



**Monitoring report form
(Version 04.0)**

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT

| | |
|--|--|
| Title of the project activity | La Vuelta and La Herradura Hydroelectric Project |
| Reference number of the project activity | 0735 |
| Version number of the monitoring report | 02.1 |
| Completion date of the monitoring report | 02/02/2015 |
| Registration date of the project activity | 15 January 2007 15/01/2007 |
| Monitoring period number and duration of this monitoring period | Monitoring period number: 5 Duration of this monitoring period: 01/01/2012 – 31/12/2013 |
| Project participant(s) | Empresas Públicas de Medellín E.S.P. (private) MGM Carbon Portfolio S.a.r.l. |
| Host Party(ies) | Colombia |
| Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s) | Sectoral scope 1: "Energy Industries – Renewable Sources". Baseline methodology ACM0002/version 15 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources". |
| Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD | 154.298 t CO ₂ e |
| Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period | 161,919 t CO ₂ e |
| Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable) | 81,125 |
| Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable). | 80,794 |

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The purpose of the project activity is to build a hydroelectric power plant, with a total installed nameplate 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). The proposed subprojects were not strictly built to cover the expected increase in electricity demand but to add efficiency to the electricity system as a whole, to improve electricity service in the west of Antioquia Department, and to contribute to the regional sustainable development, while reducing CO₂ emissions.

The project displaces other generation sources connected to the local grid that use fossil fuels to produce energy. The project provides clean energy and reduces CO₂ emissions in Colombia.

The following table shows a description of the technology that was included in the registered PDD:

Tabla 1: Design data of La Vuelta and La Herradura Hydroelectric Project.

| Hydro Plant | La Vuelta | La Herradura |
|-------------------|--------------------------------------|---------------------------------------|
| Characteristic | | |
| Nominal Capacity | 12.4 MW | 21.08 MW |
| Mean flow | 12 m ³ /s | 10 m ³ /s |
| Net design fall | 112.9 m | 230.6 m |
| Hydraulic turbine | Francis horizontal axis. One unit | Francis horizontal axis. Two units |

The construction of the facilities started in April 2002. La Vuelta was completed and fully commissioned in December 2004 and La Herradura was completed and fully commissioned in October 2004, at which points they started commercial operations. The power plants have been generating electricity since then.

The emission reductions achieved by the implementation of the project activity for the monitoring period, 1 January 2012 - 31 December 2013 are 161,919 tCO₂e.

A.2. Location of project activity

The project activity is located in the Republic of Colombia. The power plants are located in the north-western area of Antioquia Department, under the jurisdiction of Cañasgordas, Frontino and Abriaquí municipalities, although the whole of Urabá Antioqueño can be considered as regional area of influence, which goes from Santa Fé de Antioquia to Arboletes.

La Herradura Sub-Project

La Herradura plant is located on La Herradura River, starting from an existing topographic fall between that river and the Cañasgordas River. Both rivers later join to form the Sucio River basin, a tributary to the Atrato River. The hydrographic basin area of La Herradura River is 320 km², which contributes to a mean flow of 14 m³/s at catchment point. The construction is located in Frontino and Cañasgordas jurisdictions.

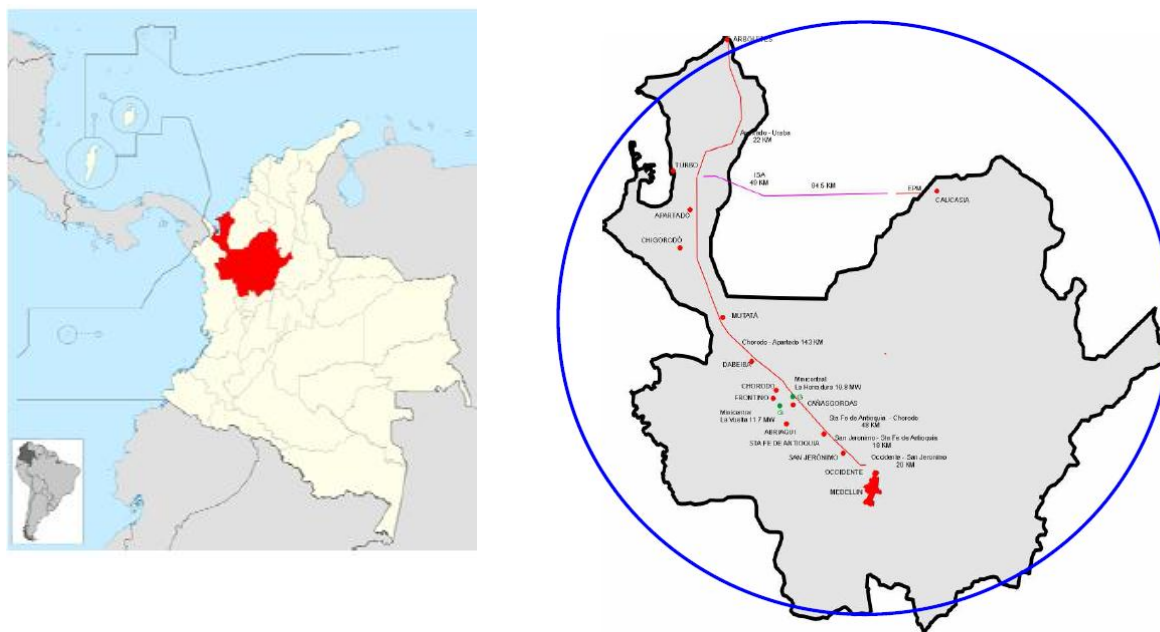
Location of La Herradura power plant: -76.09°; 6.73° (-76°05'18.01"; 6°43'49.60")

La Vuelta Sub-Project

La Vuelta plant is located in the upper and middle basin of La Herradura River, up to the fork at the Nancuí gulch, at 1,595 m elevation, covering all Abriaquí municipality. The limits coincide with the dividing basin and, to a lesser extent, with Frontino municipality. The hydrographic basin area of La Herradura River contributes to a mean flow of 12.3 m³/s at catchment point.

Location of La Vuelta power plant: -76.08°; 6.80° (-76°04'52.90"; 6°48'10.08")

Location of Substation Chorodó: -76.14°; 6.85° (-76°08'16.50"; 6°50'53.93")



A.3. Parties and project participant(s)

| Party involved (host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|--|---|
| Colombia (host) | Empresas Públicas de Medellín E.S.P | No |
| Switzerland | MGM Carbon Portfolio, S.a.r.l. (private) | No |

A.4. Reference of applied methodology and standardized baseline

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The methodology applied to the registered CDM project activity is ACM0002 Version 6: "Consolidated methodology for grid-connected electricity generation from renewable sources". The methodology also refers to the "Tool for demonstration and assessment of additionality". By the time of project register, the available tool version was version 02.

A.5. Crediting period of project activity

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The crediting period of the project activity is January 1st 2012 to December 31st 2018 (renewable)

A.6. Contact information of responsible persons/ entities

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Empresas Públicas de Medellín

Oscar Alonso Fernandez

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Oscar.fernandez@epm.com.co

SECTION B. Implementation of project activity**B.1. Description of implemented registered project activity**

>>

The project is fully implemented and operational since the end of 2004.

No events or situations occurred during the monitoring period, which may impact the applicability of the methodology.

During the monitoring period maintenance was performed according to the schedule established for this purpose, as can be verified by the DOE in the project log books.

| | La Vuelta | La Herradura |
|-------------------------|------------------|-----------------|
| Construction start date | 15 April 2002 | 22 April 2002 |
| Operation start date | 18 December 2004 | 08 October 2014 |

Technologies and/or measures

The project activity consists of two hydroelectric power plants, with a total installed turbine capacity of 33.48 MW¹, 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

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

La Herradura Sub-Project

| | |
|--------------------------|--------------------------|
| Hydraulic Turbine | |
| Type | Francis, horizontal axis |

¹ As per post registration changes PRC ref No. PRC-0735-001, approved on May 20-2014

| | |
|-------------------------------------|-----------------------------|
| Number of units | 1 |
| Nameplate capacity (without losses) | 10,540 kW ¹ |
| Rotation speed | 900 min ⁻¹ |
| Design net head | 230.6 m |
| Generator | |
| Type | synchronic, horizontal axis |
| Number of units | 2 |
| Nominal power output (nameplate) | 12,000 kVA |
| Nominal tension | 13,800 V |
| Nominal frequency | 60 Hz |
| Power factor (cosine ϕ) | 0.85 |
| Synchronic speed | 900 rpm |

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 submersible 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 system².

Each generation unit has a control center 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 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).

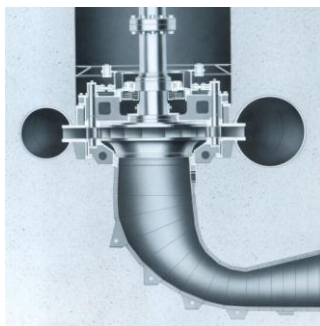


Figure 1: Francis Turbine Spiral Cased Horizontal Shaft - typical arrangement

² As stated in the methodology ACM0002 version 15.0.0, "the use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected"; thus potential emissions from the emergency diesel generator at the project site are neglected

B.2. Post registration changes**B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

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There were no temporary deviations from registered monitoring plan or applied methodology during the current monitoring period.

B.2.2. Corrections

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There were no corrections from registered project activity / monitoring plan or applied methodology during the current monitoring period.

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

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There were no corrections from registered monitoring plan or applied methodology during the current monitoring period.

B.2.4. Changes to project design of registered project activity

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A post registration change (PRC ref No. PRC-0735-001) was submitted and accepted by the Chair of the EB on May 20 2014.

B.2.5. Changes to start date of crediting period

>>

Not applicable

B.2.6. Types of changes specific to afforestation or reforestation project activity

>>

This section is not applicable.

SECTION C. Description of monitoring system

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The Monitoring Plan is based on i) recording electricity generation of LV and LH power plants and ii) obtaining the data required to calculate the grid emission factor: electricity generation and fuel consumption of all power plants serving the interconnected national system.

Considering the project boundary, the following data need to be monitored in order to calculate baseline emissions and emission reductions:

- Hourly electricity generation of the hydroelectric plants of the project. EE.PP.M takes measurements every hour (ID number of section D.2.1.3 of the registered PDD: 1).
- Plant dispatch order of the grid (ID number of section D.2.1.3 of the registered PDD: 2).
- Hourly electricity generation of all power plants and imports serving the interconnected national system (ID number of section D.2.1.3 of the registered PDD: 5 and 14).
- Power plants fuel consumption or heat rates for each fuel (ID number of section D.2.1.3 of the registered PDD: 6, 7 and 10).
- Emission factor and Net Calorific Value of each fuel used in the thermal power plants of the grid (ID number of section D.2.1.3 of the registered PDD: 8 and 9)

- Identification of the power plants for the OM and BM (ID number of section D.2.1.3 of the registered PDD: 3 and 4)

Electricity generation:

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” (Measurements Team) of EE.PP.M is in charge of taking the measurements. The Measurements Team is responsible for reporting to XM, the operator of the National Dispatch Center, on the Generation Boundaries, the boundaries between the agents and the large energy clients supplied by EE.PP.M. 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”).

Meters Information:

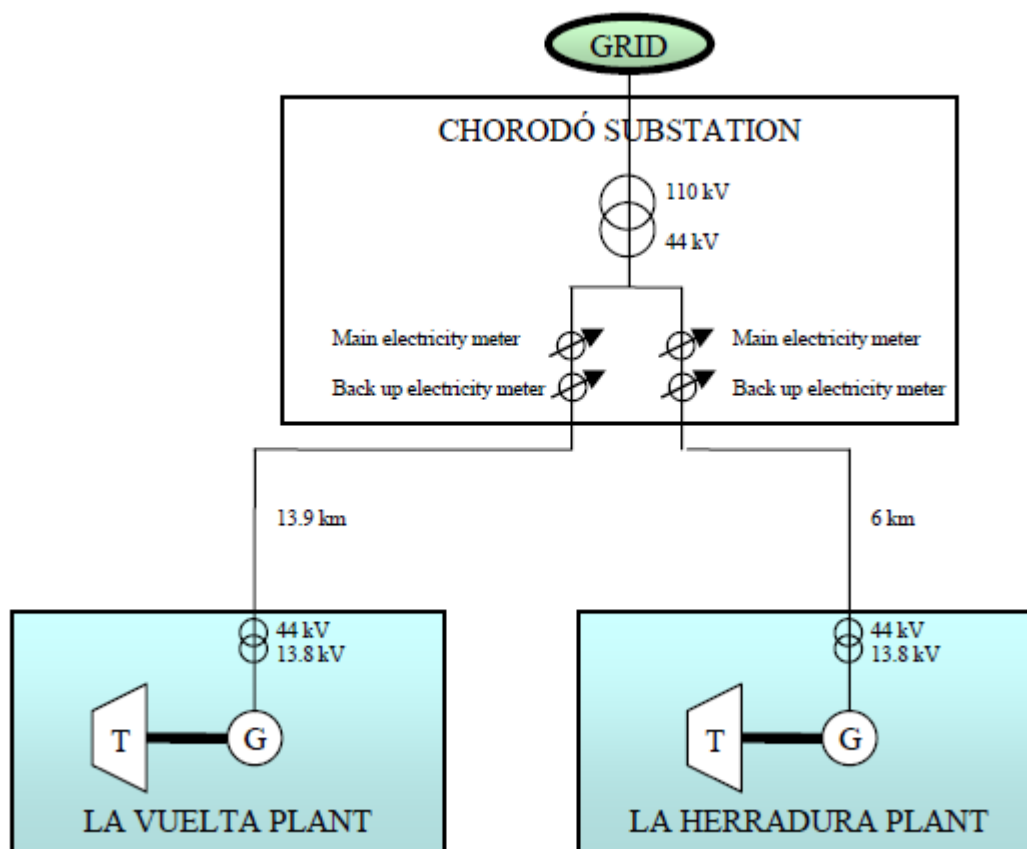
| LA VUELTA ELECTRICITY METERS | |
|------------------------------------|------------------------------------|
| Main | Backup |
| Serial: 36099685 | Serial: 36099687 |
| Type: SL761A061 | Type: SL761A061 |
| Brand: ACTARIS | Brand: ACTARIS |
| Voltage: 3x57.7/100V – 3x240/415V | Voltage: 3x57.7/100V – 3x240/415V |
| Current: 5(10)A | Current: 5(10)A |
| Calibration constant: 10000 Wh/Imp | Calibration constant: 10000 Wh/Imp |
| TP measure: 44000/V3/120/V3V | TP measure: 44000/V3/120/V3 |
| 3 Phases – 4 lines | 3 Phases – 4 Lines |
| TC Measure: 300/5 | TC measure: 300/5 |
| Class: 0.2S | Class: 0.2S |

| LA HERRADURA ELECTRICITY METERS | |
|------------------------------------|------------------------------------|
| Main | Backup |
| Serial: 36099681 | Serial: 36099684 |
| Type: SL761A061 | Type: SL761A061 |
| Brand: ACTARIS | Brand: ACTARIS |
| Voltage: 3x57.7/100V – 3x240/415V | Voltage: 3x57.7/100V – 3x240/415V |
| Current: 5(10)A | Current: 5(10)A |
| Calibration constant: 10000 Wh/Imp | Calibration constant: 10000 Wh/Imp |
| TP measure: 44000/V3/120/V3V | TP measure: 44000/V3/120/V3 |
| 3 Phases – 4 lines | 3 Phases – 4 Lines |
| TC Measure: 300/5 | TC measure: 300/5 |
| Class: 0.2S | Class: 0.2S |

This information is backed up by the IT Department of EE.PP.M 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.

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



Environmental management plan:

It is important to note that this environmental management plan was not included as part of the monitoring plan in the PDD. This is an independent initiative taken by EE.PP.M that contributes to sustainable development of the region.

La Vuelta and La Herradura hydroelectric plants apply an environmental management plan that includes actions towards mitigating the negative impacts on environment during construction and operation of the plants. In addition, EE.PP.M developed 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:

Management of Environmental Impacts:

- 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, towels 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 follow up on the application of the plan and to identify opportunities for improvement.

Additional discretionary 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

- Geomorphological 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 m² of affected areas due to erosion were identified as part of the program 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.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

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

| | |
|---------------------|---|
| Data / Parameter: | EF _{grid,CM,y} |
| 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 "Tool to calculate the emission factor for an electricity system" (version 4.0.0). |
| Source of data: | Calculated in accordance with the "Tool to calculate the emission factor for an electricity system" (version 4.0.0) 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: | 0.4239 tCO ₂ /MWh |
| Purpose of data: | Baseline emissions calculations |
| Additional comment: | For both the operating margin and the build margin, the ex-ante option is applied as given in the "Tool to calculate the emission factor for an electricity system" (version 4.0.0). |

D.2. Data and parameters monitored

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

| Data / Parameter: | EG_y | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|----------|-----------|--------|-----------|--|-----------|-------------|-----------|------|----------|-----------|------|-----|--|---------|----------|-----------|------|-----|--|--------------|------|----------|-----------|------|-----|--|---------|----------|-----------|------|-----|--|
| Data unit: | MWh / year | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Description: | Electricity generation by the plan Quantity of net electricity generation supplied by the project plant/unit to the grid in year y | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Measured /Calculated /Default: | Measured 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). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Source of data: | EE.PP.M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Value(s) of monitored parameter: | 2012: 191,379 (LV: 65.069 + LH: 126.309) 2013: 190,597 (LV: 68.706 + LH: 121.890) See table in section E.1 for details | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Monitoring equipment: | <table border="1"> <thead> <tr> <th>Plant</th><th></th><th>Serial</th><th>Type</th><th>Class</th><th>Cal. Freq</th><th>Calibration</th></tr> </thead> <tbody> <tr> <td rowspan="2">La Vuelta</td><td>Main</td><td>36099685</td><td>SL761A061</td><td>0.2S</td><td>2 y</td><td>29/03/2011 02/05/2012 29/05/2013 10/05/2014</td></tr> <tr> <td>Back Up</td><td>36099687</td><td>SL761A061</td><td>0.2S</td><td>2 y</td><td>29/03/2011 02/05/2012 29/05/2013 10/05/2014</td></tr> <tr> <td rowspan="2">La Herradura</td><td>Main</td><td>36099681</td><td>SL761A061</td><td>0.2S</td><td>2 y</td><td>29/03/2011 02/05/2012 29/05/2013 10/05/2014</td></tr> <tr> <td>Back Up</td><td>36099684</td><td>SL761A061</td><td>0.2S</td><td>2 y</td><td>29/03/2011 02/05/2012 29/05/2013 10/05/2014</td></tr> </tbody> </table> | Plant | | Serial | Type | Class | Cal. Freq | Calibration | La Vuelta | Main | 36099685 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | Back Up | 36099687 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | La Herradura | Main | 36099681 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | Back Up | 36099684 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 |
| Plant | | Serial | Type | Class | Cal. Freq | Calibration | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| La Vuelta | Main | 36099685 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Back Up | 36099687 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| La Herradura | Main | 36099681 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Back Up | 36099684 | SL761A061 | 0.2S | 2 y | 29/03/2011 02/05/2012 29/05/2013 10/05/2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Measuring/ Reading/ Recording frequency: | Hourly measurements and monthly recording | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calculation method (if applicable): | N.A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| QA/QC procedures: | <p><u>Calibration of meters:</u></p> <p>Calibration tasks follow national standards and are in accordance with the calibration instructive specified in Colombian standard NTC 4,856 for electricity metering devices. The calibration frequency is maximum every 2 years, as defined by EPM, since there is no regulatory requirement for calibration frequency.</p> <p>EPM has adopted its own procedure based on the Colombian technical norm NTC-ISO-IEC 17,025 and NTC 4,856, 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.</p> <p>Despite of calibration frequency is set every two years, EPM carry out a calibration per year.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Purpose of data: | Baseline calculation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|---------------------|---|
| Additional comment: | 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. |
|---------------------|---|

D.3. Implementation of sampling plan

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

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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According to the applied methodology, baseline emissions are calculated as follow:

$$BE_{sp,y}(tonCO_2 / yr) = EF_y (tonCO_2 / MWh) \cdot EG_y (MWh / yr) \quad (1)$$

Where EG_y is the project generation (comprising “La Vuelta” and “La Herradura” plants) and EF_y is the grid emission factor calculated as the weighted average of the Operating Margin emission factor (EF_{OMy}) and the Build Margin emission factor (EF_{BMy}).

EGy:

Generation of the plants for years 2012 and 2013

| Year | Month | Net Generation of the plants (MWh) | | |
|------|--------------|------------------------------------|------------------|------------------|
| | | La Vuelta | La Herradura | Total |
| 2012 | January | 7302.42 | 13870.62 | 21173.03 |
| | February | 3374.05 | 9439.64 | 12813.68 |
| | March | 4290.40 | 9753.99 | 14044.39 |
| | April | 5493.53 | 11795.55 | 17289.08 |
| | May | 6953.10 | 12112.64 | 19065.73 |
| | June | 6246.80 | 9597.77 | 15844.57 |
| | July | 5182.69 | 9215.42 | 14398.11 |
| | August | 4384.50 | 8023.29 | 12407.80 |
| | September | 3181.69 | 7954.79 | 11136.48 |
| | October | 5865.64 | 11610.94 | 17476.58 |
| | November | 6232.71 | 11083.96 | 17316.66 |
| | December | 6562.37 | 11850.86 | 18413.23 |
| | TOTAL | 65069.89 | 126309.47 | 191379.35 |
| 2013 | January | 2411.94 | 8582.72 | 10994.65 |
| | February | 584.07 | 6913.07 | 7497.14 |
| | March | 3811.56 | 7597.37 | 11408.92 |
| | April | 5229.35 | 8997.89 | 14227.25 |
| | May | 6775.51 | 8480.12 | 15255.63 |
| | June | 7980.50 | 12710.31 | 20690.80 |
| | July | 6110.68 | 11998.29 | 18108.97 |
| | August | 6028.20 | 11134.53 | 17162.73 |

| | | | |
|--------------|-----------------|------------------|------------------|
| September | 7180.28 | 13356.56 | 20536.83 |
| October | 6581.08 | 12513.83 | 19094.91 |
| November | 7716.91 | 8365.68 | 16082.60 |
| December | 8296.58 | 11240.12 | 19536.70 |
| TOTAL | 68706.66 | 121890.49 | 190597.15 |

Please refer to the spreadsheet "Hourly generation_LVLH_2012-2013" for the hourly generation of each plant. It can also be found in the web of XM through NEON system: <http://informacioninteligente10.xm.com.co/pages/default.aspx>

EF_y

As per the register PDD for the second crediting period, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

Operating Margin (OM): 0.5546 tCO₂/MWh

Build Margin (BM): 0.3804 tCO₂/MWh

Combined Margin (CM):

EF_y is the grid emission factor (combined margin emission factor) calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), as follows:

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (7)$$

The relative weights according to the default value provided by the methodology are 0.25 for w_{OM} and 0.75 for w_{BM} .

$$EF_y = 0.25 \times 0.5546 + 0.75 \times 0.3804 = \mathbf{0.4239 \text{ tCO}_2/\text{MWh}}$$

Baseline calculation:

$$BE_y = 0.4239 \times 381,976 = \mathbf{161,919 \text{ tCO}_2} \text{ (2012 and 2013 included)}$$

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

No project emissions are considered in the present project

E.3. Calculation of leakage

>>

No leakage emissions are considered in the present project

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Considering that there are neither project emissions nor leakage for the proposed project activity, the annual emission reductions are equal to:

$$ER_y (\text{tonCO}_2 / \text{yr}) = BE_y (\text{tonCO}_2 / \text{yr}) \quad (13)$$

$ER_y = 161,919 \text{ tCO}_2$ (2012 and 2013 included)

| Item | Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e) | Project emissions or actual net GHG removals by sinks (t CO ₂ e) | Leakage (t CO ₂ e) | Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e) |
|-------------------------|--|---|-------------------------------|--|
| Total 2012 | 81,125.71 | 0.00 | 0.00 | 81, 125.71 |
| Total 2013 | 80,794.13 | 0.00 | 0.00 | 80, 794.13 |
| Total monitoring period | 161,919.84 | 0.00 | 0.00 | 161,919.84 |

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

| Item | Values estimated in ex-ante calculation of registered PDD | Actual values achieved during this monitoring period |
|--|---|--|
| Emission reductions or GHG removals by sinks (t CO ₂ e) | 77,149 | 2012: 81,125 2013: 80,794 |
| Project Generation (MWh) | 182,000 | 2012: 191,379.35 2013: 190,597.15 |

E.6. Remarks on difference from estimated value in registered PDD

>>

The electricity generation of the project during 2012 and 2013 was 4.94% higher than the average value used in the PDD, which corresponds with the average of the historical data from 2008 to 2010 (last three years of the first crediting period).

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

| Item | Actual values achieved up to 31 December 2012 | Actual values achieved from 1 January 2013 onwards |
|--|--|--|
| Emission reductions or GHG removals by sinks (t CO ₂ e) | 2005-2007: 154,232 2008: 50,841 2009: 53,351 2010: 47,353 2011: 56,371 2012: 81,125 | 2013: 80,794 |

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Appendix 1. Contact information of project participants and responsible persons/ entities

| | |
|--|---|
| Project participant and/or responsible person/ entity | <input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM |
| Organization name | EMPRESAS PÚBLICAS DE MEDELLÍN E.S.P. |
| Street/P.O. Box | Carrera 58 N° 42-125 / P.O. Box: 940 |
| Building | |
| City | Medellín |
| State/Region | Antioquia |
| Postcode | Does not exist in Colombia |
| Country | Colombia |
| Telephone | 011-57-54-3808080 |
| Fax | |
| E-mail | |
| Website | www.epm.com |
| Contact person | Oscar Alonso Fernandez |
| Title | Engineer |
| Salutation | Mr. |
| Last name | Fernandez |
| Middle name | Alonso |
| First name | Oscar |
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Document information

| <i>Version</i> | <i>Date</i> | <i>Description</i> |
|---|-----------------|---|
| 04.0 | 25 June 2014 | <p>Revisions to:</p> <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement. |
| 03.2 | 5 November 2013 | Editorial revision to correct table in page 1. |
| 03.1 | 2 January 2013 | Editorial revision to correct table in section E.5. |
| 03.0 | 3 December 2012 | Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11). |
| 02.0 | 13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20). |
| 01 | 28 May 2010 | EB 54, Annex 34. Initial adoption. |
| Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report | | |