unbundled generation, transmission, distribution, and commercialization framework.

Following is a brief analysis on how the regulatory framework has not been affected with relation to the project activities, in comparison to the baseline situation at the beginning of the first crediting period:

Law/ Policy	Key elements/requirements	Was this law/policy valid during initial registration (Y/N)	Are there any relevant changes since then?	How the law/policy affects the baseline
Law 143 of 1994	Establishes the norms and procedures for the generation, interconnection, transmission, distribution, and commercialization of electricity in Colombia.	Yes	No	The Law 143 can be considered as the General Electricity Law, and it still prevails. It does not affect the project.
Resolution 055 of 1994	Regulates general conditions for the electricity market in Colombia	Yes	No	Art. 11 establishes that power generators with capacity lower than 20 MW can always access the interconnected system
Resolution 086 of 1996	Regulates the power generation activities of plants with capacity lower than 20 MW	Yes	No	It sets up conditions for generating and connecting to the grid. It was partially modified by Resolution 039 of 2001,
Resolution 107 of 1998	Regulates the activity of cogeneration and makes adjustments to the provisions of Resolution 086 of 1996	Yes	No	It does not affect the baseline scenario.

Resolution 039 of 2001	Sets up complementary conditions for power generators with capacity lower than 20 MW.	Yes	No	It sets up conditions for small generators dispatching to the grid, which now can have access to the wholesale market, but within the prevailing price conditions.
Law 1715 of 2014	It regulates the integration of non-conventional renewable energies into the National Energy System.	No	-	It does not affect the baseline scenario.

The national electricity market in Colombia is ruled according to the Law 143 of 1994. Through this law the market becomes competitive, and the wholesale competitive market is set according to periodic open power auctions. The law assigns the coordinating and regulatory role to the Commission on Energy and Gas (CREG), and unbundles the provision of transmission and power generation and commercialization services. The only natural monopoly remains in the provision of transmission service, the other services being competitive. The wholesale market is administered at the National Dispatch Center, which belongs to the company in charge of transmission through the national grid.

Small power generators (less than 20 MW) have preferential access to the market, and are always dispatched. Price is the result of demand and supply for private transactions, and of the auction for the wholesale market (safe some charges for securing the minimum generation level). Small generators supplying to the wholesale market have to use the prevailing price at that market. The central dispatch is based on the lower cost to attend daily demand, creating a merit order system. Small generators and low cost, such as La Vuelta and La Herradura Hydroelectric Project power plants, are always dispatching first.

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

There is no impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions. The conditions used to determine the baseline emissions in the previous crediting period are still valid.

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

This sub-step is applicable to the project activity since the baseline scenario identified at the validation is the continuation of the current practice, i.e. the electricity that would be supplied by the power grid in the absence of the project activity. It is clear that the power grid as an electricity system would maintain its technical possibility for a much longer time than the crediting period of the project activity.

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

There are some parameters, which were determined at the start of the second crediting period and not monitored during the second crediting period, are not valid anymore. So, relevant data and parameters, i.e. the operating margin emission factor for the combined margin emission factor, were updated for the third 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 (including OM). Other parameters needed to be included.

Application of Steps 1.1, 1.2, 1.3 and 1.4 above confirmed that the current baseline remains valid for the third crediting period; even though, some data and fixed parameters needed to be updated due to changes presented above. Therefore step 2 is assessed below.

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

Step 2.1: Update the current baseline

The baseline emissions for the third crediting period have been updated in accordance with the stated above in step 1.4., without reassessing the current baseline, according to 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 mentioned in step 1.4 above, all parameters regarding the grid emission factor calculation have been updated for this third crediting period. The build margin emission factor calculated for the second crediting period was used again. On the other hand, the operating margin emission factor was reassessed and other some parameters needed to be included. More details can be seen in section B.6 and B.7 (updated monitoring parameters).

B.5. Demonstration of additionality

It is important to note that the assessment of additionality has been done at the project original validation. This assessment has been already approved. The analysis included in the original PDD at the registration time is the following.

This section is not modified for the renewal of the crediting period, as this is no requirement. Therefore, the same analysis is included as in the approved PDD of the first crediting period, as well as in the approved PDD of the second crediting period.

Step 0. Preliminary screening based on the starting date of the project activity

EE.PP.M is a leading company in Colombia, which has adopted an internal environmental strategy to deal with its main business activities and new investments. It is also one of the pioneer enterprises in considering CDM as a part of its decision-making process[5].

Since people working for the World Bank —looking for projects to be presented to the Prototype Carbon Fund (PCF) — contacted EE.PP.M and suggested the possibility of developing CDM project activities[6], EE.PP.M has paid a great attention to the novel Clean Development Mechanism[7]. They were also involved in contacting experts in order to closely follow CDM consolidation and to be kept apprised of the status of current negotiations in this issue. Their first successful experience was the presentation of the Jepirachi Carbon Offset Project[8] (19.5 MW Wind Power Plant in Alta Guajira, Colombia, 2002) to the PCF (the Emission Reduction Purchase Agreement was signed in December 2002).

[5] Three of the official Colombian projects were developed by EE.PP.M (Jepirachi Wind Power Project, Río Amoya Hydroelectric Project, and La Vuelta and La Herradura Hydroelectric Project).

[6] On that occasion EE.PP.M started working with two projects, the Jepirachi Carbon Offset Project and the previously low-priority —and almost already disregarded— project of La Vuelta and La Herradura.

[7] Take into account that by that time CER prices scenarios were highly optimistic, around US$ 20 per tonne of CO_2e.

[8] Jepirachi Carbon Offset Project (19.5 MW Wind Power Plant in Alta Guajira, Colombia), Baseline Assessment, the Prototype Carbon Fund, May 2002. The information can be found in www.prototypecarbonfund.org .

Aware of the potentiality that the CDM offered, EE.PP.M submitted a letter to the Colombian Ministry of Environment, in September 2001, expressing the intention of exploring the possibility to develop a joint GHG mitigation project activity with two run-of-river hydro plants in La Herradura River basin. After that EE.PP.M reached a collaboration agreement with MGM International to identify and develop CDM project activities in a wider framework[9].

The proposed project activity is a consequence of those facts and circumstantial meetings, which contributed to the EE.PP.M decision to reconsider the project among their possibilities, also taking into account that a contact with a potential buyer (Electric Power Development Corporation, of Japan) was already established thanks to the above-mentioned agreement.

This project was conceived many years ago, but it was just after CDM acquired a real body when EE.PP.M reconsidered the project, giving it a high priority among its investment opportunities.

La Herradura basin has been studied for electric generation purposes since 1965. Between 1994 and 1997, technical and economic feasibility studies as well as environmental and design studies were undertaken. The mentioned studies defined the outline of effective use of the two subprojects. During 2001 E.PP.M. conducted internal reviews of the technical and environmental documents and studies. The economic and financial viability analysis concluded that financial risks could be reduced through CER revenues if the project was registered as a CDM. Thus, in the absence of project registration as a CDM, EE.PP.M. would not have made any other project or they would have waited and looked for another CDM project in the future.

However, none of these projects were done due to the same kind of barriers La Vuelta and La Herradura faced at that time. Those barriers could be overcome thanks to CDM (a possibility that EE.PP.M has seriously considered as shown by the three CDM projects submitted). Taking into account the social and economic uncertainties of developing countries, CDM registration is a certain opportunity to overcome this kind of barriers, also contributing to sustainable development.

It is worth recognizing that, when evaluating the implementation of La Vuelta and La Herradura Hydroelectric project, CDM is envisaged not only by its revenues and the added value given by carbon credits but also by other monetarily non quantifiable qualities, such as:

- Positioning of EE.PP.M in an emergent market through the early participation in a learning-by-doing process.
- Gaining public image and recognition through national and international certifications along the assessment process (the whole project cycle).
- Contributing to sustainability and improving social conditions in a scantly developed rural region, among other non-material aspects.

Therefore, EE.PP.M started the development of the PDD and related documents with active involvement and close collaboration with MGM International and not only hiring consultants to develop the studies, which is the business-as-usual in this kind of projects.

Finally, in October 2004 and December 2004, La Herradura and La Vuelta started operating.

---

[9] In particular, EE.PP.M has dispatched to MGM Buenos Aires office a person from the Planning and Energy Sub-Manager Department in order to support work on the PDD and also to further knowledge in this new and evolving concept. The company has also devoted a person of this Department to work in the project baseline determination. Therefore, the CDM portion of the project is highly regarded as a main part of La Vuelta and La Herradura hydroelectric project development.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity

The alternatives identified are the following:

1. Continuation of the current capacity addition trend
2. Implementation of the project without CDM assistance
3. No implementation of any project

Regarding the first alternative, it can be clearly seen that the current trend involves capacity addition using thermal power generation technologies. Since the 1994 power sector reform in Colombia (Law 142 on public services and Law 143 on electricity), capacity additions have been performed by both the public and the private sector. Table 4 shows that independent power producers have privileged gas-based thermal generation. Most of the thermal plants were constructed due to the incentive created by the new electricity market. The only hydro project added in this period, the 405 MW Porce II owned by EE.PP.M, began its construction in 1992 prior to the power sector reform. (EE.PP.M is public sector, but it is highly focused on financial performance to the point that it is the most profitable company in Colombia[10]).

Table 4: Capacity additions, 1995-2001 (values in MW)[11]

Type of generation	Private	Public	Total	%
Hydro	-	405	405	10
Coal	165	150	315	8
Natural gas	2,415	755	3,170	81
Total	2,580	1,310	3,890	-
% by investor	66	34	-	-

Public companies only contributed to 34% of the expansion; therefore, the largest portion was in charge of independent producers. Over 80% of the 1995-2001 capacity addition was natural gas and only 10% was hydro. All the latter were by the public sector. Coal power plants added up to 8% of the total, evenly divided among private and public sectors.

This electricity market behaviour —favouring thermal power plants over hydroelectric projects— has indeed been the experience in all countries —both industrial and developing— where the power sector was deregulated in the 90s.

Independent power producers have diminished their investment rate lately. While capacity additions exceeded 700 MW in 1995 and 1996, they were less than 200 MW in 2001. Guerrilla attacks on the transmission network are partly responsible for this outcome.

The long interconnection lines required for hydroelectric generation have been highly exposed to guerrilla attacks. This leads to prioritize the installation of power plants close to the largest consumption centers; again, favouring thermal power plants.

There are also other factors such as the important increase in natural gas prices in 1999 and some regulatory uncertainties on capacity charge values.

[10] See for example the Colombian journal —Semana July 7, 2003; http://www.semana.com
[11] Source: Reference Expansion Plan 2002-2011, UPME, Bogotá, Oct. 2002.

Colombia's important fuel reserves and the need to guarantee electricity supply through a more balanced mix between thermal and hydroelectric generation[12] have supported the trend towards thermal power generation. (Currently, Colombian reserves are equivalent to 34 years of natural gas production and more than 150 years of coal production).

Sub-step 1b. Enforcement of applicable laws and regulations

All alternatives identified above are in line with all the legal and regulatory requirements of Colombia.

Taking into account the current capacity addition trend, all projects that may be considered (including EE.PP.M. portfolio) are included in the Colombian National Expansion Plan. For this reason, it is assumed that any possible project that starts operations will comply with all the legal and regulatory requirements of Colombia. Moreover, as it was mention in Step 0 of this PDD, the proposed CDM project is operating since the end of 2004.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

An analysis of alternative cost options in terms of investment requirements, NPV and IRR (if corresponds), comparing the proposed project against potential projects by the project developer or other IPP is a way to demonstrate additionality. Then the option chosen is Option II "Investment Comparison Analysis".

Sub-step 2b. – Option II. Apply investment comparison analysis

This analysis is presented for the options handled by EE.PP.M while deciding to go ahead with the proposed project activity under the CDM and also comparing their options with the most attractive options for other IPP.

This analysis also demonstrates that La Vuelta and La Herradura Hydroelectric Project was not a prioritized project of EE.PP.M, but that this project became a priority project due to the anticipated CDM benefits.

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

This sub-step is presented together with **Sub-step 2d: Sensitivity analysis.**

The most attractive options at the time La Vuelta and La Herradura was decided were those related to thermal generation. Table 5 shows a financial analysis.

Table 5: Economic indicators for thermal plants

Power plant	Capacity (MW)	Investment (USD million, Dec. 1996)	NPV (USD million, energy price 33 USD/MWh)	IRR (%)
Simple cycle	300	154	12.6	10.36
Combined cycle	150	113	135.9	19.92

In 2001 EE.PP.M assessed the potential to develop a CDM project in order to contribute to global warming mitigation through an evolving mechanism. EE.PP.M decided to promote a relatively low

[12] Moreover, global climate change now produces more abrupt variations in hydrological cycles, altering water availability and thus hydroelectric generation in an unpredictable way.

investment cost option with an excellent sustainable development contribution. The project itself was not financially viable but CDM benefits were considered as a key factor that helped support the decision- making process, leading to the formulation of the proposed project under the CDM.

By carrying out an NPV analysis of the project, it is obvious that the project could not be developed due to its financial unattractiveness. The required investment is US$ 38.7 million and NPV is negative (−9.1 million US$) without CER revenues, applying a discount rate of 7.86% (WACC).

If carbon credits are considered in the analysis the project's NPV turns positive at approximately US$ 12 per tonne of CO_2e (for example, at 20 US$/t$CO_2e$, the NPV is US$ 6.4 million and the IRR is 9.1%). In conclusion, and from a financial point of view, the project could only be carried out if CER revenues are considered in order to surmount the economic hurdles of the project.

Furthermore, if light variations (±10%) of the discount rate (WACC) used for the project's NPV analysis are applied, NPV still shows negative results, which confirm the robustness of the financial analysis and the trustworthiness of the conclusions derived from it, i.e., that the project could not be carried out without including CER revenues.

Other alternatives (belonging to EE.PP.M. project portfolio) were directly excluded due to huge investment and very negative NPV values.

Besides financial barriers, the project has an important social content contributing to sustainable development, thus providing a motivation to implement it. But it was not a competitive option due to disappointing sectoral circumstances. It is understandable that the company would have waited for another opportunity in the future when sectoral conditions were more appropriate. It was when EE.PP.M realized the valuable opportunity that CDM represents; this played a role speeding up the decision to go on with the project. And what could be better than beginning with a small renewable energy project, reducing also transaction relative costs.

Step 3. Barrier analysis

Sub-step 3a. Identify barriers that would prevent the implementation of the type of the proposed project activity

Barrier due to prevailing practice: hydro plants were not the actual and current practice in the electricity market despite the fact that the national system was highly based on hydroelectricity in the past. In recent years deregulation has strongly favored more economically attractive options based on thermal energy.

Moreover, run-of-river power plants (with Francis turbines) have a very low technological penetration in Colombia.

Sectoral barrier: there were also regulatory uncertainties on capacity charge values, circumstances related to fuel availability and prices, security of the interconnected system which could not be based so strongly on hydroelectricity due to hydrological uncertainties (moreover affected by the consequences of climate change).

Social and institutional barrier: guerrilla attacks on transmission towers mainly affected hydro plants because they are located in rural areas where such attacks were more common.

Political and investment barrier: in addition to the arguments provided in the investment analysis presented above, Colombia was undergoing difficult times, which made also difficult for that project developers to attract investors or get financing from banks.

Although the best alternative for investors is to construct a thermal power plant, the continuation of this capacity addition trend was not a possibility considered by EE.PP.M., since the main objective of the proposed project activity was related to provide clean energy to the west of Antioquia Department, improving the electricity service and contributing to regional development, which is in line with the environmental and social politics of the company.

It is clear that the first alternative identified (current capacity addition trend) is not the best option to contribute to sustainable development, as well as to climate change mitigation.

The need of local sources of generation and the fact that Colombia has 34-year of natural gas reserves and 150-year of coal reserves (if the capacity addition trend continues, it may lead to fuel switching from natural gas to coal, increasing GHG emissions), show that the thermal generation expansion trend would have been continued by other IPPs (situation that might contribute to accelerate climate change and its environmental and social negative consequences).

It is also clear that none of the projects of EE.PP.M portfolio would have been developed since they were quite unviable. This alternative does not face any barrier or risk to the company and it is considered the most plausible scenario that would occur in the absence of CDM incentives.

La Vuelta and La Herradura project is the least investment cost option with the best sustainable development contribution among all projects considered by EE.PP.M. But it was not a competitive option due to the disappointing sectoral circumstances. Thus, it is clearly demonstrated that, in the absence of CDM registration, EE.PP.M. would not have carried out any project.

Step 4. Common practice analysis

As stated above, the Colombian power sector is dominated by hydroelectric generation power plants. However, since 1994's electric sector reform, the capacity addition trend reflects that the thermal generation has been favored. Therefore, the thermal generation dominated the capacity additions since 1994. The only hydropower plant added since the reform, and previous to the consideration of La Vuelta and La Herradura project implementation, was one of 405 MW whose construction started in 1992, previous to the reform. Furthermore, when EE.PP.M. decided to implement La Vuelta and La Herradura project, there were just a few run-of-river hydropower plants in Colombia.

As of September 2005, Colombia had only 6 run-of-river power plants, of which one of them was out of order due to a terrorist attack. The table below provides the list of Colombia's run-of-river power plants.

Table 6: run-of-river power plant as of September 2005

Power plant name	Status
Esmeralda	Operating
Ínsula	Operating
San Francisco	Operating
Florida II	Operating
Río Mayo	Operating
Calderas	Out of order

Therefore, the proposed CDM activity is not a common practice in Colombia.

Step 5. Impact of CDM registration

As it is demonstrated through all the steps analyzed above, the only way to implement the proposed project activity was by overcoming all the stated barriers and by decreasing the associated risks to this kind of project.

La Vuelta and La Herradura subprojects were put on hold until conversations with relevant CDM actors influenced on the project sponsor's point of view —focusing again on run-of-river hydro plants in spite of barriers and political conditions and based on the incentive of getting a new source of income. Those facts contributed to renewing project development, in line with the environmental and social politics of EE.PP.M.

The CDM potential of the subprojects was a crucial incentive for EE.PP.M to consider the opportunity of developing the project activity for registration under the CDM based on the CER revenues and the contribution to the sustainable development in Colombia. Otherwise (without CER incentive), La Vuelta and La Herradura hydroelectric project would have never became a reality.

Another important aspect of the project registration as a CDM project is that the implementation of the project brings technology transfer to a developing country that otherwise would have continued generating electricity with non-renewable sources. The CDM registration may have a replication effect, attracting investors and, in consequence, bringing last generation technology to the country.

Moreover, the project implementation generates CO_2 emission reductions, contributing to GHG atmospheric concentration stabilization.

For all the arguments exposed above, it is clear that the CDM registration was a critical, if not the most important, fact that was taken into account when deciding to implement the proposed project activity.

All the steps of the "Tool for the demonstration and assessment of additionality" were strictly followed, resulting in the demonstration that the proposed CDM project activity is additional.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. It is assumed that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are calculated as follows:

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

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)
$EF_{grid,CM,y}$:	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the TOOL07 "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Since the power plants La Vuelta y La Herradura were implemented as new grid-connected renewable power plants at a site where no renewable power plant was operated prior to the implementation of the project activity, $EG_{PJ,y}$ is given as:

$$EG_{PJ,y} = EG_{facilitly,y} \tag{2}$$

Where:

$EG_{PJ,y}$:	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)
$EG_{facilitly,y}$:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Therefore, the equation for the baseline emissions is:

$$BE_y = EG_{facilitly,y} \; x \; EF_{grid,CM,y} \tag{3}$$

The combined margin emission factor ($EF_{grid,CM,y}$) is calculated following the guidance in the TOOL07 "Tool to calculate the emission factor for an electricity system" (Version 7.0) 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.

STEP 1. Identify the relevant electricity systems.

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 (i.e., La Vuelta y La Herradura) and that can be dispatched without significant transmission constraints. In this case, the project electricity system is given as the interconnected national system, i.e. the national power grid of Colombia.

From paragraph 25 of the tool, option (a) is chose for net electricity imports from connected electricity system, i.e. the emission factor of imports is 0 tons CO_2 per MWh.

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

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* data vintage:

Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

All power plants connected to the interconnected national system are included. Power plants registered as CDM project activities are also included as suggested by the tool. Historical data of the three most recent years is available from XM (Compañía de Expertos en Mercados S.A. E.S.P.), which is the power grid administrator.

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

The simple adjusted operating margin emission factor $EF_{grid,OM\text{-}adj,y}$ (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 (*m*), as follows:

$$EF_{grid,OM-adj,y} = (1-\lambda_y)\cdot\frac{\sum_m EG_{m,y}\cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y\cdot\frac{\sum_k EG_{k,y}\cdot EF_{EL,k,y}}{\sum_k EG_{k,y}} \quad (4)$$

Where:

$EF_{grid,OM\text{-}adj,y}$:	Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
λ_y:	Factor expressing the percentage of time when low-cost/must-run power units are on the margin in 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 *m* in year *k* (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*
y:	The relevant year as per the data vintage chosen in Step 3

The lambda factor (λ) is determined as:

$$\lambda = \frac{number\ of\ hours\ per\ year\ low-cost/must-run\ sources\ are\ on\ the\ margin}{8760\ hours\ per\ year} \quad (5)$$

According to the methodology, there are two approaches to determine lambda (λ_y). Approach 2 is chosen; therefore, lambda of a year (λ_y) is determined by applying the step wise procedure provided in appendix 3 of the TOOL07:

Step i) Plot a load duration curve
Collect chronological load data (typically in MW) for each hour of the year *y*, and sort and plot the load data from the highest to the lowest annual system load. Plot MW against 8,760 hours in the year, in descending order. See Figure 4 below.

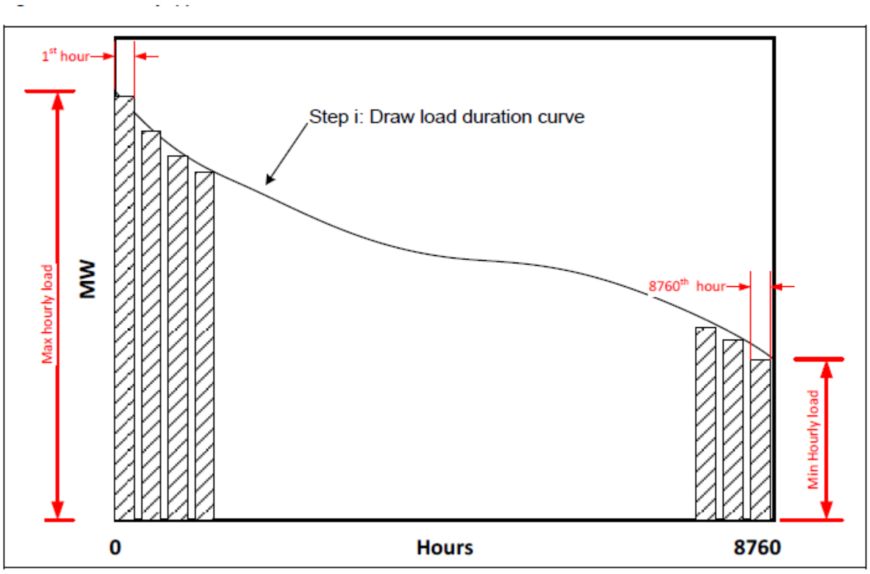


Figure 4. Step (i) to determine the lambda of a year (λ_y).

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

Step iii) Fill 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 resources. The following sub steps are used to find the intersection point:

(a) As the load changes every hour from highest load to lowest load in a year, the intersection can be defined by adding incremental areas in MW times hour in every hour over the area corresponding to lowest annual system load. For the first area from the sorted load data, take the lowest MW level and multiply it by hours in a year (e.g. 8,760). See Figure 5 below:

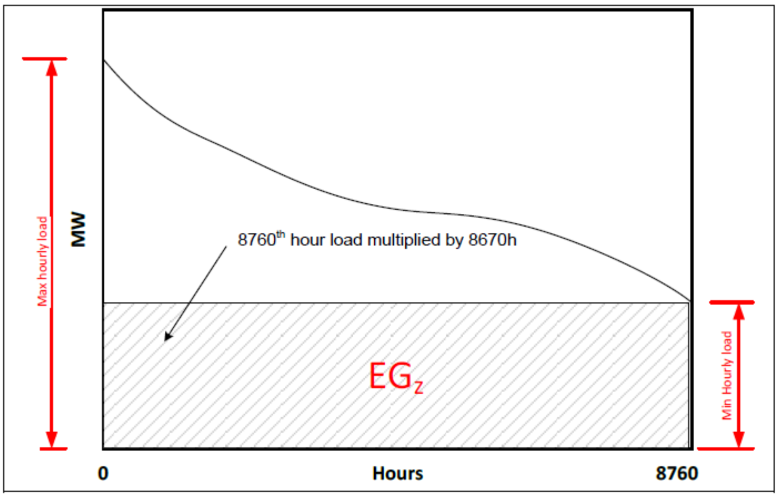


Figure 5. Step iii (a).

(b) For the following areas from the sorted load data take the level next to the one from the previous step, subtract the load from the previous level and multiply the result by number of hours that corresponds to this level (Figure 6 below).

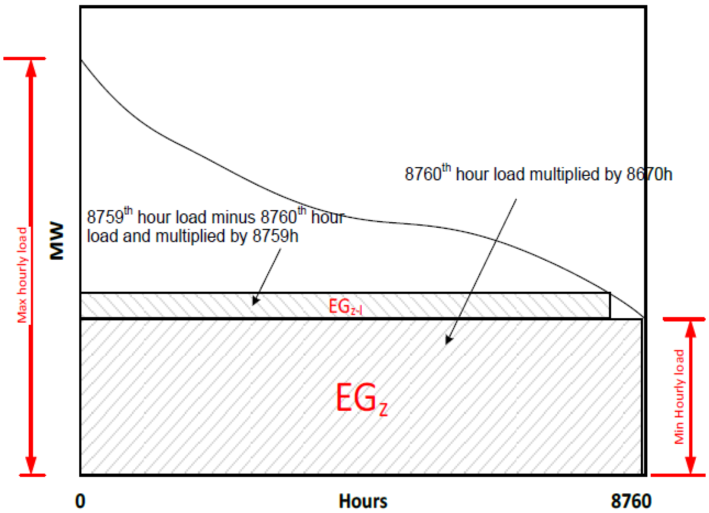


Figure 6. Step iii (b).

(c) Calculate the cumulative electricity generation.

(d) Check the cumulative electricity generation against the total generation (in MWh) from low-cost/must-run power plants/units till $EG_{cumul} \geq \Sigma_k EG_{k,y}$. See Figure 7 below.

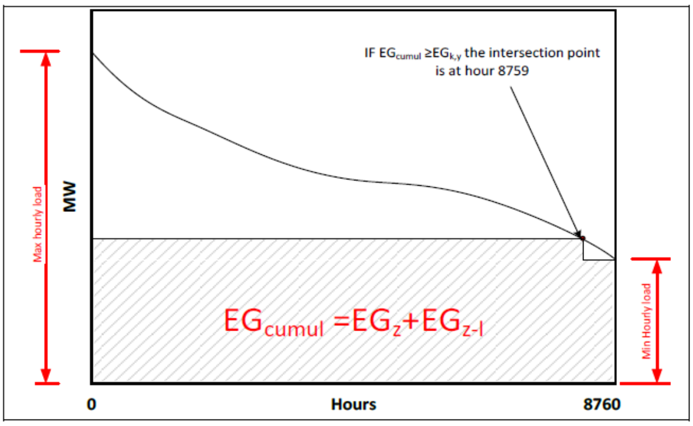


Figure 7. Step iii (d).

Step iv) Determine the "Number of hours per year 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 8,760 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. Lambda is the calculated number of hours, divided by 8,760. See Figure 8 below.

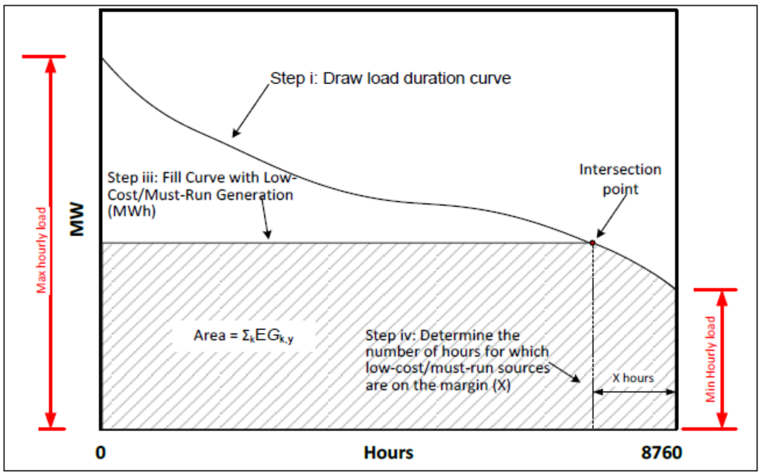


Figure 8. Step iv.

<u>Determination of $EF_{EL,m,y}$</u>

The emission factor of each power unit *m* is determined as follows:

For all power units *m* for which data on fuel consumption and electricity generation is available, option A1 of the tool is chosen as the most appropriate approach. This is the case for all power plants with at least 20 MW, which based on the regulatory requirement, have to report fuel consumption that are published by the grid administrator (see EF spreadsheets "2015 EFOM plants", "2016 EFOM plants" and "2017 EFOM plants" in file named "LV LH combined_OM_BM_EF_Lambda_method_2017 v5").

$$EF_{EL,m,i,y} = \frac{\sum FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad (6)$$

Where:

$EF_{EL,m,y}$:	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$:	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$:	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$:	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$EG_{m,y}$:	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m:	All power units serving the grid in year *y* except low-cost/must-run power units
i:	All fuel types combusted in power unit *m* in year *y*
y:	The relevant year as per the data vintage chosen in Step 3

For all power units *m* for which data on fuel consumption is not available, option A2 is chosen. This is the case for minor power plants with less than 20 MW, which do not have to report fuel consumption (see EF spreadsheets "Heat rates minors"). Where several fuel types are used in the power unit, the fuel type with the lowest CO_2 emission factor is used.

$$EF_{EL,m,y} = \frac{EF_{CO2,i,y} \times 3.6}{\eta_{m,y}} \quad (7)$$

Where:

$\eta_{m,y}$: Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

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

For the first crediting period, the vintage data for the build margin were chosen as per option 2 of the tool:

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, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Therefore, the *ex ante* option is applied for the second crediting period, as well as for the third crediting period.

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 are determined as per the following procedure:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in 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});

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 activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, 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. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), 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, in this case all steps (a) to (f) need to be applied and the resulting sample group of power units *m* is the $SET_{sample\text{-}CDM\text{->}10yrs}$

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, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum EG_{m,y} \times EF_{EL,m,y}}{\sum EG_{m,y}} \quad (8)$$

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

TOOL07 - Tool to calculate the emission factor for an electricity system (version 07.0), indicates that for the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Step 6: Calculate the combined margin (CM) emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \qquad (9)$$

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 third crediting period, i.e. $W_{OM} = 0.25$ and $W_{BM} = 0.75$.

Project emissions

Some project activities may involve project emissions that can be significant. These emissions comprehend project emissions from fossil fuel consumption, project emissions from the operating of dry, flash steam or binary geothermal power plants and project emissions from water reservoirs of hydro power plants in year *y*.

The ACM0002 methodology indicates that for all renewable energy power generation project activities (such as La Vuelta and La Herradura Hydroelectric Project), emissions due to the use of fossil fuels for the backup generator can be neglected.

On the other hand, project emissions coming from the operating of dry, flash steam or binary geothermal power plants apply exclusively for geothermal project. Therefore, these emissions do not apply to La Vuelta and La Herradura Hydroelectric Project.

Finally, project emissions from water reservoirs of hydro power plants must be considered. The power density (*PD*) of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

$PD_{La\ Vuelta} = 3{,}332.44\ W/m^2$

$PD_{La\ Herradura} = 10{,}409.88\ W/m^2$

If more details are needed, see section B.2.

According to paragraph 41 of the ACM0002 version 19.0, since the power densities of both small hydroelectric projects are greater than 10 W/m^2, $\boldsymbol{PE_y = 0}$**.** Thus, project emissions of renewable power generation project are not relevant for the project activity.

Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are neglected as suggested by the methodology.

Emission reductions

Since project emissions and leakage emissions are zero, emission reductions are directly given as the baseline emissions as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y:	Emission reductions in year *y* (tCO_2e/yr)
BE_y:	Baseline emissions in year *y* (tCO_2/yr)
PE_y:	Project emissions in year *y* (tCO_2e/yr)

B.6.2. Data and parameters fixed ex ante

Data/Parameter	***$EF_{CO2,i,y}$, $EF_{EL,m,i,y}$ and $EF_{EL,k,i,y}$***
Data unit	kg/TJ
Description	CO_2 emission factor of fossil fuel type *i* for power plant *m* or *k* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value(s) applied	Diesel oil = 72,600 kg/TJ Residual fuel oil = 75,500 kg/TJ Natural gas = 54,300 kg/TJ Subbitouninous coal = 92,800 kg/TJ Other bituminous coal = 89,500 kg/TJ
Choice of data or measurement methods and procedures	The CO_2 emission factor is used to calculate the CO_2 emission coefficients of the power plants in the grid. Step necessary to find the baseline emission of the grid according to the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0). Simple adjusted OM: once for each crediting period using the most recent three historical years: 2015-2017 (ex ante option) for the third crediting period. BM: for the third crediting period, the *ex ante* BM calculation at the start of the second crediting period will be used.
Purpose of data	Calculation of baseline emissions.
Additional comment	For those power plants with information on the heat rate from XM, it has been calculated the EF following the TOOL07. For those without information on the heat rate, it has been taken the official values from UPME, which also follow the TOOL07.

Data/Parameter	***$EG_{m,y}$ and $EG_{k,y}$***
Data unit	MWh
Description	Net electricity generated and delivered to the grid by power unit *m* or *k* in year *y*
Source of data	Data recorded, archived and supplied by the Colombian National Dispatch Center, CND available in: http://informacioninteligente10.xm.com.co/oferta/Paginas/HistoricoOferta.aspx
Value(s) applied	It varies by plant and year. CND keeps records of this variable for its users.
Choice of data or measurement methods and procedures	The data are suitable for the calculation of the national grid emission factor following the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0). Simple adjusted OM: once for each crediting period using the most recent three historical years: 2015-2017 (*ex ante* option) for the third crediting period. BM: for the third crediting period, the *ex ante* BM calculation at the start of the second crediting period will be used.
Purpose of data	Calculation of baseline emissions
Additional comment	This value is calculated ex-ante and will be used throughout the crediting period.

Data/Parameter	***$\eta_{m,y}$ and $\eta_{k,y}$***
Data unit	Dimensionless
Description	Average net energy conversion efficiency of power unit *m* of *k* in year *y*
Source of data	For grid power plants: data from XM - the National Dispatch Center
Value(s) applied	See spreadsheet “Emission Factors per Plant” in file “LV LH combined_OM_BM_EF_Lambda_method_2017 v5”
Choice of data or measurement methods and procedures	As per the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0).
Purpose of data	Calculation of baseline emissions
Additional comment	This value is calculated ex-ante and will be used throughout the crediting period.

Data/Parameter	***$EF_{grid,OM,y}$***
Data unit	tCO_2/MWh
Description	Operation margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0).
Source of data	Ex-ante calculations
Value(s) applied	0.6541
Choice of data or measurement methods and procedures	As per the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0).
Purpose of data	Calculation of baseline emissions
Additional comment	This value is calculated ex-ante and will be used throughout the crediting period.

Data/Parameter	***$EF_{grid,BM,y}$***
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0).
Source of data	Ex-ante calculations
Value(s) applied	0.3804
Choice of data or measurement methods and procedures	As per the TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0).
Purpose of data	Calculation of baseline emissions
Additional comment	This value is calculated ex-ante and will be used throughout the crediting period.

Data/Parameter	***$EF_{grid,CM,y}$***
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the TOOL07 "Tool to calculate the emission factor for an electricity system" (version 7.0).
Source of data	Calculated in accordance with the TOOL07 "Tool to calculate the emission factor for an electricity system" (Version 7.0) based on fuel consumption of the individual power plants connected to the grid. All data used for the analysis is from "XM Compañía de Expertos en Mercados S.A. E.S.P.", which is the market administrator, and being in charge of the National Dispatch Center.
Value(s) applied	0.4488 tCO_2/MWh
Choice of data or measurement methods and procedures	This is in accordance with the methodology ACM0002 (version 19.0).
Purpose of data	Calculation of baseline emissions
Additional comment	For the build margin, the ex-ante option is applied as given in the TOOL07 "Tool to calculate the emission factor for an electricity system" (version 7.0). The operating margin is reassessed according to the afore-mentioned tool. ***$EF_{grid,CM,y}$*** is calculated ex-ante and will be used throughout the crediting period.

Data/Parameter	***Cap_{BL}***
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data	Project site
Value(s) applied	Because La Vuelta and La Herradura were new hydroelectric power plants, Cap_{BL} is zero for each hydroelectric plant. Thus: $Cap_{BL\ La\ Vuelta}$ = 0 W $Cap_{BL\ La\ Herradura}$ = 0 W
Choice of data or measurement methods and procedures	As is suggested by the methodology ACM0002 "Grid-connected electricity generation from renewable sources" (Version 19.0).
Purpose of data	Calculation of baseline emissions
Additional comment	These values will be used throughout the crediting period

Data/Parameter	***A_{BL}***
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data	Project site
Value(s) applied	Because La Vuelta and La Herradura were new reservoirs, A_{BL} is zero for each hydroelectric plant. Thus: $A_{BL\ La\ Vuelta}$ = 0 W $A_{BL\ La\ Herradura}$ = 0 W

Choice of data or measurement methods and procedures	As is suggested by the methodology ACM0002 “Grid-connected electricity generation from renewable sources” (Version 19.0).
Purpose of data	Calculation of baseline emissions
Additional comment	Indicated values will be used throughout the crediting period

Data/Parameter	***Percentage share of total installed capacity of the specific technology***
Data unit	%
Description	The percentage share of total installed electricity capacity which comes from the water resource related to the total installed grid connected power generation capacity in Colombia
Source of data	Data supplied by the XM - Colombian National Dispatch Center, (CND)
Value(s) applied	XM informed that electricity that comes from water in Colombia in 2018 represented 67.77% of the generation mix. Total installed capacity of the specific technology: 11,820.67 MW. Total installed grid connected power generation capacity in Colombia: 17,443.25 MW
Choice of data or measurement methods and procedures	As per the ACM0002 “Grid-connected electricity generation from renewable sources” (version 19.0), section 5.10 Data and parameters not monitored, paragraph 66, Data / Parameter table 9
Purpose of data	Demonstration of additionality
Additional comment	Indicated value will be used throughout the crediting period

Data/Parameter	***Total installed capacity of the technology***
Data unit	MW
Description	The total installed capacity of the water electricity in Colombia
Source of data	Data supplied by the XM - Colombian National Dispatch Center, (CND)
Value(s) applied	XM informed that electricity total installed capacity coming from water resources in Colombia in 2018 was 11,820.67 MW.
Choice of data or measurement methods and procedures	As per the ACM0002 “Grid-connected electricity generation from renewable sources” (version 19.0), section 5.10 Data and parameters not monitored, paragraph 66, Data / Parameter table 10
Purpose of data	Demonstration of additionality
Additional comment	Indicated value will be used throughout the crediting period

B.6.3. Ex ante calculation of emission reductions

As shown above, the emission reductions are directly given by the baseline emissions and are calculated as follows:

$ER_y = BE_y = EG_{facility,y} \times EF_{grid,CM,y}$ = 187,660 MWh/yr × 0.4488 tCO_2e/MWh = **84,221 tCO_2/y**

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 ($t\ CO_2e$)
2019	84,221	0	0	84,221
2020	84,221	0	0	84,221
2021	84,221	0	0	84,221
2022	84,221	0	0	84,221
2023	84,221	0	0	84,221
2024	84,221	0	0	84,221
2025	84,221	0	0	84,221
Total	**589,547**	0	0	**589,547**
Total number of crediting years	7 (in third crediting period)			
Annual average over the crediting period	**84,221**	**0**	**0**	**84,221**

Note that the baseline emissions shown in the table are reduced in decimals (rounded down).

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/unit to the grid in year *y*
Source of data	Electricity meters read by Empresas Públicas de Medellín.
Value(s) applied	It varies by year, depending of different external and internal conditions (water flow, the indications of the National Dispatch Center, the maintenance procedures, among others). CND keeps records of this variable. Hourly values reported by CND, which monitors continuously the value of this variable. Average annual generation is expected to be 187,660 MWh/y.

<table>
<tr><td>Measurement methods and procedures</td><td>Following Colombian regulations, the electricity generation from each power plant connected to the grid will be monitored on site using metering equipment located at the commercial frontier, which will be located in Chorodó substation, connecting La Vuelta and La Herradura Hydroelectric Project power with the national interconnected system. In Colombia, The Measurement Code “Código de Medida” establishes mandatory high technical standards, procedures for reading, registering and recording activities of electricity transactions performed in the Colombian energy market. This code is part of the CREG´s existing resolution, which is followed for electricity output measurements.
The net generation is continuously measured, hourly registered and monthly recorded with the following electricity meters located at the substation “Chorodó”. The meters are bi-directional and therefore measure the net balance of the quantity of electricity supplied by the project plant to the grid and the quantity of electricity delivered to the project plant from the grid (as given in the methodology).

<table><tr><th>Plant</th><th></th><th>Class</th></tr><tr><td rowspan="2">La Vuelta</td><td>Main</td><td>0.2S</td></tr><tr><td>B. up</td><td>0.2S</td></tr><tr><td rowspan="2">La Herradura</td><td>Main</td><td>0.2S</td></tr><tr><td>B. up</td><td>0.2S</td></tr></table></td></tr>
<tr><td>Monitoring frequency</td><td>The energy meters are read via the MV-90i software every 24 hours using tele-measurement technology (remotely) by the “Equipo de Medida” (Measurement Team) of EPM.</td></tr>
<tr><td>QA/QC procedures</td><td>Calibration tasks follow national standards and are in accordance with the calibration instructive specified in Colombian standard NTC 4856 for electricity metering devices. The calibration frequency is in accordance with Energy and Gas Regulation Committee -CREG- (Comisión de Regulación de Energía y Gas, CREG, by its acronym in Spanish).
EPM has adopted its own procedure based on the Colombian technical norm NTC-ISO-IEC 17025 and NTC 4856, under the so-called “Instructive to perform on-site electricity meter proofs with a pattern metering device” (DIS-EM-LE-IN-009-01). This procedure is carried out to verify that the meters are working properly with the corresponding accuracy. They are also checked for alarms.
The electricity generated by La Vuelta and La Herradura Hydroelectric Project will be cross check with net electricity generation registered by the Colombian National Dispatch Center (CND), correcting the measure taking into account the transmission losses, estimated based on the technical specifications of the transmission line.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of yearly emissions</td></tr>
<tr><td>Additional comment</td><td>All data collected as part of the monitoring process is archived electronically and kept at least for two years after the end of the last crediting period.
All metering devices used to monitor and measure data follow rules that have been issued by the CREG, which specifies the technical characteristics measurement, telecommunications and back-up equipment to meet installation, testing, certification, operation and maintenance procedures.</td></tr>
</table>

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

Value(s) applied	***Cap**La Vuelta*: 12,400,000 W ***Cap**PJLa Herradura*: 21,080,000 W (total of two turbines; each turbine capacity is 10.54 MW)
Measurement methods and procedures	Installed capacity based on manufacturer's specifications
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Purpose of data	Verification of the installed capacity of each hydro power plant after the implementation of the project activity
Additional comment	According to ACM0002: Grid-connected electricity generation from renewable sources - version 19.0)

Data/Parameter	***A**PJ*
Data unit	m^2
Description	Area of the single reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site. Dimensions of the water intake infrastructure on La Herradura river for La Vuelta and for La Herradura small hydroelectric plants.
Value(s) applied	The water river flow is conducted to an intake of the following dimensions: 61 m (length) and 61 m (width) for La Vuelta small hydroelectric plant. 45 m (length) and 45 m (width) for La Herradura small hydroelectric plant. ***A**La Vuelta*: 3,721 m^2 ***A**La Herradura*: 2,025 m^2
Measurement methods and procedures	Area of each intake measured on site
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Purpose of data	Verification of the area of the single reservoir measured in the surface of the water, after the implementation of La Vuelta and La Herradura hydroelectric project
Additional comment	According to ACM0002: Grid-connected electricity generation from renewable sources - version 19.0)

B.7.2. Sampling plan

There is no sampling involved in the monitoring of the proposed project activity.

B.7.3. Other elements of monitoring plan

The Monitoring Plan is based on recording electricity generation of La Vuelta and La Herradura power plants.

This type of project requires only straightforward collection of data, as described below.

Considering the project boundary and that the combined margin CO_2 emission factor is determined *ex ante*, only the electricity generation of the hydroelectric plants of the project need to be monitored in order to calculate baseline emissions and emission reductions.

The power plants La Vuelta and La Herradura belong to the Metropolitan Area under the *"Subgerencia Operación"* of the *"Gerencia Generación Energía"* in charge of the operation and maintenance of the power plants. Monitoring procedures can be implemented on site or remote, using tele-measurement technology. The *"Equipo de Medida"* (Measurement Team) of EPM is in charge of taking the measurements. The Measurement Team is responsible for reporting to XM on the Generation Boundaries, the boundaries between the agents and the large energy clients supplied by EPM. In the case of La Vuelta and La Herradura, the energy meters (in Chorodó substation) are read via the MV-90i software every 24 hours and uploaded in the *GCE-Grandes Clientes de Energía* software.

Once the information is uploaded, a file is created: cr41/mes/día.TXT and it is sent to XM. The codes assigned by XM to this project are:

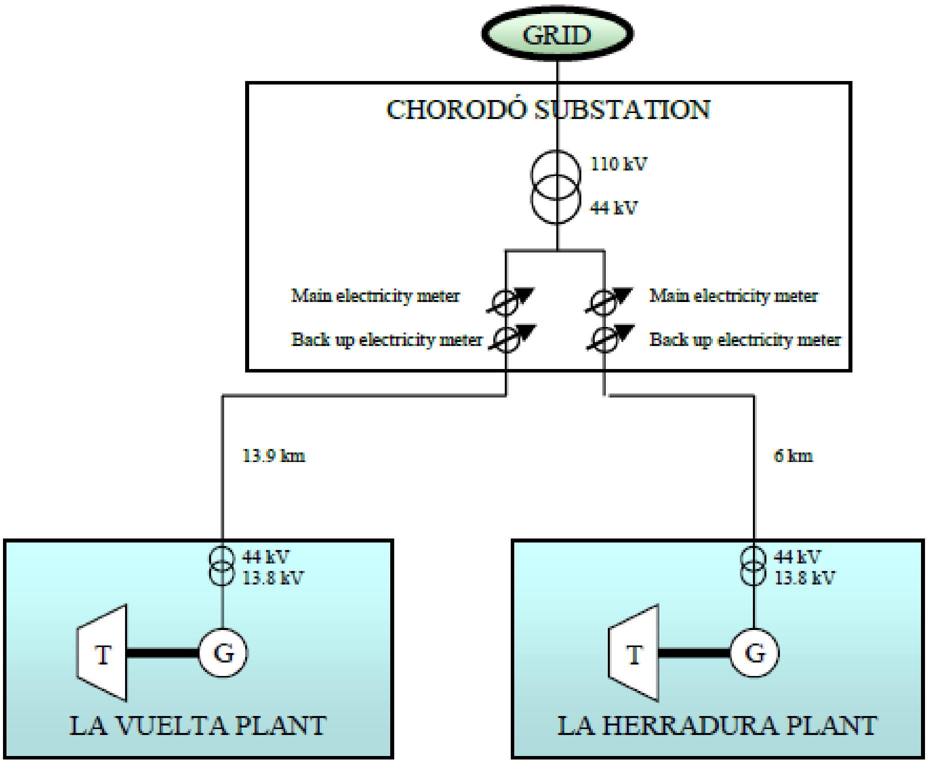
EVLT1001 LA VUELTA
EHRD1001 LA HERRADURA

Electricity generation is measured by *electronic electricity meters*. The values are cross-checked with the generation measured in terminals and vs. SCADA system ("Supervisory Control And Data Acquisition"). If any erroneous measurement is identified, EPM is obliged by the system administrator to take corrective measures. Since the invoicing process is based on the reported data, any identified erroneous measurement is handled in a conservative way, assuring by the system administrator that the reported energy does not exceed the real generation.

Each electricity meter has a backup meter as indicated in section B.7.1, which assures correct measurement in case of failures of the main electricity meters. If any other emergency would not allow measuring correctly the power generation of the plants 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.

This information is backed up by the IT Department of EPM through the software for *GCE-Grandes Clientes de Energía ("*Large Energy Consumers"). Daily data are read remotely using *MV-90xi* software. The IT Department (*Unidad Informática Energía*) does information backups of the *GCE* database on a daily basis at 8.00 PM through the SQL Server. The backup of the previous day is overwritten by the new one. During the day, backups of the transaction log from the same database are made every three hours. The files are copied to a tape every day during a week. In this way, there is always an available backup of the previous week. Additionally, a tape is kept per week during a month and a tape per months during three months. Finally, the data is included in an excel spreadsheet for emission reductions calculations on a monthly basis. All data collected as part of the monitoring process is archived electronically and kept at least for two years after the end of the last crediting period.

The following scheme shows the power plants, the substation and the metering points:



QA/QC measures

Calibration tasks follow national standards and are in accordance with the calibration instructive specified in Colombian standard NTC 4856 for electricity metering devices.

EPM has adopted its own procedure based on the Colombian technical norm NTC-ISO-IEC 17025 and NTC 4856, under the so-called ―Instructive to perform on-site electricity meter proofs with a pattern metering device‖ (DIS-EM-LE-IN-009-01). This procedure is carried out to verify that the meters are working properly with the corresponding accuracy.

Personnel responsible for CDM monitoring

Figure 5 shows the organizational chart of the monitoring.

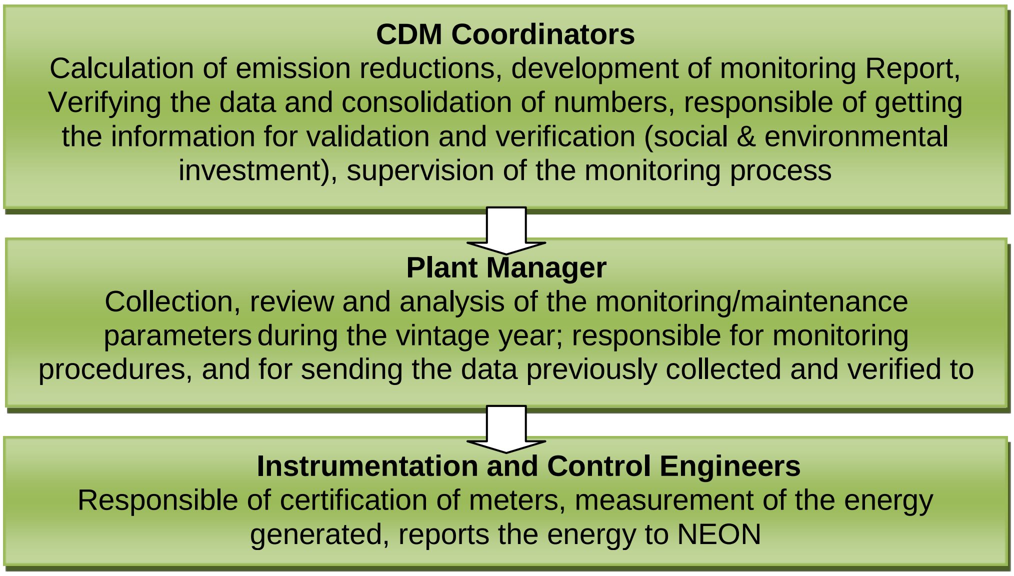


Figure 5: Operational Structure of the monitoring plan

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 develop the monitoring report in accordance with the UNFCCC rules.

- The Plant Manager is responsible for verification of energy measurement. He is responsible for checking and verifying the meter readings downloaded by the Instrumentation and Control Engineer.

- The Instrumentation and Control Engineers are responsible for electricity generation reading and for processing the energy produced by La Vuelta and La Herradura from the meters installed at Chorodó substation on a monthly basis. Records of the meter are downloaded in a spreadsheet for measurement control and the data discharged from the meter is stored electronically and sent to NEON (www.xm.com.co).

Personnel who carry out monitoring tasks are familiar with the basic CDM requirements and structures. New personnel have to participate in a basic training in order to get familiarized with the CDM monitoring procedures. 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 as part of the daily operation, no specific training is required. Moreover, the project has already been monitoring its emission reductions during a complete crediting period and the personnel have acquired sufficient experience. The experienced CDM Coordinators that are part of EPM's ―Climate Change Group‖ have wide knowledge of the CDM process and assure correct fulfillment by supervising the personnel involved in the monitoring. They also carry out corrective actions if any inconsistency is identified and train the Plant Manager and the Instrumentation and Control Engineers if necessary.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

15/04/2002.

The starting date of the project activity is given by the construction start of La Vuelta.

C.2. Expected operational lifetime of project activity

50 years and zero months[13].

C.3. Crediting period of project activity

C.3.1. Type of crediting period

The project was registered on January 15, 2007, with a 7-year renewable crediting period. The first 7-year renewable crediting period started on 01/01/2005 and ended on 31/12/2011. The second 7-year renewable crediting period started on 01/01/2012 and will end on 31/12/2018.

This document corresponds to the third 7-year renewable crediting period.

C.3.2. Start date of crediting period

01/01/2019 (third crediting period).

C.3.3. Duration of crediting period

Seven years and zero months.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The full assessment of environmental impacts was done during original validation of the project. Therefore, paragraph afterwards, are a copy of the PDD presented by the original validation.

Before constructing La Vuelta and La Herradura power plants, an Environmental Impact Assessment (EIA) was carried out by INTEGRAL Ingeniero Consultores in order to present the project to the environmental authorities in accordance with the law 99 from 1993.

---

[13] http://www.elcolombiano.com/negocios/economia/se-represan-las-futuras-grandes-hidroelectricas-en-el-pais-HG7118988 y https://repository.cesa.edu.co/bitstream/handle/10726/1855/MFC_814.pdf?sequence=1&isAllowed=y pág. 10, 22, 27.

The objective of the EIA is to guarantee the correct use of resources and minimize their negative impact, particularly:

i. Describe the environment in the region of the project in order to obtain the necessary knowledge for the evaluation and planning of the impacts generated by the project.
ii. Diagnosis of potential positive and negative impacts generated by the construction and operation of the project.
iii. Assessment to organize hierarchically the environmental impacts
iv. Develop the environmental management plan
v. Proposal of monitoring and control measurements

The conclusions of the EIA were positive and allowed the issuance of the environmental license and the construction permits:

vi. The environmental aspects in the region are hardly affected by the project.
vii. There are no economic, social or cultural activities in the region that could be affected by the project.
viii. The discharge of the Herradura river to the Cañasgordas river will decrease the flow in the Herradura river. However, in the relevant section, there are several tributary rivers that help to mitigate this effect.
ix. The discharge of the Herradura river to the Cañasgordas river will increase of the flow in the Cañasgordas river. Since that river has a very irregular hydrology (periodical fluctuations in the average flow), the new conditions will not affect significantly the river.

D.2. Environmental impact assessment

Environmental management plan:

La Vuelta and La Herradura hydroelectric plants apply an environmental management plan that includes actions towards mitigating the negative impacts on environment during operation of the plants. In addition, EPM develops a discretionary environmental management plan that involves physical-biotic and social aspects to protect natural resources and to promote a sustainable development of the hydroelectric complex. The plan consists of:

<u>Management of Environmental Impacts:</u>

- The Environmental Licenses consider concessions and permits of spills and river banks occupation and adaptation of the internal ways of the hydroelectric plants. To achieve this, the information requirements of the *Corporación Autónoma Regional Corpourabá* (Autonomous Regional Corporation of Corpourabá) need to be met regarding environmental monitoring programs.
- Report on turbinated flows once every three months to the Corporación Autónoma Regional Corpourabá (Autonomous Regional Corporation of Corpourabá).
- Monitoring and control of the flow designated for energy generation and for water consumption.
- Inspection and maintenance of domestic wastewater treatment systems belonging to the hydroelectric system facilities.
- Monitoring of domestic wastewater treatment systems in order to verify the efficiency and the compliance with the estimated removal percentages in accordance with the environmental law.
- Implementation of a solid wastes management system including different containers corresponding to different type of solid wastes. Moreover, tows and sheets soaked with oils are delivered to a third party for treatment and final disposal in accordance with the applicable law.
- Visits from officials of the Corporación Autónoma Regional Corpourabá (Autonomous Regional

Corporation of Corpourabá) to do the follow up of the application of the plan and to identify opportunities for improvement.

Additional discretional programs of environmental management

Process of Environmental Impacts Management:

- Hydrologic monitoring: rainfall, runoff, transport of sediments and water quality of the main source.
- Water quality monitoring of the sources that supply drinking water to the facilities of the hydroelectric complex.

Process of Conserving Natural Resources

- Geomorphologic study of La Herradura River and its river dynamics in order to implement measures to control the critical factors that generate the torrential conditions and the high production of sediments in the basin.
- In 2007, the recovery of several points of erosion of the La Herradura River basin was initiated. In this regard, 22,500 m^2 of affected areas due to erosion were identified. It is necessary to implement activities tending to protect the surface, control of runoff and stabilization of the areas in order to control the supply of sediments that affect the machines that generate energy.

Process of Voluntary Social Management:

- Joint participation between Empresas Públicas de Medellín E.S.P. and municipalities in the development of productive projects.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The full assessment of local stakeholder consultation was done during the original validation of the project. Therefore, paragraph afterwards, are a copy of the PDD presented by the original validation.

The process followed to collect stakeholder comments was a consultation through a survey for the evaluation of the environmental performance of La Vuelta and La Herradura subprojects.

The following set of questions was sent to local stakeholders, during May and June, 2003:

1. Do you believe that the socio-economic situation of the region will improve due to the implementation of “La Vuelta” and “La Herradura” hydro projects?
2. Is the implementation of projects able to improve the environmental situation in the region?
3. How does the development of projects affect you (positively or negatively) or on your environment?
4. Would you recommend private companies or authorities to develop projects of this nature?
5. Do you think “La Vuelta” and “La Herradura” will contribute to the Sustainable Development of Colombia?
6. Any additional comments you would like to make.

The surveys addressees were:

1. Dr. Adiela Reyes Collazos. Head of Planning at Frontino Municipality and Member of the Supervising Committee for the Hiring of the Project Staff.

2. Dr. Diana Jannet Zapata. Frontino Municipality Representative and Member of the Supervising Committee for the Hiring of the Project Staff.
3. Tech. Elkin Jaramillo Vergara. Director of the Farming and Environment Technical Assistance Unit of Frontino Municipality.
4. Eng. John Fredy Cardona. Manager of the Far East Public Administration Company – Empucol Ltd. (a company belonging to the municipalities of the region).
5. Dr. Rubén Rojo Moreno. Mayor of Abriaquí Municipality.
6. Soc. Doris Eugenia Montoya Álvarez. Community Development of the Abriaquí Municipality.
7. Eng. Jairo de Jesús Ortiz Rojas. Head of Planning of Cañasgordas Municipality and Member of the Supervising Committee for the Hiring of the Project Staff.
8. Tech. Humberto Quintero Manco. Head of Public Works at Cañasgordas Municipality and Member of the Supervising Committee for the Hiring of the Project Staff.
9. Ms. Elvia Rosa Ramos Henao. Corregidor at Abriaquí Municipality and Member of the Supervising Committee for the Hiring of the Project Staff.
10. Mr. Luis Fernando Zapata. Mayor of Cañasgordas Municipality.
11. Eng. Edison Isaza Ceballos. Manager of Corpourabá at Urabá region.

E.2. Summary of comments received

A synthesis of the comments received is summarized in Table 12. The most important point highlighted by local stakeholders is added to the answers.

Table 7: Stakeholder comments.

Persons / **Questions**	**Manager Empucol Ltd**	**Head of Planning Frontino**	**Representa tive Frontino**	**Director of Farming and Environmen t**	**Manager Corpourabá**
Do you believe that the socio- economic situation of the region will improve due to the implementation of “La Vuelta” and “La Herradura” hydro projects?	yes, employment generation and improvement of regional economics	yes, social and economics improvements	yes, under correct funds destination	yes, employment generation	yes, employment generation
Is the implementation of projects able to improve the environmental situation in the region?	indifferent	yes, reforestation	yes	yes	yes, under right use of electric sector transferences
How does the development of projects affect you (positively or negatively) or on your environment?	positively	positively		positively, under correct use of royalties	positively, strengthening of the region
Would you recommend private companies or authorities to develop projects of this nature?	yes	yes	yes, improvement of life quality	yes	yes, contribution to the electricity system
Do you think “La Vuelta” and “La Herradura” will	yes	yes	yes	yes	yes, depending on political

contribute to the Sustainable Development of Colombia?					decisions
Any additional comments you would like to make	needs for more investments	high employment rate		helping regional development	

E.3. Consideration of comments received

The comments received by local stakeholders were highly positive. They were in line with a previous survey performed for identifying the main social and environmental concerns of local community, as a part of the environmental impact study and following tasks. The main issues and needs for corrective actions were already taken into consideration by EPM in order to comply with the Environmental Management Plan Following recommendations.

SECTION F. Approval and authorization

The letters of approval of the Parties for the project activity are available on the UNFCCC website of the registered project (of the first crediting period), including Colombia, Japan and Switzerland:

http://cdm.unfccc.int/Projects/DB/DNV-CUK1161865279.03/view

Appendix 1. Contact information of project participants

Organization name	Empresas Públicas de Medellín E.S.P.
Country	Colombia
Address	Carrera 58 No. 42 – 125 Medellín, Antioquia
Telephone	(574) 380 2245 (574) 380 4445
Fax	(574) 380 6752
E-mail	oscar.fernandez@epm.com.co isabel.giraldo.ospina@epm.com.co
Website	www,epm.com.co
Contact person	Óscar Alonso Fernández Taborda Isabel Cristina Giraldo Ospina

Organization name	MGM Carbon Portfolio, S.a.r.l.
Country	Luxembourg
Address	
Telephone	+1.786.425.9251
Fax	
E-mail	mgmcp@mgminter.com
Website	
Contact person	Pablo Fernandez de Mello e Souza

Appendix 2. Affirmation regarding public funding

There is no public funding in this project.

Appendix 3. Applicability of methodologies and standardized baselines

All information on the validity of the selected methodology is provided in Section B.2.

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

All information about the ex ante calculation of emission reductions over third crediting period (2019-2025) is provided in the file named "LV LH combined_OM_BM_EF_Lambda_method_2017 v5".

Data for calculating the Operating Margin emission factor
The method used to calculate the OM is the simple adjusted ex-ante option. Table 8 presents the main findings:

Table 8: Summary of combined margin CO_2 emission factor calculation.

	2015	2016	2017
Electricity generation (MWh)	66,548,474	65,940,002	66,666,980
Electricity generation – low cost/must run (MWh)	44,750,278	46,951,755	57,660,650
Electricity generation – cogeneration plants (MWh)	1,043,200	1,139,437	1,116,710
Electricity thermal generation plants (MWh)	20,754,996	17,848,810	7,889,620
CO_2 emissions – LCMR (tCO_2), except cogeneration plants	0	0	0
CO_2 emissions – cogeneration plants (tCO_2)	2,536,785	3,054,039	3,081,840
CO_2 emissions – thermal generation plants (tCO_2)	15,176,659	13,058,803	5,764,848
Lambda factor	0.0026	0.0128	0.3243
Operating Margin Emission Factor (tCO_2/MWh)	0.7295	0.7231	0.5107

All the data presented in the above tables was provided by XM and UPME and is considered official information.

Data for calculating the Build Margin emission factor

According to the TOOL07 "Tool to calculate the emission factor for an electricity system" (version 07.0), the build margin emission factor calculated for the second crediting period should be used, should be used for the third crediting period. For the second crediting period, the build margin emission factor was dated 2010. Thus, $EF_{grid,BM,2010}$ = 0.3804 tCO_2/MWh.

For more details, it is suggested to revise the file named "LV LH combined_OM_BM_EF_Lambda_method_2017 v5".

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

A post registration change (PRC ref No. PRC-0735-001) was submitted and accepted by the Chair of the EB on May 20 2014[18], which included the following correction:

Capacity changes:

The registered PDD of the first crediting period (Version 6 – 06 September 2006) includes three different capacities for each of the two power plants – i.e., La Vuelta and La Herradura – included in the CDM project:

1) **Installed capacity** (effective net output capacity): This is the "net effective output capacity" of each power plant at the interconnection point with the electricity grid, i.e. it represents the capacity of the power plant to deliver and sell electricity to the grid. This capacity depends on the

characteristics and configuration of the total plant as a system. Basically, the turbine capacity is limited by the generator, which acts as a bottleneck. The equipment and transformer, as well as the transmission line to the substation, also have power losses that affect the net effective output of the plant. Moreover, the plant has an auxiliary consumption, which also needs to be subtracted, resulting in the effective net output capacity.

This effective output capacity is the official capacity used by the CREG (*Regulatory Commission* for *Gas* and *Energy)* as per the definition in the Annex 4 of Resolution No. 059 of November 6th, 1999[19]. Most importantly, this capacity defines and limits the power delivered to the grid (maximum capacity) as per the Colombian regulation and therefore is the key parameter for the electricity that can be delivered to the grid and corresponding income (independent from specific turbine and generator capacities).

2) **Turbine capacity** (nominal power output): This is the nominal capacity of the turbine(s), determined by the equipment provider at laboratory conditions, and as such included in the first PDD (version 06).

3) **Generator capacity** (nominal power output): This is the nominal capacity of the generator(s), determined by the equipment provider at laboratory conditions, and as such included in the first PDD (version 06).

The following table summarizes the values for the different capacities included **in the original PDD**:

Parameter	La Vuelta Sub-Project	La Herradura Sub-Project
Effective net output capacity (MW). This is used as the "installed capacity" in the original PDD.	11.7 MW	19.8 MW
Turbine capacity (MW)	12.25 MW	20.8 MW (2 x 10.4 MW)
Generator capacity (MW)	14.0 MVA; or 11.9 MW	24.0 MVA (2 x 12.0 MVA); or 20.4 MW (2 x 10.2 MW)

[18] http://cdm.unfccc.int/PRCContainer/DB/prcp997252573/view

[19] **Definition**: The Net Effective Capacity is the maximum capacity (expressed in MW) that can be delivered by a plant and/or generation unit in normal operational conditions, measured at the interconnection point (note: this point is called –commercial front‖ in Colombia).

Power output in MVA multiplied with the power factor (cosine φ) = 0.85

Since the "effective net output capacity" determines the capacity of energy generation at the interconnection point with the grid, the corresponding value of 31.5 MW[20] (11.7 MW La Vuelta and 19.8 MW La Herradura), was included in the PDD registered for the first crediting period (version 6) as the "installed capacity"**.**

The onsite nameplate capacities of the turbine capacities and the generator as included **in the revised PDD** are given in the following table (also including the effective output capacity of the plant for comparison):

Parameter	La Vuelta Sub-Project	La Herradura Sub-Project
Effective net output capacity (MW)	11.7 MW	19.8 MW

Turbine capacity (MW). This is used as the -**installed capacity" in the new PDD**.	12.4 MW	21.08 MW (2 x 10.54 MW)
Generator capacity (MW)	14.0 MVA; or 11.9 MW (1)	24.0 MVA (2 x 12.0 MVA); or 20.4 MW (2 x 10.2 MW) (1)

(1) Power Output in MVA multiplied with the power factor (cosine φ) = 0.85

MGM Carbon Portfolio was included as project participant in section A.4., since this project participant was approved after project registration.

Document information

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).

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

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document