MONITORING REPORT

June, 2009

La Vuelta and La Herrradura Hydroelectric Project (Colombia)

(UNFCCC #0735)

Empresas Públicas de Medellín E.S.P

Period: January 1st, 2008 – December 31st, 2008

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1. INTRODUCTION

The purpose of the present monitoring report is to show the calculation of the emission reductions achieved by the implementation of the project activity, from January 1st 2008 until 31st December 2008.

The report also shows the Monitoring and Verification Plan for data collection and auditing followed by *Empresas Públicas de Medellín E.S.P.* in order to determine real and credible emission reductions.

The project activity development applies the approved CDM methodology *ACM0002 (version 6): "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"*.

The project was registered by the CDM Executive Board on January 15th, 2007. It is available on http://cdm.unfccc.int/Projects/DB/DNV-CUK1161865279.03/view.html

2. DESCRIPTION OF THE PROJECT ACTIVITY

The purpose of the project activity is to build a hydroelectric power plant with a total installed capacity of 31.5 MW, in order to explore the capacity of the La Herradura River by installing two hydroelectric plants in a chain: *La Vuelta Hydro plant* and *La Herradura Hydro plant.*

The project would displace other generation sources connected to the local grid that use fossil fuels to produce power. The project provides clean energy and reduces CO_2 emissions in Colombia.

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

Table 1: Technical characteristics of La Vuelta and La Herradura Hydroelectric Project. Operating Data.

Hydro Plant / Characteristic	La Vuelta	La Herradura
Installed Capacity	11.7 MW	19.8 MW
Mean flow	12.3 m^3/s	14.0 m^3/s
Fall	112 m	220 m
Hydraulic turbine	Francis, horizontal axis	Francis, horizontal axis
	One unit	Two units

Table 2: Design data of turbines of La Vuelta and La Herradura Hydroelectric Project.

Hydro Plant / Characteristic	La Vuelta	La Herradura
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	Francis, horizontal axis
	One unit	Two units

The difference between reported operative data (table 1) and design data (table 2) is that turbine manufacturers put onto nameplates the information at laboratory conditions where the equipment is calibrated. At operative level, the data are adjusted to the environmental conditions of the place where the generation plants are to be installed.

Capacity: Data on installed capacity in the nameplates of the generation units are design data. The installed capacity when the units are registered in XM is defined in accordance to the operative conditions that the agent considers as optimal, after carrying out on-site tests.

Mean Flow: The mean flow in the nameplates is the maximum operative mean flow of the turbines. The mean flow for plant design is obtained from historic data and/or flow estimates for the place where the hydroelectric plants will be installed.

Head or fall: The fall considered by the manufacturers is that for the maximum head corresponding to the maximum water level and for one unit generating at its maximum capacity. The project owner takes as head the one that corresponds to the normal water level (not the maximum), with all the units generating at actual capacity.

3. PROJECT LOCATION

The Republic of Colombia is located in Northern South America, bordering the Caribbean Sea between Panama and Venezuela, and the North Pacific Ocean, between Ecuador and Panama. The project, which uses water from the La Herradura River, is located in the north-western sector of the Antioquia Department, under the jurisdiction of the Cañasgordas, Frontino and Abriaquí municipalities, although the whole of Urabá Antioqueño can be considered as a regional influence area that extends from Santa Fé de Antioquia to Arboletes. In this area of approximately 230 km^2, important municipalities such as Dabeiba, Mutatá, Chigorodó, Apartadó, and Turbo are located (See Figure 1).

La Herradura plant is located on the 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 the La Herradura River is 320 km^2, which contributes to a mean flow of 14 m^3/s at catchment point. The construction is located in Frontino and Cañasgordas jurisdictions.

La Vuelta plant is located at the upper and middle basin of the 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 hydrographical basin area of the La Herradura River contributes to a mean flow of 12.3 m^3/s at catchment point.

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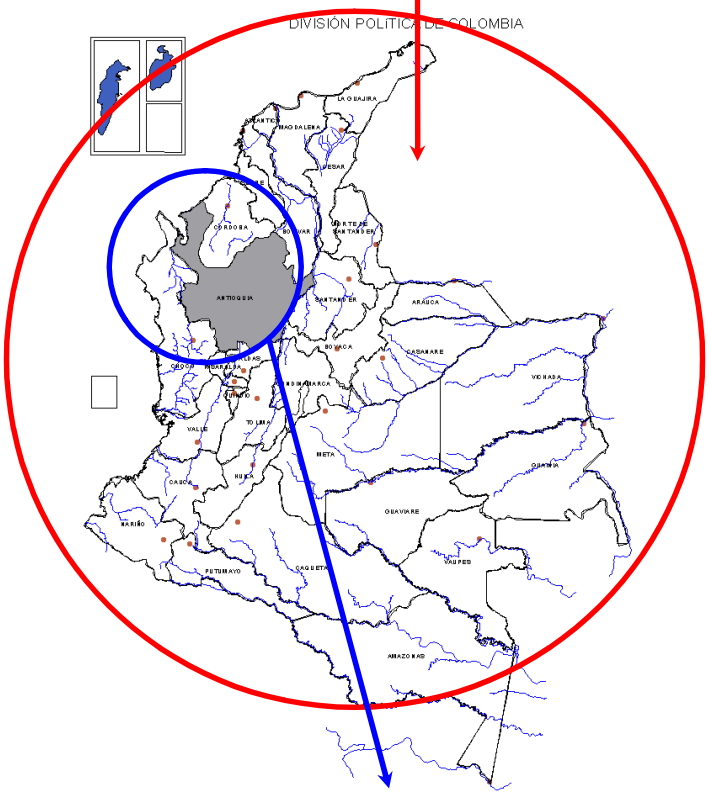

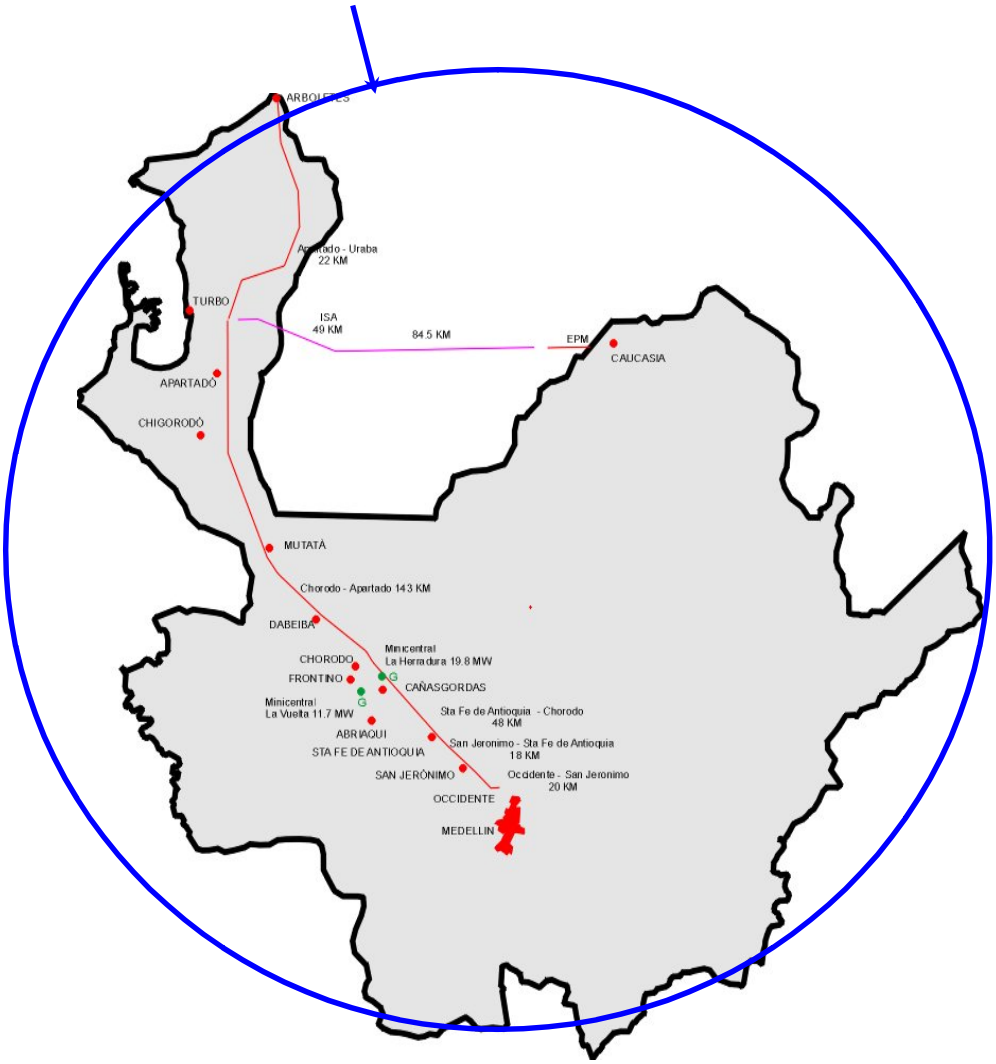

Figure 1: Colombia (above) and Antioquia Department (below)
Geographic coordinates: Approx. 6ºN, 76ºW
Source: http://www.eia.gov/cia/publications/factbook/geos/co.html
Green dots represent La Vuelta and La Herradura power plants location

4. APPLIED METHODOLOGY

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"*.

The electricity grid mix of Colombia is dominated by hydro plants (65.6%) and, to a lesser extent,by thermal plants (34.4%). Power plants are dispatched according to their generation costs: the least-cost plants enter first, while the plant dispatched later to cover the demand sets the marginal price of electricity.

In the context of the renewable project activity, only baseline emissions are considered in the calculation of emission reductions. Leakage emissions are not to be included under this methodology, and as the power density of the project is greater than 10 W/m^2 (1,893 W/m^2 for La Vuelta and 6,199 W/m^2 for La Herradura), then methane emissions are to be disregarded.

Baseline emissions are calculated applying the combined margin emission factor (CM), calculated as the combination of the operating margin (OM) and the build margin (BM). The method chosen to calculate the OM is **option c) Dispatch Data Analysis (DDA)** of ACM0002 Version 6, which provides a more accurate calculation. Moreover, **Option 2** of the methodology is selected to calculate the BM.

The weights applied to the OM and the BM in order to calculate the CM are 0.5 and 0.5, respectively.

5. MONITORING PLAN IMPLEMENTATION

Under the monitoring plan outlined in accordance with the requirements of ACM0002 Version 6, the variables to be monitored during the crediting period are:

- Electricity generation from the proposed project activity.
- Data needed to recalculate the OM, if needed, based on the choice of the method to determine the OM, consistent with the consolidated baseline methodology.
- Data needed to recalculate the BM, if needed, consistent with the consolidated baseline methodology.
- For new hydroelectric projects, the surface area of reservoir at the full reservoir level.

La Vuelta and La Herradura power plants belong to the Metropolitan Area under *"Subgerencia Operación"* ["Sub-management operation"] of *"Gerencia Generación Energía"* ["Power Generation Management"] responsible for the operation and maintenance of the power plants. Monitoring procedures can be implemented on-site or remotely by using tele-measurement technology. The *"Equipo de Medida"* (Measurement Team) 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 La Vuelta and La Herradura's case, the energy meters (in Chorodó substation) are read via the MV-90i software every 24 hours and uploaded in the *GCE* software.

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

EVLT1001 LA VUELTA
EHRD1001 LA HERRADURA

And these codes include the official data reported to XM.

The following two sub-sections of this report show monitored variables and also parameters not monitored used to calculate the emission reductions from the CDM project.

5.1 - Variables under monitoring

For the calculation of the combined margin emission factor, historical data on the most relevant variables are obtained through an online service based on databases of the wholesale energy market. The ASIC (*Administrador del Sistema de Intercambios Comerciales* – Administrator of the Commercial Transactions System) provides information to the generators supported on Colombia's largest Data Warehouse in the energy sector. As a result, the search for information is done online in a more consistent, faster way.

The following table shows those variables that were monitored during the crediting period, how they were monitored and the quality assurance procedures applied during their monitoring.

Table 2: Data for Baseline Emissions calculation

1

Data variable	***Electricity Generation (EG)***
Data unit	MWh
Source	EE.PP.M
Measurement and recording frequency	Hourly measured. Monthly recorded. See table 4 in section 8.1 with the monitored values.
Measurement procedures **And** **Comments about QA/QC**	**Measurement of Electricity Generation:** Electricity generation is measured by *electronic electricity meters*. The obtained values are cross-checked with the generation measured in terminals and vs. SCADA system ("Supervisory Control And Data Acquisition"). 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 by using the *MV-90xi* software. The IT Department (*Unidad Informática Energía* – Energy Computing Unit) does information backups of the *GCE* database at 8.00 PM on a daily basis 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 take place every three hours. The files are copied to a tape every day during a week. Thus, there is always an available backup of the previous week. Additionally, one tape is kept per week during a month, and one tape per month during three months. **Quality Control and Quality Assurance:** <u>Calibration of meters:</u> Electricity meters were calibrated at EE.PP.M laboratory before being installed in the plant in 2004. The files *"PROTOCOLO MEDIDOR LA HERRADURA_2004"*, *"PROTOCOLO MEDIDOR LA VUELTA_2004"* show the calibration protocols used to calibrate the meters. The calibration tasks follow national standards and comply with the calibration guidelines specified in Colombian standard NTC 4856 for electricity metering devices. The calibration frequency is approximately every 4 years. During 2008, another calibration took place *in-situ* (refer to *"CALIBRACIÓN*

	EN SITIO-LA VUELTA Y LA HERRADURA-2008-02-13") EE.PP.M has adopted its own procedure based on the Colombian technical norm NTC-ISO-IEC 17,025 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 patterns used to calibrate the electricity meters *in-situ* could be any of the following: • Portable Standard MTE Nº 16, 17, 18 (accuracy 0.05) • Calibration Bench LANDIS TALOGYR 6061 • Calibration Bench ZERA ED 6816

2

Data variable	***Colombian grid emission factor (EF): Combined Margin emission factor (CM)***
Data unit	tCO_2/MWh
Source	EE.PP.M.
Measurement and recording frequency	This variable is calculated as the weighted sum of OM and BM emission factors. Refer to section 7.1 for formulae. Annually updated and recorded. See spreadsheet *"LVLH_Monitoring_ER_2008.xls"* where combined margin is calculated.
Measurement procedures **And** **Comments about QA/QC procedures**	This variable is calculated, not measured, and therefore does not need specific quality control procedures.

3

Data variable	***Build Margin emission factor (BM)***
Data unit	tCO_2/MWh
Source	EE.PP.M.
Measurement and recording frequency	Refer to section 7.1 for formulae on calculation of this variable. Annually updated and recorded as per Option 2 of ACM0002 Version 6. See Spreadsheets *" Building Margin_2008.xls"* Where the data used and method of calculation are developed.

Measurement procedures And Comments about QA/QC procedures	This variable is calculated, not measured, and therefore does not need specific quality control procedures.

4

Data variable	***Operating Margin emission factor (OM)***
Data unit	tCO_2/MWh
Source	EE.PP.M
Measurement and recording frequency	This variable is calculated as per **option c) DDA** of methodology ACM0002 Version 6. Refer to section 7.1 for formulae applied. Annually updated and recorded. See spreadsheets *"Operating Margin_LVLH_2008.xls"* Where the data used and method of calculation are developed.
Measurement procedures And Comments about QA/QC procedures	This variable is calculated, not measured, and therefore does not need specific quality control procedures.

5.2 – Non- monitored data

According to Annex 3 Baseline Data of the Registered PDD, the following data are considered fixed along the first crediting period and, therefore, not monitored:

Table 3: Not monitored data

Item	Description	Value/Unit	Source
$OXID_{coal}$	Coal oxidation factor	0.98	IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Volume 3 (1996)
$EF_{CO2coal}$	CO_2 emission factor for coal	94.6 ton CO_2/TJ	IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Volume 3 (1996)
$OXID_{NG}$	Natural gas oxidation factor	0.995	IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Volume 3

			(1996)
EF_{CO2NG}	CO_2 emission factor for natural gas	56.1 ton CO_2/TJ	IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Volume 3 (1996)

6. ENVIRONMENTAL MANAGEMENT PLAN

Firstly, 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, which 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 develops a discretionary environmental management plan that involves physical-biotic and social aspects to protect natural resources and 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 *Corporación Autónoma Regional Corpourabá* (Autonomous Regional Corporation of Corpourabá) need to comply with environmental monitoring programs.
- Report on turbinated flows once every three months to *Corporación Autónoma Regional Corpourabá* (Autonomous Regional Corporation of Corpourabá).
- Monitoring and control of the flow designated for energy generation and 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 their efficiency and compliance with the estimated removal percentages in accordance with the environmental law.
- Implementation of a solid waste management system including different containers corresponding to different types of solid waste. 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 of representatives of *Corporación Autónoma Regional Corpourabá* (Autonomous Regional Corporation of Corpourabá) to follow up of the application of the plan, and 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 The 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.

Process of Voluntary Social Management:

- As part of the support given to the local communities of Abriaquí, programs for solid wastes management and food safety were developed. Along with the municipality of Cañasgordas, there is an agreement to improve the Imántago-Morotó road and establish agro-forestry areas that benefit the communities. A further agreement regarding food safety and environmental protection was also signed with the Frontino municipality.
- EE.PP.M is working with people involved in food safety, environmental protection and infrastructure improvement, in order to strengthen the community organizations that are in the area of influence of the hydroelectric plants.
- EE.PP.M participates in the "día clásico" (classic day) and "día del campesino" (rural workers day) in the municipalities of Frontino, Cañasgordas and Abriaquí.
- EE.PP.M delivered school packages to the children that attend the rural schools near La Vuelta and La Herradura hydroelectric plants.

The total investment carried out by EE.PP.M to develop the Environmental Management Plan, and the additional discretional plans associated to the hydroelectric project during its operation phase, add up to **106,536,182** million Colombian pesos for 2008.

DETAIL COST OF PROGRAMS SUPPORT ON 2008 (Colombian pesos)

Area	Line	Abriaqui	Cañasgordas	Frontino
Education	Students support	1,101,100	1,246,700	1,820,000
Total Education		1,101,100	1,246,700	1,820,000
Support to Communitarian infrastructure	Communitarian infrastructure	2,004,213	2,004,213	2,004,213
Total Communitarian		2,004,213	2,004,213	2,004,213
Communication infrastructure	Roads		20,785,832	
Total Infrastructure			20,785,832	
Support to production projects	Agriculture and Farming activities	31,079,612	20,240,299	
Total projects		31,079,612	20,240,299	
Cultural events	Events	10,750,000	6,750,000	6,750,000
Total Cultural		10,750,000	6,750,000	6,750,000
TOTAL		44,934,925	51,027,044	10,574,213

7. FORMULAS USED FOR CALCULATION OF EMISSION REDUCTIONS

The following table provides the formulas used for calculation of emission reductions:

Project emissions	
Variable	**Formulas**
Estimated CO_2 emissions, *PE*	No project emissions are considered in the present project.
Baseline emissions	
Variable	**Formulas**
Estimated CO_2 emissions in the baseline, *BE*	They are calculated applying the combined margin emission factor calculation and the energy generated by the plants: $BE_y(tonCO_2/yr) = EF_y(tonCO_2/MWh) \cdot EG_y(MWh/yr)$ 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}).
Leakage	
Variable	**Formulas**
Estimated CO_2 emissions, *LE*	No leakage is considered in the present project.
Emission Reductions	
Variable	**Formulas**
CO_2 emission reductions, *ER*	Considering that there are neither project emissions nor leakage for the proposed project activity, the annual emission reductions are equal to: $ER_y(tonCO_2/yr) = BE_y(tonCO_2/yr)$

7.1 Calculation of the Combined Margin Grid Emission Factor (CM):

Operating Margin (OM):

According to the data available for the Colombian electricity sector, the methodological choice selected to calculate the OM is Dispatch Data Analysis (DDA), Option C of the methodology.

The operating margin is calculated on an hourly basis for each day of the year, for the set of power plants in the top 10% of the grid system dispatch order during the hour *h*.

$$EF_{OM\_DispatchData,y}(tonCO_2/MWh) = \frac{E_{OM,y}(tonCO_2)}{EG_y(MWh)} \quad (1)$$

where EG_y is the generation of the project in the year *y*, and $E_{OM.y}$ are the emissions associated with the operating margin calculated as:

$$E_{OM,y}(tonCO_2) = \sum_h EG_h(MWh) \cdot EF_{DD,h}(tonCO_2/MWh) \quad (2)$$

where EG_h is the generation of the project in each hour *h* and $EF_{DD,h}$ is the hourly generation-weighted average emissions per unit of energy of the set of power plants (*n*) in the top 10% of grid system dispatch order during the hour *h*.

$EF_{DD,h}$ is calculated on an hourly basis as the fuel consumed by the generation power plant in the hour *h* (informed by the dispatch data center, CND), times the emission factor of the fuel, divided by the electricity generation of the corresponding generation device in the hour *h*. CND will provide the hourly generation of every power plant, including La Vuelta and La Herradura. The fuel consumed may calculate as the product between the electricity generation of the plant and its associated specific consumption. Thus, the hourly generation-weighted average emissions per unit of energy are calculated as follows:

$$EF_{DD,h}(tonCO_2/MWh) = \frac{\sum_{i,n}\left[F_{i,n,h}(kton) \cdot COEF_{i,n}(tonCO_2/kton)\right]}{\sum_n GEN_{n,h}(MWh)} \quad (3)$$

The quantity of fuel consumed by each plant is calculated as follows:

$$F_{i,n,h}(kton) = GEN_{i,n,h}(MWh) \cdot SC_{i,n}(kton/MWh) \quad (4)$$

where $GEN_{i\,n,h}$ is the electricity generation of plant *n* consuming fuel *i* in the hour *h*, and $SC_{i,n}$ is the specific consumption of power plant *n* consuming fuel *i* (mass or volume converted to kton). This approach is used because no official data are available for hourly fuel consumption of thermal power plants serving the system.

Additionally, the emission coefficient of each fuel is calculated as follows:

$$COEF_{i,n}(tCO_2/kton) = NCV_i(TJ/Kton) \cdot EF_{CO_2 i}(tonCO_2/TJ).OXID_i \quad (5)$$

where NCV_i is the net calorific value of the fuel *i*, $OXID_i$ is the oxidation factor of the fuel *i*, and $EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

As CND provides the specific consumption (*SC*) or heat rate (*HR*) for each power plant, the equations are simplified to:

$$EF_{DD,h}(tCO_2/MWh) = \frac{\sum_{n,i} SC_{i,n}(kton/MWh) \cdot COEF_{i,n}\ (tonCO_2/kton) \cdot GEN_{i,n,h}\ (MWh)}{\sum_{n} GEN_{n,h}(MWh)} \quad (6)$$

However, as EPM (who calculated the emission factors) does not manage fuel consumption of the plants or their heat rate, the emission factor for each of the plants is calculated with the following equation:

$$EF_j = HR_{i,j}, \cdot NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \quad (7)$$

The emission factor is provided by UPME for each plant. EPM uses directly the following equation:

$$EF_{DD,h} = \frac{\sum_{j,n} EF_j \cdot GEN_{j,n,h}}{\sum_{j,n} GEN_{j,n,h}} \quad (8)$$

Build Margin (BM):

It is calculated as the generation-weighted average emission factor of a sample of power plants *m*, as follows:

$$\frac{\sum_i F_{i,y} \times COEF_i}{\sum_m GEN_{m,y}}$$

Option 2 of the methodology ACM0002/version 06 is selected for the BM calculation. The sample group *m* consists of either:

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

From these two options, the sample group that comprises the larger annual generation will be used. Power plant capacity additions registered as CDM project activities will be excluded from the sample group *m*.

Taking into account the considerations mentioned above, the BM will be calculated as a generation-weighted average emission factor of a sample of power plants *m*, as follows:

$$EF_{BM,y}(tonCO_2/MWh) = \frac{\sum_{i,m}\left[F_{i,m,y}(kton)\cdot COEF_{i,m}(tonCO_2/kton)\right]}{\sum_{m} GEN_{m,y}(MWh)}$$

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_{OMy}) and the Build Margin emission factor (EF_{BMy}), as follows:

$$EF_y(tonCO_2/MWh) = w_{OM}\cdot EF_{OM,y}(tonCO_2/MWh) + w_{BM}\cdot EF_{BM,y}(tonCO_2/MWh)$$

The relative weights, w_{OM} and w_{BM}, are assumed to be equal to 0.5, according to the default value provided by the methodology.

Please refer to the following section where the results of the calculation are presented.

8. EMISSION REDUCTIONS CALCULATION

It is important to point out that the calculated emissions are lower compared with those estimated and included in the PDD. The reasons for this are:

- Lower energy generation of the plants due to:
  - Lack of generation because of maintenance activities (corrective and preventive), switching of mechanic parts, performance of tests, adjustments and calibrations, start-up of systems, equipment cleaning and maintenance.
  - Lack of generation due to lower-than-expected water flow.
  - Lack of generation due to electric conditions of the power system that do not allow the connection to the interconnected system.
  - Lack of generation due to river currents that drag leaves and branches that clog the entry filters of the system, thus reducing the water flow to the turbines.

- Different grid emission factors: the emission factor used *ex-ante* to estimate the emission reductions presented in the PDD is higher than those factors calculated and used ex-post for the year 2008.

The emission reductions are calculated as per the formulae shown in the previous section. The following tables show the information related to the calculation of emission reductions:

8.1 - Power generation by La Vuelta and La Herradura hydroelectric plants:

Table 4: Generation of the plants for the year 2008

Year	Month	Net Generation of the plants (MWh)		
		La Vuelta	La Herradura	Total
2008	January	6,458.87	11,925.45	18,384.32
	February	4,679.35	6,653.31	11,332.65
	March	7,535.81	11,461.49	18,997.31
	April	6,505.83	6,777.70	13,283.53
	May	2,640.00	7,976.61	10,616.60
	June	4,825.30	9,566.03	14,391.33
	July	5,093.79	10,688.66	15,782.45
	August	5,328.11	9,755.92	15,084.04
	September	6,277.99	10,484.06	16,762.04
	October	6,654.08	10,041.02	16,695.10
	November	4,777.56	6,116.12	10,893.68
	December	5,949.97	9,485.74	15,435.71
Total		**110,932.10**	**66,726.66**	**177,658.75**

8.2 - Combined margin emission factors calculation

Build Margin Calculation

Option 2 of ACM0002 version 6 is selected for BM calculation. This factor is updated annually *ex-post* so it was calculated for the year 2008. Refer to the corresponding file[1] to check the calculation of the build margin for that year.

The results are:

Year 2008 BM: **0.2740** tCO_2/MWh

Operating Margin Calculation

As previously explained, it was calculated applying the Dispatch Data Analysis (option C of ACM0002 Version 6). The result for the 2008:

Year 2008 OM: **0.2983** tCO_2/MWh

Combined Margin Calculation

When applying a 0.5 weight for both operating margin and build margin, the combined margin emission factors for the Colombian grid are:

[1] *"Building Margin 2008.xls"*

Year 2008 CM: **0.2862** tCO_2/MWh

The weights used will remain fixed throughout the first crediting period, in line with the indicated in the methodology.

8.3 - Emission reductions obtained

Baseline Emissions:

	2008
BASELINE EMISSIONS (tCO_2e)	50,841

Emission Reductions:

	2008
EMISSION REDUCTIONS (tCO2e)	**50,841**